DOCUMENT 00 01 01
PROJECT TITLE PAGE
PROJECT MANUAL
CONSTRUCTION DOCUMENTS

PROJECT DETAILS

Project Description: Project consists of interior renovations to the existing building 5,992.40 S.F. and an expansion of 6,972.60 S.F. The improvements consist of six classroom additions, including a new laboratory, computer lab, IT closet, server room, riser room, Electrical room, and four standard classrooms, and installation of new finishes. Other site improvements include the re-surfacing of the service drive and adjustments connecting to the covered walkway.

Project located at:
New Mercedes Campus
2000 East US Expressway 83
Mercedes, Texas 78570

OWNER REPRESENTATIVE

Triumph Public High Schools
Contact: Frances Berrones-Johnson, Superintendent CEO
1208 South Presa
San Antonio, Texas 78210-2838

ARCHITECT

Laura N. Warren, AIA, NCARB/President
The Warren Group Architects, Inc.
804 S. Main Street
McAllen, Texas 78501
Office: 956.994.1900
lwarren@twgarch.com
Cc: clopez@twgarch.com
admin@twgarch.com

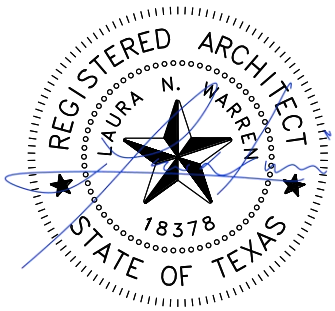
END OF DOCUMENT

DOCUMENT 00 01 07
SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

ARCHITECT

The Warren Group Architects Inc.
Texas Registration No. 30112289
Sections except where indicated
as prepared by other design
Professionals of record.



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TECHNICAL SPECIFICATIONS

Triumph High School

SEPTEMBER 2023

PREPARED BY:

Halff Associates, Inc.
5000 West Military, Suite 100
McAllen, TX 78503
956.664.0286
TBPELS Firm #312

Project No. 55353.001

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TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

000110 - Table of Contents

001340 - Shop Drawings, Product Data, & Samples, O&M Manuals

001601 - Job Conditions

002224 - Trenchless Utility Installation

003132 - Geotechnical Data

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011030 - Special Procedures

012500 - Product Substitutions

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013233 - Photographic Documentation

013300 - Submittal Procedures

014000 - Quality Control

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015000 - Temporary Facilities and Controls

015600 - Construction Traffic Control

017700 - Closeout Procedures

017823 - Operation and Maintenance Data

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2.02 DIVISION 04 -- MASONRY

2.03 DIVISION 05 -- METALS

2.04 DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

2.05 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

2.06 DIVISION 08 -- OPENINGS

2.07 DIVISION 09 -- FINISHES

2.08 DIVISION 10 -- SPECIALTIES

2.09 DIVISION 11 -- EQUIPMENT

2.10 DIVISION 12 -- FURNISHINGS

2.11 DIVISION 13 -- SPECIAL CONSTRUCTION

2.12 DIVISION 14 -- CONVEYING EQUIPMENT

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2.14 DIVISION 22 -- PLUMBING

2.15 DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
2.16 DIVISION 25 -- INTEGRATED AUTOMATION
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331120 - Water Valves
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A. 334213 - Stormwater Culverts
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2.22 DIVISION 40 -- PROCESS INTEGRATION
2.23 DIVISION 46 -- WATER AND WASTEWATER EQUIPMENT

END OF SECTION

DOCUMENT 00 01 07
SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

MEP ENGINEERS MEP Solutions Engineering
Texas Registration No. F-9748
Luis Javier Peña, P.E.
Texas Registration No. 97260

The following sections:

STATE OF TEXAS
LUIS JAVIER PENA
97260
LICENSED
PROFESSIONAL ENGINEER

10.31.2023

MEP SOLUTIONS ENGINEERING
MECHANICAL, ELECTRICAL, PLUMBING ENGINEERS
600 E. BEAUMONT AVE. SUITE 2 McALLEN, TX 78501 (956) 664-2727
TEXAS BOARD OF PROFESSIONAL ENGINEERS REGISTRATION # F-9748

DIVISION 21: FIRE SUPPRESSION

211313 - FIRE PROTECTION SYSTEM

DIVISION 22: PLUMBING
220510 - PLUMBING GENERAL REQUIREMENTS
220515 - MATERIALS AND METHODS
220529 - HANGERS AND SUPPORTS
220553 - PLUMBING IDENTIFICATION
220713 - PLUMBING INSULATION
221316 - SANITARY WASTE AND VENT PIPING
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230515 - MATERIALS AND METHODS
230523 - VALVES
230529 - HANGERS AND SUPPORTS
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230553 - MECHANICAL IDENTIFICATION
230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC
230713 - HVAC INSULATION
230900 - BUILDING AUTOMATION SYSTEM (BAS)
233113 - METAL DUCTS
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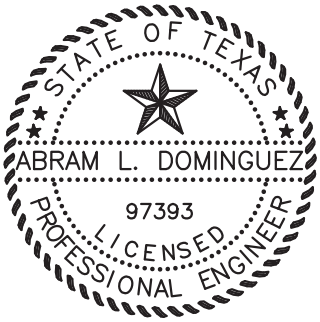
233600 - AIR TERMINAL UNITS
233713 - DIFFUSERS, REGISTERS, AND GRILLES
237416 - PACKAGED ROOFTOP AIR-CONDITIONING UNITS



DOCUMENT 00 01 07
SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

10.31.2023

MEP ENGINEERS

MEP Solutions Engineering
Texas Registration No. F-9748
Abram L. Dominguez, P.E.
Texas Registration No. 97393

The following sections:

MECHANICAL, ELECTRICAL, PLUMBING ENGINEERS
600 E. BEAUMONT AVE. SUITE 2 McALLEN, TX 78501 (956) 664-2727
TEXAS BOARD OF PROFESSIONAL ENGINEERS REGISTRATION # F-9748

DIVISION 26: ELECTRICAL

260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS
260923 - LIGHTING CONTROL DEVICES
262416 - PANELBOARDS
262726 - WIRING DEVICES
262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS
264313 - SURGE PROTECTIVE DEVICES FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS
265100 - INTERIOR LIGHTING

DIVISION 27: COMMUNICATIONS

275123 - INTERCOM, PAGING, AND EMERGENCY MESSAGING SYSTEM

DIVISION 28: ELECTRONIC SAFETY AND SECURITY

283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM
283112 - INTRUSION, CCTV, AND ACCESS CONTROL

DOCUMENT 00 01 07
SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

Structural Engineer

Solorio, Inc. (F-1616)
Simon G. Solorio, PE
Texas Registration No. 83066
Sections except where indicated
as prepared by other design
Professionals of record.

The following sections:

02200 Earthwork
02282 Termite Control
02311 Rough Grading
03100 Concrete Forms
03200 Concrete Reinforcement
03300 Cast-In-Place Concrete
03350 Concrete Finishing
03390 Concrete Curing
04230 Reinforced Unit Masonry
05120 Structural Steel
05210 Steel Joists
05310 Steel Deck
05500 Metal Fabrications
07191 Vapor Barrier

10/30/2023

END OF DOCUMENT

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c. Non-Collusive Proposal Certificate & Acknowledgment
d. Felony Conviction Notification
e. Certification Regarding Debarment, Suspension, Ineligibility, and Exclusion
f. Clean Air and Water Act Certification
g. Certification Regarding Lobbying for Federal Funds
h. Certification of Criminal History Review of Employees
i. Child Support Certification

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Section 00 01 07 Seals Page Architect
Seals Page Civil
Seals Page MEP
Seals Page Structural
Section 00 01 10 Table of Contents
Section 00 01 15 List of Drawing Sheets
Section 00 13 40 Shop Drawings, Product Data, & Samples, O&M Manuals
Section 00 16 01 Job Conditions
Section 00 18 00 Respondents Qualifications
Ranking Criteria
Section 00 21 13 Instructions to Bidders
AIA A701-2018 Instructions to Bidders
Section 002224 Trenchless Utility Installation
Section 00 25 13 Prebid Meeting
Section 00 26 00 Procurement Substitution Procedures
CSI Form 1.5
Section 003132 - Geotechnical Data
Geotechnical Report
Section 00 41 13 Competitive Sealed Proposal Form
Section 00 43 21 Allowance Form
Section 00 43 23 Alternates Form
TADCO Roofing and Waterproofing Inspection Report
Section 00 43 73 Proposed Schedule of Values Form
Section 00 43 93 Bid Submittal Checklist
Section 00 45 00 Bid Bond
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Section 00 73 00 Supplementary Conditions
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Phase I Environmental Site Assessment

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Section 012500 - Product Substitutions - CIVIL
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Section 01 30 00 Administrative Requirements
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Section 013233 - Photographic Documentation
Section 01 33 00 Submittal Procedures -ARCH
Section 013300 - Submittal Procedures -CIVIL
Section 01 33 23 Shop Drawings and Samples
Section 01 40 00 Quality Requirements
Section 014200 - Definitions and Terminology
Section 01 45 23 Testing and Inspecting Services
Section 01 50 00 Temporary Facilities and Controls - ARCH
Section 015000 - Temporary Facilities and Controls -CIVIL
Section 015600 - Construction Traffic Control
Section 01 60 00 Product Requirements
Section 01 70 00 Project Closeout
Section 01 73 00 Execution
Section 017700 - Closeout Procedures
Section 01 81 19 Indoor Air Quality Requirements
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Section 02282 Termite Control
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Section 02 41 19 Selective Demolition
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Section 03200 Concrete Reinforcement
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Section 03350 Concrete Finishing
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Section 03 35 00 Concrete Finishing - ARCH

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Section 07 19 10 Vapor Barrier - ARCH
Section 07 21 00 Thermal Insulation
Section 07 21 20 Board Insulation
Section 07 22 00 Roof and Deck Insulation
Section 07 24 00 Exterior Insulation and Finish System
Section 07 25 00 Weather Barriers
Section 07 27 26 Fluid-Applied Weather Barriers
Section 07 41 13 Metal Roof Panels
Section 07 42 13 Metal Wall Panels
Section 07 42 93 Soffit Panels
Section 07 54 23 TPO Mechanically Fastened Roofing System
Section 07 60 00 Sheet Metal Flashing and Trim
Section 07610 Metal Roofing
Section 07 72 00 Safepro Roof Hatch Access Door
Section 07 72 60 Roof Hatch Safety Rail System and Ladder Extension
Section 07 84 56 Fire Safing
Section 07 90 00 Joint Protection
Section 07 92 00 Joint Sealants

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Section 08 14 16 Flush Wood Doors
Section 08 41 00 Aluminum Framed Entrances and Storefronts
Section 08 51 13 Aluminum Windows
Section 08 71 00 Door Hardware

Section 08 80 00 Glazing

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Section 09 28 13 Cementitious Backing Boards
Section 09 29 00 Gypsum Wallboard
Section 09 30 00 Tiling
Section 09 31 00 Thin Set Tile Work
Section 09 51 13 Acoustical Panel Ceilings
Section 09 62 80 Static Control Flooring ESD Flooring Dur-A-Guard ESD with Armor Stat ESD Topcoat Floor System
Section 09 65 13 Resilient Bases and Accessories
Section 09 65 19.19 Resilient Tile Flooring
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Section 10 21 13. 13 Floor-Mounted Metal Toilet Partitions
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Section 10 44 00 Fire Protection Specialties

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Section 12 36 23.13 Plastic Laminate-Clad Countertops

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Section 220529 - Hangers And Supports
Section 220553 - Plumbing Identification
Section 220713 - Plumbing Insulation
Section 221316 - Sanitary Waste and Vent Piping
Section 221413 - Storm Drainage Piping
Section 224250 - Plumbing Specialties

DIVISION 23: HEATING, VENTILATING AND AIR CONDITIONING

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Section 230515 - Materials And Methods
Section 230523 - Valves
Section 230529 - Hangers And Supports
Section 230548 - Vibration And Seismic Controls
Section 230553 - Mechanical Identification
Section 230593 - Testing, Adjusting, And Balancing For HVAC
Section 230713 - HVAC Insulation
Section 230900 - Building Automation System (Bas)
Section 233113 - Metal Ducts
Section 233300 - Duct Accessories

Section 233600 - Air Terminal Units
Section 233713 - Diffusers, Registers, and Grilles
Section 237416 - Packaged Rooftop Air-Conditioning Units

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Section 260526 - Grounding And Bonding For Electrical Systems
Section 260533 - Raceways And Boxes For Electrical Systems
Section 260544 - Sleeves And Sleeve Seals For Electrical Raceways And Cabling
Section 260553 - Identification For Electrical Systems
Section 260923 - Lighting Control Devices
Section 262416 - Panelboards
Section 262726 - Wiring Devices
Section 262816 - Enclosed Switches And Circuit Breakers
Section 264313 - Surge Protective Devices For Low Voltage Electrical Power Circuits
Section 265100 - Interior Lighting

DIVISION 27: COMMUNICATIONS

Section 275123 - Intercom, Paging, And Emergency Messaging System

DIVISION 28: ELECTRONIC SAFETY AND SECURITY

Section 283111 - Digital, Addressable Fire-Alarm System
Section 283112 - Intrusion, Cctv, And Access Control

DIVISION 31 – EARTHWORK
Section 311100 - Clearing and Grubbing
Section 312200 - Trench Excavation, Backfill, and Compaction
Section 312350 - Groundwater Handling
Section 312500 - Erosion and Sedimentation Control During Construction
Section 315000 - Excavating
Section 315100 - Trench Protection System

DIVISION 32 -- EXTERIOR IMPROVEMENTS

Section 321313 - Concrete Pavement
Section 321320 - Concrete Reinforcement
Section 321373 - Concrete Paving Joint Sealants
Section 321623 - Sidewalks
Section 323000 – Cast-in-Place Concrete Site Work
Section 323119 – Echelon II Ameristar Fence Products

DIVISION 33 – UTILITIES

Section 331110 - Water Transmission Lines and/or Pressure Wastewater Lines
Section 331120 - Water Valves
Section 333113 - Wastewater Collection Systems
Section 334000 - Stormwater Collection System
Section 334213 - Stormwater Culverts
Section 334230 - Stormwater Drains

END OF DOCUMENT

DOCUMENT 00 01 15
LIST OF DRAWING SHEETS

LIST OF DRAWING SHEETS

A. Drawings: Consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Triumph Public Highschool New Mercedes Campus, 2000 East US Expressway 83, Mercedes, TX 78570 dated October 31, 2023, as modified by subsequent Contract modifications.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

ARCHITECTURAL:

G0.00 COVER SHEET
G0.0 GENERAL NOTES
AD1.01 DEMOLITION SITE PLAN
AD1.11 DEMOLITION PLAN
AD2.11 DEMOLITION EXTERIOR ELEVATIONS
A1.01 SITE PLAN
A1.02 SITE PLAN DETAILS
A1.03 SITE PLAN DETAILS
A1.11 FLOOR PLAN
A1.21 REFLECTED CEILING PLAN
A1.31 ROOF PLAN
A1.41 FLOOR PATTERN
A1.42 ACCENT WALL PATTERN
A2.11 EXTERIOR ELEVATIONS
A3.01 BUILDING SECTIONS
A3.11 WALL SECTIONS
A3.12 WALL SECTIONS
A4.11 ENLARGED FLOOR PLAN
A4.12 ENLARGED FLOOR PLAN
A5.11 PLAN DETAILS
A6.01 WALL & PARTITIONS SCHEDULE
A6.11 ROOM FINISH SCHEDULE
A6.21 DOOR & WINDOW SCHEDULE & ELEVATION
A7.11 MILLWORK ELEVATIONS

A7.12 MILLWORK ELEVATIONS & SECTIONS

CIVIL:

C0.0 COVER
C1.0 GENERAL NOTES
C2.0 EXISTING CONDITIONS & SURVEY CONTROL SHEET
C3.0 DEMOLITIAN PLAN
C4.0 PAVING & DIMENSIONAL CONTROL PLAN
C4.1 FENCING PLAN
C5.0 GRADING PLAN
C6.0 DRAINAGE PLAN
C6.1 DRAINAGE PROFILE
C7.0 EXISTING DRAINAGE AREA MAP
C7.1 PROPOSED DRAINAGE AREA MAP
C8.0 WATER LINE PLAN
C8.1 FIRE TRUCK AUTO TURN
C9.0 WASTEWATER LINE PLAN
C9.1 WASTEWATER LINE PROFILE
C10.0 SUGGESTED EROSION CONTROL PLAN
C11.0 PAVING & DRAINAGE DETAILS
C11.1 PAVING & DRAINAGE DETAILS
C11.2 WATER DETAILS
C11.3 WASTEWATER DETAILS
C11.4 SUGGESTED EROSION CONTROL DETAILS

STRUCTURAL:

S101 GENERAL NOTES
S102 GENERAL NOTES
S201 FOUNDATION PLAN
S301 ROOF FRAMING PLAN
S401 TYPICAL CONCRETE DETAILS
S402 FOUNDATION DETAILS
S403 TYPICAL CMU DETAILS
S404 FRAMING DETAILS

MEP:

DM1.01 DEMO-MECHANICAL FLOOR PLAN
DE1.00 DEMO-ELECTRICAL SITE PLAN
DE1.01 DEMO-ELECTRICAL LIGHTING & POWER FLOOR PLAN
DP1.01 DEMO-PLUMBING FLOOR PLAN
M1.01 MECHANICAL FLOOR PLAN
M2.01 MECHANICAL SCHEDULE
M3.01 MECHANICAL CONTROL DIAGRAM
M4.01 MECHANICAL DETAILS
E1.00 ELECTRICAL SITE PLAN
E1.01 ELECTRICAL LIGHTING FLOOR PLAN
E1.02 ELECTRICAL POWER FLOOR PLAN
E1.03 ELECTRICAL MECH & PLUMBING LOC FLOOR PLAN
E2.01 ELEC LEGEND, SPECS, RISER DIAGRAM & SCHS
E3.01 ELECTRICAL PANEL SCHEDULES
E4.01 ELECTRICAL DETAILS
P1.00 PLUMBING SITE PLAN
P1.01 PLUMBING SEWER FLOOR PLAN
P1.02 PLUMBING HW/CW FLOOR PLAN
P1.03 PLUMBING ROOF PLAN
P2.01 PLUMBING SCHEDULES
P2.02 PLUMBING SEWER RISER SCHEM. DIAGRAM

END OF DOCUMENT

SECTION 001340
SHOP DRAWINGS, PRODUCT DATA & SAMPLES, O&M MANUALS

PART 1 - GENERAL

1.01 SUMMARY

A. General:
   1. Section Addresses:
      a. Mechanics and administration of the submittal process for shop drawings, product data, samples and operation and maintenance manuals.
   2. Related Sections include but are not necessarily limited to:
      a. Division 1 - General Requirements.

1.02 DEFINITIONS

A. Shop Drawings:
   1. See Technical Specification Manual.
   2. Product data and samples are Shop Drawing information.

B. Miscellaneous Submittals:
   1. Submittals other than Shop Drawings:

C. Representative types of miscellaneous submittal items include but are not limited to:
      a. Construction schedule.
   2. Concrete, soil compaction, and pressure test reports.
      a. Installed equipment and systems performance test reports.
      b. Manufacturer's installation certification letters.
      c. Instrumentation and control commissioning reports.
      d. Warranties.
      e. Service agreements.
      f. Survey data.
      g. Cost breakdown (Schedule of Values).

1.03 TRANSMITTALS

A. Shop Drawings, Operation and Maintenance Manuals, Manufacturers and Installers Quality Control and Quality Assurance documentation:

B. Transmit 1 copies of all submittals to:
   Halff Associates, Inc.
   5000 W. Military Hwy, Suite 100
   McAllen, Texas 78503
   Attn: Roxxie L De La Cruz, PE
   (956) 664-0286
   (956) 664-0282 FAX

C. Utilize a copy of attached Exhibit "A" to transmit all shop drawings, product data and samples.

D. Utilize a copy of attached Exhibit "B" to transmit all Operation and Maintenance Manuals.

E. All transmittals must be from Contractor and bear his approval stamp. Transmittals will not be received from or returned to subcontractors.

F. Shop drawing transmittal stamp shall read “(Contractor's Name) represents that we have determined and verified all field dimensions and measurements, field construction criteria, materials, catalog numbers, and similar data, and that we have verified the requirements of the work and the Contract Documents."

G. Operation and Maintenance Manual transmittal stamp may be Contractor’s standard approval stamp.

H. Provide submittal information defining specific equipment or materials utilized on the project. Generalized product information not clearly defining specific equipment or materials to be provided will be rejected.

I. Calculations required in individual specification sections are required as For-Information Only-For-Future-Use submittals. Calculations and other submittals identified as For-Information-Only-For Future-Use submittals shall be transmitted directly to the Engineer at the following address:

Halff Associates, Inc.
5000 W. Military Hwy, Suite 100
McAllen, Texas 78503
Attn: Roxxie L De La Cruz, PE
(956) 664-0286
(956) 664-0282

J. Submittal schedule:
1. Schedule of shop drawings:
   a. Submitted and approved within 20 days of receipt of Notice to Proceed.
2. Operation and Maintenance Manuals and Equipment Record Sheets:
3. Initial submittal within 60 days after date shop drawings are approved.

K. Miscellaneous Submittals:
1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit 4 copies of all submittals to:

Halff Associates, Inc.
5000 W. Military Hwy, Suite 100
McAllen, Texas 78503
Attn: Roxxie L De La Cruz, PE
(956) 664-0286
(956) 664-0282

1.04 PREPARATION OF SUBMITTALS

A. Shop Drawings:
1. Number transmittals consecutively beginning with 1.
2. Number transmittals of resubmitted items with the original root number and a suffix letter starting with "A" on a new transmittal form.
3. Restrict each letter of transmittal to only one Specification Section or portion thereof.
4. Provide breakout of each transmittal contents on transmittal form. Each component thus defined will receive specific action by the Engineer. Define manufacturer, item, Contract Document tag number, and Contract Drawing/Specification reference.
5. With prior approval of the Engineer, components of an original submittal or prior resubmittal that have not received an "R" or "E" Action may be withheld from a resubmittal. Such components shall be listed on the resubmittal transmittal form and indicated as "Outstanding - To Be Resubmitted at a Later Date."
6. For 8-1/2 x 11 IN size sheets, provide four copies of each page for Engineer plus the number required by the Contractor.
7. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed 10.

B. For items not covered in above paragraphs submit one reproducible transparency and one print of each drawing until approval is obtained. Utilize mailing tube; do not fold.
1. The Engineer will mark and return the reproducible to the Contractor for his reproduction and distribution.
2. Contractor shall not use red color for marks on transmittals.
3. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible. Outline Contractor marks on reproducible transparencies with a rectangular box.

C. Transmittal contents:
   1. Coordinate and identify shop drawing contents so that all items can be easily verified by the Engineer.
   2. Identify equipment or material use, tag number, drawing detail reference, weight, and other project specific information.
      a. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
      b. Submit items like equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages. Indicate exact item or model and all options proposed.
      c. Include legible scale details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout drawings, parts catalogs, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data. Arrange data and performance information in format similar to that provided in Contract Documents. Provide, at minimum, the detail provided in the Contract Documents.
      d. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.

D. Samples:
   1. Identification:
      a. Identify sample referencing transmittal number, manufacturer, item, use, type, project designation, tag number, specification section or drawing detail reference, color, range, texture, finish and other pertinent data.
      b. If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
   2. Include application specific brochures, and installation instructions.
   3. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
   4. Resubmit samples of rejected items.

1.05 OPERATION AND MAINTENANCE MANUALS:

A. Number transmittals for Operation and Maintenance Manual with original root number of the approved shop drawing for the item.
   1. Submit one copy until approval is received.
   2. Identify resubmittals with the original number plus a suffix letter starting with "A."
   3. Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 IN size heavy first quality paper with standard three-hole punching and bound in stiff metal hinged binder constructed as a three-ring style. Provide binders with titles on front and on spine of binder. Tab each section of manuals for easy reference with plastic-coated dividers. Provide index for each manual. Provide plastic sheet lifters prior to first page and following last page.
   4. Reduce drawings or diagrams bound in manuals to an 8-1/2 x 11 IN or 11 x 17 IN size. However, where reduction is not practical to ensure readability, fold larger drawings separately and place in vinyl envelopes which are bound into the binder. Identify vinyl envelopes with drawing numbers.

B. Transmittal Content:
   1. Submission of Operation and Maintenance Manuals is applicable but not necessarily limited to: 1) Major equipment. 2) Equipment used with electrical motor loads of 1/6 HP nameplate or greater. 3) Specialized equipment including valves and instrumentation and control system components for process systems.

2. Prepare Operation and Maintenance manuals to include, but not necessarily limited to, the following detailed information, as applicable:
   a. Equipment function, normal operating characteristics, and limiting operations.
   b. Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
   c. Operating instructions for start-up, routine and normal operation, regulation and control, shutdown, and emergency conditions.
   d. Lubrication and maintenance instructions.
   e. Guide to "troubleshooting."
   f. Parts list and predicted life of parts subject to wear.
   g. Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
   h. Test data and performance curves.
   i. A list of recommended spare parts with a price list and a list of spare parts provided under these specifications.
   j. Copies of installation instructions, parts lists or other documents packed with equipment when delivered.
   k. Instrumentation or tag numbers relating the equipment back to the Contract Documents.
3. For equipment items involving components or subunits, an Equipment Record Sheet for each operating component or subunit is required.

C. Manufacturer's Certificates:
   1. When specified in individual specification Sections, submit manufacturers' certificate to Engineer for review, in quantities specified for Product Data.
   2. Indicate material or product conforms to or exceeds specified requirements. Submit supporting references date, affidavits, and certifications as appropriate.
   3. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

PART 2 - ENGINEER'S REVIEW ACTION

2.01 SHOP DRAWINGS AND SAMPLES:

A. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
   1. **R** - Reviewed, No exceptions taken.
   2. **E** - Exceptions taken, Make correction noted
   3. **RR** - Revise & Resubmit

B. Transmittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp. Drawings not stamped by the Contractor or stamped with a stamp containing language other than that specified above, will not be reviewed for technical content and will be returned without any action.

C. Transmittals returned with Action "R" and "E" are considered ready for fabrication and installation. If for any reason a transmittal that has an "R" and "E" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "R" and "E" Action that are superseded by a resubmittal.

D. Transmittals with Action ""R" and "E" combined with Action "RR" (Revise and Resubmit) will be individually analyzed giving consideration as follows:

E. The portion of the transmittal given "RR" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference). One copy or the one transparency of the "RR" drawings will be marked up and returned to the Contractor. Correct and resubmit items so marked.

F. Items marked "R" or "E" will be fully distributed.

G. If a portion of the items or system proposed are acceptable, however, the major part of the individual drawings or documents are incomplete or require revision, the entire submittal may be given "RR" Action. This is at the sole discretion of the Engineer. In this case, some drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package." Distribution to the Owner and field will not be made (unless previously agreed to otherwise).

H. Failure to include any specific information specified under the submittal paragraphs of the specifications will result in the transmittal being returned to the Contractor with "RR" Action.

I. In addition to calculations stamped and returned "Engineer's Review Not Required," other transmittals such as submittals which the Engineer considers as "Not Required," submittal information which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "R"' or "E" Action in a prior transmittal, will be returned with Action "Engineer's Review Not Required."

J. Samples may be retained for comparison purposes. Remove samples when directed. Include in bid all costs of furnishing and removing samples.

K. Approved samples submitted or constructed, constitute criteria for judging completed work. Finished work or items not equal to samples will be rejected.

2.02 OPERATION AND MAINTENANCE MANUALS:

A. Engineer will review and indicate one of the following review actions:
   1. ACCEPTABLE.
   2. FURNISH AS NOTED.
   3. REVISE AND RESUBMIT.
   4. REJECTED.

B. Acceptable submittals will be retained with the transmittal form returned with a request for {five} additional copies.

C. Deficient submittals will be returned along with the transmittal form which will be marked to indicate deficient areas.

END OF SECTION

SECTION 00 18 00
RESPONDENTS QUALIFICATIONS

PART 1 - GENERAL

1. SECTION INCLUDES

This section contains the bidder's qualifications for the project.

2. REFERENCES – Not Used

3. BIDDER'S EXPERIENCE

a. Respondent shall have experience, human resources and access to the equipment necessary for performing the project work.

b. Respondent shall have performed substantially the same type of work as is required in the project in its prior work experience.

c. The successful Respondent shall appoint a "competent person" of the company to be full time supervisor or superintendent at the site. The competent person must be available at all times during the pendency of the project and must be available during "off-hours.

4. STATEMENT OF QUALIFICATIONS AND OWNER'S REVIEW

Respondent shall submit at the time of Proposal date and on the form furnished in this section for that purpose, a Statement of Respondent's Qualifications. The Owner shall have the right to take such steps or perform such investigations as it deems necessary to determine the ability of the Respondent to perform the obligations under this Contract, and the Respondent shall furnish any and all information or data requested for this purpose. The Owner reserves the right to reject, qualify or disqualify any Proposal if the evidence submitted by or investigation of such Respondent fails to satisfy the owner that such Respondent is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional Proposals will not be accepted.

1.2 CONSIDERATION OF PROPOSAL

a. Properly identified Proposals received on time will be considered.
b. Triumph Public High Schools shall have the right to reject any or all Proposals and in particular to reject a Proposal not accompanied by any required security bond or data required by the Contract Documents or a Proposal in any way incomplete or irregular.
c. Triumph Public High Schools shall have the right to waive any formality or irregularity in any proposal received.
d. If Triumph Public High Schools accepts any Alternates, the Triumph Public High Schools shall have the right to accept the Alternates in any order or combination.
e. It is the intent of Triumph Public High Schools to award a contract to the offeror submitting the proposal providing the "best value" to the School District provided the Proposal has been submitted in accordance with the requirements of the Solicitation Documents and selection criteria.
f. Award of Contract may include full consideration of Proposal Amount and Alternates if any. Triumph Public High Schools may accept or reject any or all alternates if any and make an award of contract

as deemed in the best interest of Triumph Public High Schools. Triumph Public High Schools' decision shall be final.

g. Contractor may provide supplemental information to support selection criteria.

h. The selection of a qualified Contractor shall be based on the enclosed Ranking Criteria.

STATEMENT OF QUALIFICATIONS AND OWNER'S REVIEW

B. Respondent shall submit in this section, a Contractors Qualifications Statement. Triumph Public High Schools shall have the right to take such steps or perform such investigations as it deems necessary to determine the ability of the respondent to perform the obligations under this Contract, and the respondent shall furnish any and all information or data requested for this purpose. Triumph Public High Schools reserves the right to reject any proposal if the evidence submitted by or investigation of such respondent fails to satisfy Triumph Public High Schools that such respondent is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional proposals will not be accepted. Refer Supplementary Instructions to Respondents Document 00 22 13.

Date: _____, 2023

Proposal of _____ (hereinafter called "Respondent") a

_____ (Corporation, Partnership, LLC, LLP, etc.) organized and existing under the laws of the

State of Texas.

To Triumph Public High Schools (hereinafter called "Owner").

The Respondent is in compliance with the Respondent's Qualifications Section(s) of the specifications for the

_____, having examined the plans and

specifications with related documents and the site of the proposed work, and being familiar with all the conditions

surrounding the construction of the proposed project, hereby submits the following:

STATEMENT OF QUALIFICATIONS.

P A R T 2 P R O D U C T S - Not Used
P A R T 3 E X E C U T I O N - Not Used

END OF SECTION

Ranking Criteria for
Selection of Building Contractors

Project Name: _____ Contractor: _____

Project Location(s): _____ Proposal: _____

Ranking Date: _____ Proposal Opening Date: _____

CATEGORY	MAXIMUM SCORE	RANKED SCORE	TOTAL POINTS
1. PROPOSAL AMOUNT • Construction Cost	**35**	_____	
2. Proposers Experience / Proposers Reputation And Proposers References	**20**	_____	
3. Extent to which the proposer Impacts the schools ability to Comply with rules relating to Historically Underutilized Businesses	**5**	_____	
4. Proposers Safety Record	**10**	_____	
5. Proposers Proposed Personnel and Subcontractors	**15**	_____	
6. Proposers Financial Capability in relation to the scope of the project	**10**	_____	
7. Proposer Past Relationship with The school or other Charter/Public schools	**5**	_____	
TOTAL POINTS SCORED	**100**		_____

DOCUMENT 00 21 13
INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

A. AIA Document A701, "Instructions to Bidders," Refer to AIA Procurement and Contracting Requirements by reference.

1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT

SECTION 002224
TRENCHLESS UTILITY INSTALLATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. All material, labor, equipment, tools and superintendence necessary to furnish and install utility lines using trenchless installation methods in accordance with Public Works Construction Standards, NCTCOG, 4th Edition, Item 503.

1.02 REFERENCES

A. Public Works Construction Standards, NCTCOG, 4th Edition, Item 503

B. Standard Details included in the plans.

1.03 QUALITY ASSURANCE

A. DESIGN CRITERIA

1. The pipe casing shall be designed and sealed by a Licensed Professional Engineer in the State of Texas for the following loading conditions and applicable combinations thereof:
   a. Cooper's E-80 Railway loading or AASHTO HS20 loading as applicable.
   b. Earth loading with the height of fill above the casing as shown on the plans
   c. Loads applied during jacking, including axial load from jacking.
   d. All other applicable loading conditions, including loads applied during transportation and handling.

B. INSTALLER'S QUALIFICATIONS

1. Installation shall be by a competent, experienced contractor or sub-contractor. The installation contractor shall have a satisfactory experience record of at least three (3) years engaged in similar work of equal scope.
2. All welding shall be performed by a certified welder in the state of Texas.

C. PERFORMANCE REQUIREMENTS

1. Lateral or vertical variation in the final position of the pipe casing from the line an d grade established by the ENGINEER shall be permitted only to the extent of 1" in 10' feet, provided that such variation shall be regular and only in the direction that will not detrimentally affect the function of the carrier pipe.

D. JOB CONDITIONS; PERMITS AND EASEMENT REQUIREMENTS

1. Comply with the requirements of the permit and/or easement(s). The work within the Texas Department of Transportation (TxDOT) shall comply with TxDOT specifications. If required by the Right-of-Way Owner, obtain Protective Liability Insurance in the amount required by the particular company or other insurance as is specified in the permit at no cost to the Owner. Acquire a permit, agreement, or work order from the right-of-way Owner as is required.
2. No blasting shall be allowed. Existing pipelines are to be protected. The Contractor shall verify location and elevation of any pipe lines and telephone cable before proceeding with the construction and plan his construction so as to avoid damage to the existing pipe lines or telephone cables. Verification of location of existing utilities shall be the complete responsibility of the Contractor.

E. OPTIONS

1. CASING MATERIAL: Unless specified otherwise, the Contractor shall use steel pipe where encasement is specified. The material specifications for casing pipe are the minimum acceptable. The Contractor shall be fully responsible to insure the materials used are of sufficient strength for the installation method and the soil conditions encountered.

1.04 SUBMITTALS

A. Submittals shall include:

1. Shop drawings of the casing pipe from the manufacturer. Shop drawings shall include calculations for the design of the casing pipe by a Licensed Professional Engineer.

B. Provide Certificate of Adequacy of Design of casing and/or carrier pipe.
   1. Provide casing spacer manufacturer product data and installation requirements.
   2. Provide record data of casing insulators including sketches of insulators with materi al components and dimensions and proposed locations of insulators.
   3. Provide Pressure Grout material and method.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Refer to Public Works Construction Standards, NCTCOG, 4th Edition, Item 503.2.

B. Stainless steel casing spacers are required unless otherwise specified.

C. Steel casing pipe shall be new (or used if approved by the OWNER) and suitable for the purpose intended and shall have a minimum yield strength of 35,000 psi. Casing shall meet ASTM A36/A36M, ASTM A-570, ASTM A135/A135M, ASTM A139/A139M , or approved equal.

D. Casing pipe shall be coated with coal tar epoxy (15 mils min.) in accordance with AWWA C210. Pipe joints shall be welded in accordance with AWWA C206. After pipe is welded, coating shall be repaired.

E. CEMENT MORTAR: Consisting of one (1) part cement to two (2) parts clean sand with sufficient water to make a thick workable mix.

F. PRESSURE GROUT MIX: Comprised of 1 cubic foot of cement and 3.5 cubic feet of clean fine sand with sufficient water added to provide a free flowing thick slurry. If desired to maintain solids in the mixture in suspension, one cubic foot of commercial grade bentonite may be added to each 12 to 15 cubic feet of the slurry.

PART 3 – EXECUTION

3.01 GENERAL

A. Refer to Public Works Construction Standards, NCTCOG, 4th Edition, Item 503.3.

B. All casing pipe joints shall be watertight with no water entering the casing from any sources prior to carrier pipe installation.

C. The carrier pipe shall be installed within the casing between the limits indicated on the Plans to the specified lines and grades, and utilizing methods which include due regard for safety of workers, adjacent structures and improvements, utilities, and the public.

D. Furnish all necessary equipment, power, water, and utilities for carrier pipe installation, insulator runner lubricant, grouting, and other associated Work required for the Contractor's methods of construction.

E. Conduct all operations such that trucks and other vehicles do not interfere with traffic or create a dust or noise nuisance in the streets and to adjacent properties. Promptly clean up, remove, and dispose of spoils and slurry spillage and any slurry discharges.

F. All Work shall be done so as not to disturb roadways, adjacent structures, landscaped areas, or existing utilities. Any damage shall be immediately repaired to original or better condition and to the satisfaction of Engineer.

3.02 INSTALLATION OF CARRIER PIPE

A. Pipe Installation: Carrier pipe shall meet the requirements of the applicable Specification section. Remove all loose soil from casing. Grind smooth all rough welds at casing joints. Provide casing spacers, or insulators, or other approved devices, as required, to prevent flotation, movement, or damage to the pipe during installation and annular space grout placement. Every individual pipe section should be supported by spacers as shown in the Standard Details. Carrier pipe shall be installed without sliding or dragging it on the ground or in the casing in a manner that could damage the pipe. Coat the casing spacer runners with a non-corrosive/environmentally safe lubricant to minimize friction when installing the carrier pipe.

B. Testing of Carrier Pipe: Testing of the carrier pipe joints shall be completed prior to the filling of the annular space between the casing and carrier pipe with grout. Pressure testing shall be performed in accordance with the specification for the selected pipe material. Any leakage found during this inspection shall be corrected.

C. Backfill Annular Space with Grout: After the installation of the carrier pipe, the annular space (all voids) between the casing and the carrier shall be filled with grout in three (3) lifts, so all remaining surfaces of the exterior carrier pipe wall and casing interior are in contact with the grout. Furnish the necessary grout, equipment, hoses, valves, and fittings for the backfilling operation. Grout shall be pumped through a pipe or hose. Use grout pipes, or other appropriate materials to avoid damage to carrier pipe during grouting. The grout shall be proportioned to flow and to completely fill all voids between the carrier pipe and the casing. The Contractor shall provide end seals, as approved by the Engineer at each end of the casing to contain the grout backfill. The end seals shall be designed to withstand the anticipated grouting pressure and be watertight to prevent groundwater from entering the casing. Block the carrier pipe during grouting to prevent flotation during grout installation. The Contractor shall also protect and preserve the interior surfaces of the casing from damage. It is the responsibility of the Contractor to submit to the Engineer sufficient information indicating all proposed equipment, materials, and the method for filling this void.

3.03 TUNNEL/CASING PIPE SPACERS

A. General: Restraining systems shall prevent pipe joint separation during and after installation and shall provide dielectric insulation between the carrier pipe and the tunnel liner/casing pipe and shall be resistant to corrosion.

B. Types.

1. Steel Rib and Wood Lagging System:
   a. Steel ribs shall conform to ASTM A36/A36M Carbon Structural Steel. The ribs shall be of the size shown on the plans, special provisions or approved from a design load submittal. The ribs shall be bent by cold pressing in dies.
   b. Wood lagging shall have a minimum thickness of 2.75 -in. (7.0cm) and a minimum average ultimate stress capacity of 5,000-psi (34,470-kPa). The ultimate stress capacity to be determined according to ASTM D198 Static Tests of Lumber in Structural Sizes, flexure test on five randomly selected timbers from each shipment of lagging. The maximum load carried by each timber disregarding the highest and lowest one of the five timbers tested shall be averaged to determine the ultimate stress capacity of that shipment.
   c. Nuts shall conform to ASTM A307 Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength. The bolts shall conform to ASTM A449 Quenched and Tempered Steel Bolts and Studs for rib thickness equal to or greater than 0.209-in. (0.5cm) and to ASTM A307 Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength for rib thickness less than 0.209-in. (0.5cm).
2. PVC Restrained Casing Spacer System:
   a. PVC Restrained Casing Spacers shall be provided at all pipe bell joints and not more than 10-feet (3.0m) apart to support pipe and its contents.
   b. Casing spacer runners shall be an ultra-high molecular weight polymer with a minimum tensile impact of 600-ft -lbs/sq.in. (1290-k g-cm/cm2). Restrainer body and runner supports shall conform to ASTM A536 High Strength Ductile Iron Grade 65-45-12. Connecting rods and nuts shall conform to high strength, low alloy steel as designated in ANSI/AWWA C111/A21.11
3. HDPE Casing Spacers:
   a. Spacers shall provide full circumferential support in case the carrier pipe twists as it is pushed through the casing. Casing spacers shall have a minimum projection height necessary to clear the bell of the carrier pipe or as otherwise indicated on the plans. Casing spacers shall fasten tightly onto the carrier pipe to prevent spacer movement during installation. The span between spacers should result in conservative long-term load safety factors with carrier pipe full of fluid. Manufacturer shall provide the load

carrying capacity of the spacer assembly and maximum spacing shall conform to manufacturer's recommendations.

4. Alternate Casing Spacers:
   a. When approved by the OWNER, Nylon, Stainless Steel, Ductile Iron, or Carbon Steel Casing Spacers may be used. Such alternate systems shall conform to all requirements as stated in the plans.

C. Tests: Tests for compliance with this specification shall be as specified herein. A certification of compliance with this specification along with a report of each test shall be furnished to the OWNER.

D. Rejection: Tunnel/casing spacers and related materials may be rejected for failure to meet any of the requirements of this specification.

3.04 METHODS OF JACKING, BORING OR TUNNELING

A. General:
   1. Where encasement or carrier pipe is required to be installed under railroad embankments or under highways, streets or other facilities by jacking, boring or tunneling methods, construction shall be made in a manner that shall not interfere with the operation of the railroad, highway or other facility and shall not weaken or damage any embankment or structure. The CONTRACTOR shall notify all railroad companies or TxDOT at least 48-hours prior to construction. The CONTRACTOR shall provide insurance as required by the governing authority.
   2. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained around the excavation, equipment, and materials as required, until such time as the backfill has been completed and then shall be removed from the site. All excavations shall be safely secured at all times to prevent unauthorized access to the excavation site.
   3. The CONTRACTOR shall take the proper precautions to avoid excavating earth or rock or shattering rock beyond the limits of excavation needed to install the conduit. All damages caused by excavating or blasting, either to surface or subsurface structures, shall be repaired or replaced by the CONTRACTOR at the CONTRACTOR'S own cost and expense. The CONTRACTOR shall dispose of all surplus materials at its own expense.
   4. The drilling of pilot holes for the alignment of pipe prior to its installation by jacking, boring, or tunneling shall not be a requirement but may be necessary to maintain grade.

B. Construction by Jacking:
   1. If the grade of the pipe at the jacking end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. This excavation shall not be carried to a greater depth than is required for placing of the guide and jacking timbers and a horizontal distance no nearer the roadbed than the minimum distance shown on the plans.
   2. At the other end of the pipe, an approach trench shall be excavated accurately to grade. All open trenches and pits shall be braced and shored or their walls sloped in such a manner as shall adequately prevent caving or sliding of the walls into the open trench or pit.
   3. Heavy-duty jacks suitable for forcing the pipe through the embankment shall be provided by the CONTRACTOR. In operating jacks, even pressure shall be applied to all jacks used. Suitable bracing between jacks and the jacking head shall be provided so that pressure shall be applied to the pipe uniformly around the ring of the pipe. The jacking head shall be of such weight and dimensions that it shall not bend or deflect when full pressure is applied at the jack. The jacking head shall be provided with an opening for the removal of excavated material as the jacking proceeds. A suitable jacking frame or backstop shall be provided. The pipe to be jacked shall be set on guides which are straight and securely braced together in such manner as to support the section of pipe and to direct it in the proper line and grade. All timber and other materials used in the construction of the jacking assembly shall be of such quality and dimensions that they

shall withstand all stresses to which they are subjected in such a manner as to insure even pressures on the pipe during jacking operations. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe.

4. As the jacking proceeds, the embankment material shall be excavated slightly in advance of the pipe in such a manner as to avoid making the excavation larger than the outside diameter of the pipe, with the excavated material being removed through the pipe. The excavation for the underside of the pipe, for at least 1/3 of the circumference of the pipe, shall conform to the contour and grade of the pipe. The excavation for the top half of the pipe shall conform closely to the outside diameter of the pipe and a clearance greater than 2-in. (5cm) shall not be permitted. All voids between the pipe and the earth shall be filled with grout per ASTM C476 Grout for Masonry. Grout holes may be provided in the pipe, or grouting may be made through drill holes from the ground surface if practicable. The grouting shall follow immediately upon completion of the jacking operation. Grout shall have a maximum compressive strength of 100-psi (7-kg/cm2) at 28-days.
5. All carrier pipe installed by jacking shall be supported by a quarter point cradle of Class B or Class PB concrete as specified by the OWNER across the jacking pit and to the first joint in the ditch section on each end.
6. The distance that the excavation shall extend beyond the end of the pipe depends on the character of the material, but it shall generally not exceed 2-ft. (0.6m). The pipe preferably shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line and grade established by the OWNER shall be permitted only to the extent of 1-in. per 10-ft. (25mm per 3m), provided that such variation shall be regular and only in one direction and that the final grade of the flow line shall be in the direction indicated on the plans.
7. Once jacking of pipe is begun, the operation shall be carried on without interruption, insofar as practicable to prevent the pipe from becoming firmly set in the embankment.
8. Any pipe damaged in jacking operations shall be removed and replaced by the CONTRACTOR at the CONTRACTOR'S entire expense.
9. The pits or trenches excavated to facilitate jacking operations shall be filled as soon as practicable or as directed by the OWNER. The pits or trenches shall then be backfilled in accordance with the location and conditions as are covered elsewhere in these specifications.
10. If a carrier pipe is laid through an encasement pipe, the bedding of crushed rock, concrete, grout or granular material, if any, shall be considered a part of the unit price of the jacking operation.

C. Construction by Boring:
1. The hole shall be bored mechanically with a suitable boring assembly designed to produce a smooth, straight shaft and so operated that the completed shaft shall be at the established line and grade. The size of the bored hole shall be of such diameter to provide ample clearance for bells or other joints. The holes are to be bored mechanically. The boring shall be done by using either a pilot hole or a dry bore method.
2. A pilot hole boring shall be constructed by the following method: An approximate 2- in. (5cm) pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. The pilot hole shall serve as the centerline of the larger diameter hole to be bored.
3. The dry bore shall be constructed as follows: The casing pipe shall be advanced as the soil is removed by augers. Bentonite may only be used as a lubricant. Casing shall be new or used steel conduit approved by the OWNER, with a minimum inside diameter sufficiently larger than the outside diameter of the carrier pipe or ducts to accommodate placement or removal.
4. All carrier pipe installed by boring shall be supported by a quarter point cradle of Class B or Class PB concrete as specified by the OWNER across the boring pit and to the first joint in the ditch section on each end. All pits should have crushed rock and sump areas to remove water. Where groundwater is found, pits shall be lined with filter fabric.

5. All voids shall be grouted per ASTM C476 Grout for Masonry and shall be considered a part of the unit price of the boring operation.
6. In addition to the requirements stated above, the applicable provisions above. Construction by Jacking in regard to the construction of trench, tolerance in line and cradle, method of operations, backfilling, etc. shall govern for construction by boring.

D. Construction by Guided Boring or Directional Drilling: Guided boring or directional drilling shall be accomplished according to the standards in Trenchless Technology Guidelines published by the International Society for Trenchless Technology.

E. Construction by Tunneling:

F. The tunnel shall be excavated in such a manner and to such dimensions so as to permit placing of the proper supports necessary to protect the excavation. The CONTRACTOR shall take the proper precautions to avoid excavating earth or rock or shattering rock beyond the limits of excavation shown on the plans. All damages caused by excavating and blasting, either to surface or subsurface structures, shall be repaired or replaced by the CONTRACTOR at its own cost and expense. Adequate provisions shall be made for safety and health of the workers. All equipment operated in the tunnel shall be powered by either air or electricity. No equipment shall be permitted in the tunnel that uses a petroleum product such as fuel.
   1. Electric lights shall be used for illumination of completed portions of the tunnel used for passage and wherever lighting is needed for inspection of the work. A sufficient number of lamps shall be used to properly illuminate the work, and all wiring for electric power and lights shall be installed and maintained in a safe and secure manner in accordance with the current applicable electrical specifications of the OWNER. CONTRACTOR shall maintain the tunnel air in a condition suitable for the health of the workers and sufficiently clear for surveying operations. A sufficient supply of fresh air shall be provided and maintained at all times in all underground places. Provisions shall be made for the quick and complete removal of gases and dust resulting from blasting or other tunnel operations. Except when unnecessary due to natural ventilation, artificial ventilation shall be maintained in the tunnel by ventilating plants of ample capacity operated when needed to meet the preceding requirements.
   2. If required for safety, suitable steel or timber sheeting, shoring and shall be used to support the sides and roof of the excavation. When the installation is completed, and if approved by the OWNER, supports may be left in place, provided that they clear the encasement or carrier pipe. No separate payment shall be made for supports left in place. Nothing contained herein shall prevent the CONTRACTOR from placing such temporary or permanent supports as it shall deem necessary, nor shall anything contained herein be construed as relieving the CONTRACTOR from its full responsibility for the safety of workers and for all damages to personal property caused by its operations.
   3. If the tunnel is to be lined with concrete as a monolithic structure, then the overbreak, if any, or voids shall be poured with Class A or Class PA concrete as specified by the OWNER. The CONTRACTOR shall not be compensated for overbreaks.
   4. No pipe shall be placed until the foundation is in a condition satisfactory to the OWNER. Tunnel dimensions shown on the plans are minimum dimensions. Any excess excavation and subsequent backfill, concrete or grout fill shall be at the expense of the CONTRACTOR. The pipe shall be laid in the tunnel true to line and grade. Tolerance in line and grade shall be as specified above. Construction by Jacking.
   5. If indicated or specified, the entire void between the outside of the pipe and the tunnel walls or the inside face of the tunnel lining shall be grouted per ASTM C476 Grout for Masonry unless the permanent sheeting, bottom, sides and roof of the tunnel are in a condition satisfactory to the OWNER. The minimum thickness of grout backfill where specified shall be maintained throughout. Grout required for backfill in excess of the minimum dimensions shown on the plans shall be at the entire expense of the CONTRACTOR.
   6. All pipe damaged during construction operations shall be removed and replaced by the CONTRACTOR at the CONTRACTOR'S entire expense.

G. Joints. If corrugated galvanized metal pipe is used, joints may be made by field bolting or by connecting bands, whichever is feasible. When reinforced concrete pipe 24-in. (0.6m) and larger in diameter with tongue-and-groove joints is used for the encasement pipe, the interior joints for the full circumference shall be sealed, packed with mortar and finished smooth and even with the adjacent section of pipe.

3.05 SAFETY

A. The Contractor is responsible for safety on the job site. Perform all Work in accordance with the current applicable regulations of the Federal, State, and local agencies. In the event of conflict, comply with the more restrictive applicable requirement.

B. No gasoline powered equipment shall be permitted in jacking shafts and receiving shafts/pits. Diesel, electrical, hydraulic, and air powered equipment is acceptable, subject to applicable local, state, and federal regulations.

C. Methods of construction shall be such as to ensure the safety of the Work, Contractor's and other employees on site, and the public.

D. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground. Perform all required air and gas monitoring. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground work areas.

E. Perform all Work in accordance with all current applicable regulations and safety requirements of the Federal, State, and local agencies. Comply with all applicable provisions of 29 CFR 1926 , Subpart S, Underground Construction and Subpart P, Excavations, by OSHA. In the event of conflict, comply with the more stringent requirements.

F. The Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe. Keep on-site all equipment required for emergency response in accordance with the agency having jurisdiction.

END OF SECTION

DOCUMENT 00 25 13
PREBID MEETING

1.1 PREBID MEETING

A. Owner and Architect, will conduct a Prebid meeting along with site visit as indicated below:

1. Meeting Date: Friday, December 22, 2023

2. Meeting Time: 9:00 A.M. Central Standard Time

3. Location: 2000 E Expressway 83, Mercedes, Texas 78570

B. Attendance:

1. Prime Bidders: Strongly encouraged to attend.

2. Subcontractors: No mandatory attendance Pre-Bid meeting requirement.

3. Notice: No mandatory attendance Pre-Bid meeting requirement. Site walk-through will follow conclusion of Pre-Bid meeting.

C. Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of two business days prior to meeting.

D. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:

1. Procurement and Contracting Requirements:

a. Invitation for Competitive Sealed Proposals.

b. Bid Instructions.

c. Bid Proposal Form

d. Insurances.

e. Bid Security.

f. Bid Submittal Requirements.

g. Bid Submittal Checklist.

h. Notice of Award.

2. Communication during Bidding Period:
    a. Obtaining documents.
    b. Access to Project Web site.
    c. Bidder's Requests for Information.
    d. Bidder's Substitution Request/Prior Approval Request.
    e. Addenda.
3. Contracting Requirements:
    a. Agreement.
    b. The General Conditions.
    c. The Supplementary Conditions.
    d. Other Owner requirements.
4. Construction Documents:
    a. Scopes of Work.
    b. Temporary Facilities.
    c. Use of Site.
    d. Work Restrictions.
    e. Alternates and Allowances.
    f. Substitutions following Award.
5. Separate Contracts:
    a. Work by Owner.
    b. Work of Other Contracts.
6. Schedule:
    a. Project Schedule.
    b. Contract Time.

c. Liquidated Damages.

d. Other Bidder Questions.

7. Site Visits.

8. Post-Meeting Addendum.

E. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees and others known by the issuing office to have received a complete set of Procurement and Contracting Documents. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.

1. Sign-in Sheet: Minutes will include list of meeting attendees.

END OF DOCUMENT

DOCUMENT 00 26 00
PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

A. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 25 00 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

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

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

1. Extensive revisions to the Contract Documents are not required.

2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.

3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to The Warren Group Architects, Inc. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:

1. Requests for substitution of materials and equipment will be considered if received no later than 3 days prior to date of bid opening.
2. Submittal Format: Submit Procurement Substitution Request, using format provided on Project Web site.

a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.

b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
2) Copies of current, independent third-party test data of salient product or system characteristics.
3) Samples where applicable or when requested by Architect.
4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from local City Ordinances.
7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.

c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.

d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT

SUBSTITUTION REQUEST

(During the Bidding/Negotiating Stage)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ _____ Article/Paragraph: _____

Proposed Substitution: _____

_____ Manufacturer:

_____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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Form Version: January 2013
CSI Form 1.5C

SECTION 003132
GEOTECHNICAL DATA

PART 1 – GENERAL

GEOTECHNICAL DATA:

A. The below reports with it's referenced attachments is part ofthe Procurement and Contracting Requirements for this Project. They provide Owner's information for Bidder's convenience and are intended to supplement rather than serve in lieu of Bidders' own investigation. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. These document and it's attachments are part of the Contract Documents:

1. Millenium Engineers Group, Inc. performed a Geotechnical Engineering Study for this project on August 29, 2023 . This report MEG Report No. 01-23-29156, is included for Contractor’s use.

END OF SECTION

DOCUMENT 00 31 32
GEOTECHNICAL REPORT

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. A Geotechnical Engineering Report for proposed Triumph Public High School-Building Addition, Mercedes, Hidalgo County, Texas, prepared by Millennium Engineers Group (MEG Engineers), Inc., dated August 29, 2023.

C. Related Requirements:

1. Document 00 21 13 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

END OF DOCUMENT

MEG GEOTECHNICAL ENGINEERING REPORT

PROPOSED
TRIUMPH PUBLIC HIGH SCHOOL – BUILDING ADDITION

MERCEDES, HIDALGO COUNTY, TEXAS

Geotechnical Engineering • Construction Materials Engineering & Testing
Environmental • Consulting • Forensics

GEOTECHNICAL ENGINEERING REPORT
FOUNDATION AND PAVEMENT RECOMMENDATIONS
PROPOSED TRIUMPH PUBLIC HIGH SCHOOL – BUILDING ADDITION
MERCEDES, HIDALGO COUNTY, TEXAS

Prepared For
Triumph Public High School

MEG Report No. 01-23-29156

August 29, 2023

MILLENNIUM ENGINEERS GROUP, INC.
TBPE FIRM NO. F-3913
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
TEL:956-702-8500
FAX:956-702-8140
WWW.MEGENGINEERS.COM

August 29, 2023

Triumph Public High Schools
707 Lindberg Avenue
McAllen, Texas 78501
c/o Natanael Perez - The Warren Group Architects, Inc.
nperez@twgarch.com

Subject: Geotechnical Engineering Report
MEG Report No. 01-23-29156
Foundation and Pavement Recommendations
Proposed Triumph Public High School – Building Addition
Mercedes, Hidalgo County, Texas

Dear Mr. Perez:

Millennium Engineers Group, Inc. is pleased to submit the enclosed geotechnical engineering report that was prepared for the above subject project. This report addresses the procedures and findings of our geotechnical engineering study. Our recommendations should be incorporated into the design and construction documents for the proposed development.

We want to emphasize the importance that all our recommendations presented in this report and/or addendums to this report be followed. We look forward to continuing our involvement in the project by providing construction monitoring in accordance with the report recommendations and materials testing services during construction. We strongly recommend that we be a part of the preconstruction meeting to address any specific issues that are pertinent to this project.

Thank you for the opportunity to be of service to you in this phase of the project and we would like the opportunity to assist you in the upcoming phases of the project. If you have any questions, please contact our office at the address, telephone, fax or electronic address listed below.

STATE OF TEXAS
QUYET THANG PHAM
131836
LICENSED
PROFESSIONAL ENGINEER

Cordially,
Millennium Engineers Group, Inc.
TBPE Firm No. F-3913

Amos Emerson, P.E.
Geotechnical Department Manager

Quyet Thang Pham, Ph.D., P.E.
Geotechnical Engineer

The seal appearing on this document was authorized by Quyet Thang Pham, P.E. 131836 on August 29, 2023. Alteration of a sealed document without proper notification to the responsible engineer is an offence under the Texas Engineering Practice Act

Cc: 1 Original and PDF Document

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1.0 INTRODUCTION

Millennium Engineers Group, Inc. (MEG) has completed and is pleased to submit this document that presents our findings as a result of a geotechnical engineering study of this project to our client. The project site is located at 2000 E. Expressway 83 in Mercedes, Hidalgo County, Texas. The project location is shown on the Project Location Map, found in the Appendix section of this report. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendation, for foundation design and construction considerations.

Our scope of services for the project was outlined in MEG proposal No. 01-23-169G, dated July 18, 2023 and approved by Ms. Frances Johnson on July 20, 2023.

2.0 PROJECT DESCRIPTION

It is our understanding that the proposed site will accommodate the construction of a new public high school. It is also our understanding that the proposed public high school will consist of a one (1) story structure. The site construction for the proposed structure is anticipated to be on a slab-on-grade or on-fill foundation provided expansive, soil-related movements will not impair the performance of the structure.

The site will also accommodate the construction of either a rigid or flexible pavement that will serve for light duty and/or heavy duty traffic. Both flexible and rigid pavement types are viable and the selection on the type to be used will depend on the specific needs and criteria of this project site.

3.0 SCOPE AND LIMITATIONS OF STUDY

This engineering report has been prepared in accordance with accepted geotechnical engineering practices currently exercised by geotechnical engineers in this area. No warranty, expressed or implied, is made or intended. This report is intended for the exclusive use by the client and client's authorized project team for use in preparing design and construction documents for this project only. This report may only be reproduced in its entirety for inclusion in construction documents. This report in its entirety shall not be reproduced or used for any other purposes without the written consent of our firm. This report may not contain sufficient information for purposes of other parties or other uses and is not intended for use in determining construction means and methods.

The recommendations presented in this report are based on data obtained from the soil borings drilled at this site and our understanding of the project information provided to us by our client and other project team members, and the assumption that site grading will result in only minor changes in the existing topography. Subsurface soil conditions have been observed and interpreted at the boring locations only.

This report may not reflect the actual variations of the subsurface conditions across the subject site. It is important to understand that variations may occur due to real geologic conditions or previous uses of the site. The nature and extent of variations across the

subject site may not become evident until specific design locations are identified and/or construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time during the design phase and/or construction phase, we should be notified immediately to determine if our opinions, conclusions and recommendations need to be reevaluated. It may be necessary to perform additional field and laboratory tests and engineering analyses to establish the engineering impact of such variations. These services are additional and are not a part of our project scope.

The engineering report was conducted for the proposed project site described in this report. The conclusions and recommendations contained in this report are not valid for any other project sites. If the project information described in this report is incorrect, is altered, or if new information becomes available, we should be retained to review and modify our recommendations. These services are additional and are not a part of our project scope.

Our scope of services was limited to the proposed work described in this report, and did not address other items or areas. The scope of our geotechnical engineering study does not include environmental assessment of the air, soil, rock or water conditions on or adjacent to the site. No environmental opinions are presented in this report. If the client is concerned with environmental risk at this project site, the client should perform an environmental site assessment.

If final grade elevations are significantly different from existing grades at the time of our field activities (more than plus or minus one (1) foot), our office should be informed about these changes. If desired, we will reexamine our analyses and make supplemental recommendations.

4.0 FIELD EXPLORATION PROCEDURES

Subsurface conditions at the subject site were evaluated by two (2) 20-foot soil borings for the building addition and two (2) 6-foot soil borings for the proposed pavement. The Borings were drilled at the locations shown on the Borings Location Map, found in the Appendix section of this report. This location is approximate and distances were measured using a measuring wheel, tape, angles, and/or pacing from existing references. The structural soil borings were drilled in general accordance with American Society of Testing Materials (ASTM) D 420 procedures.

As part of our sampling procedures, the samples were collected in general conformance with ASTM D 1586 procedures. Representative portions of the samples were sealed in containers to reduce moisture loss, identified, packaged, and transported to our laboratory for subsequent testing. In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff. The geotechnical engineering properties of the strata were evaluated by a series of laboratory tests. The results of the laboratory and field-testing are tabulated on the boring logs and Summary of Soil Sample Analyses which are found in the Attachments section of this report.

Standard penetration test results are noted on the boring logs as blows per 12 inches of penetration. Three 6 inch increments are performed for each standard penetration test. The sum of the blows for the final two 6 inch increments is considered the "standard penetration resistance value" or "N-value." Where hard or very dense materials were encountered, the tests are terminated as follows: (1) when a total of 50 blows have been applied in any of the 6 inch increments, or (2) when a total of 100 blows have been applied, or (3) when there is no observed advance of the sampler in the application of 10 successive blows. The boring logs in the case of hard or very dense materials will be noted as follows: 50/3", where 50 is the number of blows applied in 3 inches of penetration, or 100/7½" where 100 is the number of blows applied in a total of 7 ½ inches of penetration, or 10/0", where 10 is the number of blows applied in 0 inches of penetration.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the Client.

5.0 GENERAL SITE CONDITIONS

5.1 Site Description

The project site is located at 2000 E. Expressway 83 in Mercedes, Hidalgo County, Texas. The project location is shown on the Project Location Map, found in the Appendix section of this report. At the time of our field operations, the subject site can be described as a developed tract of land with an existing building and existing asphalt pavement. The general topography of the site is relatively flat sloping down to the south with a visually estimated vertical relief of less than 3 feet. Surface drainage is visually estimated to be poor to fair.

5.2 Site Geology

According to the Soil Survey of Hidalgo County, Texas, published by the United States Department of Agriculture – Soil Conservation Service, the project site appears to be located within the Mercedes and Raymondville soil associations.

- The Mercedes series consist of deep, moderately well drained, clayey soils on nearly level soil is on plane to slightly concave uplands. These soils formed in calcareous clayey sediments. This soil is moderately well drained, surface runoff is very slow and permeability is very slow. Slopes range from 0 to 1 percent, although in most areas they are less than 0.5 percent. Areas are mostly broad and irregular in shape and range from 25 to more than 350 acres or more. The corresponding soil symbol is 40, Mercedes clay.

- The Raymondville series consist of deep, well drained, clayey soils on uplands, nearly level soil is on plane to slightly concave uplands. These soils formed in calcareous clayey sediments. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are irregular in shape and range in size from 50 to 950 acres. Surface runoff is slow and permeability is slow. The corresponding soil symbol is 52, Raymondville clay loam.

5.3 Subsurface Conditions

On the basis of our borings, four (4) generalized strata that possess similar physical and engineering characteristics can describe the subsurface stratigraphy at this site. Table 5.1 summarizes the approximate strata range in our boring logs. These were prepared by visual classification and were aided by laboratory analyses of selected soil samples. The lines designating the interfaces between strata on the boring logs represent approximate boundaries. Transitions between strata may be gradual details for each of the borings can be found on the boring logs in the appendix of this report.

Table 5.1. Approximate Subsurface Stratigraphy Depths.

Stratum	Range in Depth, ft[1]	Stratum Description[1]
I	0 – 12	lean CLAY with sand, dk. brown, dry to moist, med. stiff to very stiff
II	0 – 6[2]	fat CLAY with sand, dk. brown, moist, med. stiff
III	6 – 12[2]	sandy lean CLAY, brown to dk. brown, moist, med. stiff to stiff
IV	12 – 20	clayey SAND, brown, moist to wet, loose to med. dense

Note 1: The stratum thickness and depths to strata interfaces are approximate. Our measurements are rounded off to the nearest foot increment and are referenced from ground surface at the time of our drilling activities. Subsurface conditions may vary between the boring locations.
Note 2: Stratums II & III are applicable to Boring B-2 only.

5.4 Groundwater Conditions

The dry auger drilling technique was used to complete the soil borings in an attempt to observe the presence of subsurface water. During our drilling operations we encountered the groundwater table to be at approximately twenty (20) feet below natural ground elevation for short term conditions. Moisture content test exhibited high moisture content at a depth of fifteen (15) feet below natural ground elevation. Table 5.2 summarizes the approximate groundwater and cave in depths measured in our explorations. It should be noted that the groundwater level measurements recorded are accurate only for the specific dates on which measurement were obtained and does not show fluctuations throughout the year.

Fluctuations in Groundwater levels are influenced by variations in rainfall and surface water run-off from season to season. The construction process itself may also cause variations in the groundwater level. If the subsurface water elevation is critical to the construction process the contractor should check the subsurface water conditions just prior to construction excavation activities.

Table 5.2. Approximate Groundwater and Cave-in Depths.

Boring No.	Depth to Subsurface Water, Ft[1]	Depth to Cave-In, Ft[1]
	Time of Drilling	Time of Drilling
B-1	20	17
B-2	20	19
P-1	-	-
P-2	-	-

Note 1: Subsurface water levels and cave-in depths have been rounded to the nearest foot.

Based on the findings in our borings and on our experience in this region, we believe that groundwater seepage **may** be encountered during site earthwork activities. If groundwater seepage is encountered during site earthwork activities, it may be controlled using temporary earthen berms and/or conventional sump-and-pump dewatering methods.

6.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

6.1 General

The analysis and recommendations presented in this report are applicable specifically to the proposed foundation structure. The data gathered from both the field and laboratory testing programs on soil samples obtained from the borings was utilized to establish geotechnical engineering parameters to develop recommendations for the proposed structure. The foundation system(s) considered in this report to provide support for the proposed structure must meet two independent criteria. One of the criteria is that the movement below the foundation structure due to compression (consolidation) or expansion (swell) of the underlying soils must be within tolerable limits. This criterion is addressed in the Soil Related Movements section of this report. The other criterion is that the dead and live loads must be distributed appropriately and the foundation structure designed with an acceptable factor of safety to minimize the potential for bearing capacity failure of the underlying soils.

Geotechnical and structural engineers in this general area consider soil movements or Potential Vertical Rise (PVR) of approximately one (1) inch or less to be within acceptable structural design tolerances for most structures but may be different depending on structure use and the desired performance of the foundation. Therefore, movements of the underlying soils are not eliminated and thus one should expect a slab foundation structure to exhibit differential vertical movements. However, structural engineers design

slab foundations for the expected magnitude of soil movements without failure of the structure. More stringent soil movement criteria may be established but the owner should consider the exponential increase in cost required to design and construct a structure for such soil movements. Data obtained in this study indicate that the soils at this site have strength characteristics capable of supporting the foundation and structure if designed appropriately. Stratum I is composed of lean clay with sand and has a moderate potential to exhibit volumetric changes (contraction and expansion). Stratum II is composed of fat clay with sand and has a high potential to exhibit volumetric changes. Stratum III is composed of sandy lean clay and has a moderate potential to exhibit volumetric changes. Stratum IV is composed of clayey sand and has a low potential to exhibit volumetric changes. The potential for soil volumetric changes is dependent on variations in moisture contents of the underlying soils. Based on this data, this site is suitable for a slab foundation provided the subgrade is modified in accordance with the recommendations established in this report to reduce the potential for these soil volumetric changes.

6.2 Soil-Related Movements

The anticipated ground movements due to swelling of the underlying soils at this site were estimated for slab foundation construction using the Texas Department of Transportation (TxDOT) procedures of test method TEX-124-E for determining Potential Vertical Rise (PVR). A PVR value of two and a quarter (2 1/4) inches was estimated for the stratigraphic conditions encountered in our subsurface borings. A surcharge of 1 pound per square inch for the concrete slab, an active zone of 15 feet, and dry subsurface moisture conditions were assumed in estimating the above PVR values.

The following methods are generally acceptable for use in modifying the subgrade to reduce the potential for soil movements and volumetric changes below the foundation structure.

Excavate expansive clay soils and replace with select fill.
Chemical injection of expansive clay soils.
A combination of methods 1 and 2.

The method to be used is dependent on specific site conditions. At this site the grade will most likely need to be raised to obtain the proposed Finished Floor Elevation (FFE). As of the date of this report the CLIENT/OWNER has provided the proposed FFE of 62.50 feet AMSL. We recommend that the project civil engineer evaluate the proposed FFE with our recommendations to ensure that the subgrade modifications presented in the report are not diminished or compromised. Adding select fill is generally the most cost effective method for reducing the potential for soil related movements. Therefore, we only discuss this method in this report but we can provide details for the other methods if requested.

Based on the data obtained, the proposed FFE of 62.50 feet AMSL and natural ground elevation ranging from 60 feet AMSL to 62 feet AMSL, information provided by our client and our analysis of the site, we recommend the following modification (Table 6.1. Subgrade Modifications) of the subgrade at this area to accomplished finish floor elevation of the subgrade at this site. This method will maintain the potential for soil

related movements to an approximate PVR value of less than one (1) inch, which is generally desired for projects of this type.

Table 6.1. Subgrade Modifications

Item	Description
1	See and adhere to the Site Preparation Recommendations section of this report.
2	Excavate existing soils to a depth of 57.00 feet AMSL in accordance with the Site Preparation Recommendations section of this report.
3	Condition and compact twelve (12) inches of subgrade below excavated soils in accordance with the Site Preparation Recommendations section of this report.
4	Place **select fill,** to an elevation of 62.00 feet AMSL, for a total of 5 feet select fill, condition and compact up to the proposed FFE in accordance with the Select Fill Recommendations section of this report.

The PVR method of estimating expansive, soil-related movements is based on empirical correlations utilizing the measured plasticity indices and assuming typical seasonal fluctuations in moisture content. If desired, other methods of estimating expansive, soil-related movements are available, such as estimations based on swell tests and/or soil-suction analyses. However, the performance of these tests and the detailed analyses of expansive, soil-related movements were beyond the scope of the current study. It should also be noted that actual movements can exceed the calculated PVR values as a result of isolated changes in moisture content (such as leaks, landscape watering, etc.) or if water seeps into the soils to greater depths than the assumed active zone depth due to deep trenching and/or excavations.

6.3 Conventional Shallow Slab-on-Grade Foundation Design Criteria

As indicated previously a slab foundation may be used at this site in conjunction with the subgrade modifications listed under the Soils Related Movements section. We recommend the following soil bearing pressures, and dimensional criteria for the slab grade beams. These recommendations ensure proper utilization of soil bearing capacity of continuous beam sections in the slab-on-grade foundation and reduce the potential of water migration from the outside to beneath the slab foundation. For structural considerations the beams may need to be greater and should be evaluated and designed by the structural engineer. Where concentrated load areas are present the grade beams or slab may be thickened and widened to serve as spread footings. Soil bearing pressures and beam dimensional criteria are as follows:

Table 6.2. Bearing Criteria

Grade Beams and Continuous Footings	
Minimum depth below finished grade:	24 inches
Maximum depth below finished grade:	36 inches
Maximum width:	30 inches
Maximum allowable bearing pressure:	1,800 psf
Spread Footings (square)	
Minimum depth below finished grade:	24 inches
Maximum depth below finished grade:	36 inches
Maximum width:	60 inches
Maximum allowable bearing pressure:	2,100 psf

The above-presented maximum allowable bearing pressures will provide a factor of safety of 3 with respect to the design soil strengths. For a slab foundation structure designed and constructed in accordance with the recommendations of this report, it is anticipated that total settlements will be in the order of one (1) inch or less. If lower anticipated total settlements are required for this project further mitigation may be required and MEG must be consulted for further recommendations.

Furthermore, the above design parameters are contingent upon the fill materials (if utilized) being selected and placed in accordance with the recommendations presented in the Select Fill Recommendations section of this report. Should select fill selection and placement differ from the recommendations presented herein, MEG should be informed of the deviations in order to reevaluate our recommendations and design criteria.

Excavations for slab on grade and spread footing foundations should be performed relatively clean and with an undisturbed bearing area. The bottom 6 inches of the excavation should be performed using a flat plate excavation bucket. The excavations should be neatly excavated. No foreign debris or undisturbed soil should be left in the footing bottom. Should there be any abundance of foreign debris or disturbed soil found, it may be necessary to re-assess the fill site of its bearing capacity suitability. If the bearing area is found to be disturbed, the bearing area will require preparation and compaction for the entire depth of the disturbance in accordance with the Site Preparation and/or the Select Fill sections of this report.

The bearing surface of the grade beams and spread footings should be evaluated after excavation and immediately prior to concrete placement. We recommend that footing inspections be performed by a representative of MEG. The required inspections shall include inspecting for clean, dry (The moisture content should be within limits specified by the appropriate section in this report.) and undisturbed footing bottom, depth of footing, clearances from sides and size and spacing of reinforcing steel. Test results shall comply

with the recommendations of this geotechnical report and shall be verified by an on-site representative of MEG.

Over excavation, if necessary, for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of over excavation depth below footing base elevation. The over excavation should then be backfilled up to the footing base elevation select fill placed in lifts of 8 inches or less in loose thickness and prepared and compacted in accordance with the Site Preparation and/or the Select Fill sections of this report. Equipment should not be operated and materials should not be placed or stockpiled within a horizontal distance equal to the excavation depth from the edge of the excavation. Excavations should not be placed next to existing structures or buried utilities/structures closer than a horizontal distance equal to the excavation depth unless some form of protection for the facilities is provided.

Water should not be allowed to accumulate at the bottom of the foundation excavation. Proper barriers such as berms or swales should be placed to divert any surface runoff away from 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, properly prepared and cleaned. Excavations should not be left open overnight.

6.4 BRAB Design Criteria for Slab-on-Grade Foundations

Table 6.3 list the values for criteria developed by the Building Research Advisory Board (BRAB) for the design of shallow slab-on-grade foundations. On the basis of stratigraphy encountered and the anticipated site modifications discussed earlier, the design criteria are as follows:

Table 6.3. BRAB Values

For Existing Conditions	
Effective Plasticity Index	33
Climatic Rating Cw.	15
Soil Support Index, (c)	0.81
For Proposed Conditions	
Effective Plasticity Index	24
Climatic Rating Cw.	15
Soil Support Index, (c)	0.90

Note 1: Subgrade Modifications as outlined in the recommendations of this report;

7.0 CONSIDERATIONS DURING CONSTRUCTION

7.1 Site Grading Recommendations

Site grading plans can result in changes in almost all aspects of foundation recommendations. We have prepared the foundation recommendations based on the existing ground surface; there is a two (2) feet surcharge addition for the stratigraphic conditions encountered at the time of our study. If site grading plans differ from existing grades by more than plus or minus 1 foot, we must be retained to review the site grading plans prior to bidding the project for construction. This will enable us to provide input for any changes in our original recommendations that may be required as a result of site grading operations or other considerations.

7.2 Site Drainage Recommendations

Drainage is one of the most important aspects to be addressed to ensure the successful performance of any foundation. Positive surface drainage should be implemented prior to, during and maintained after construction to prevent water ponding at or adjacent to the building facilities. It is recommended that the building and site design include rain gutters, downspouts and concrete gutters to channel runoff to paving or storm drains.

7.3 Site Preparation Recommendations

Building areas and all area to support select fill should be stripped of all vegetation and organic topsoil up to a minimum of 5 ft. beyond the building perimeters. After stripping, remove at least six (6) inches of on-site soil as measured from existing grade when excavation of existing subgrade is not recommended in other sections of this report. The excavated material, if free of organic and/or deleterious material, may be stockpiled for use in the non-structural areas of the site. Where excavation of the subgrade is recommended in this report, the bottom of the excavation will extend at least five (5) feet beyond the limits of the planned building perimeter including canopies and sidewalks. Exposed subgrades should be thoroughly proof rolled in order to locate and compact any weak, compressible and soft spots. Proof rolling shall be in accordance with TxDOT 2014 Specification Item 216. Proof rolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proof rolling or areas where large tree roots have been removed within the limits of excavation should be removed and replaced with a suitable, compacted select fill in accordance with the recommendations presented under the Select Fill Recommendations section of this report. Proof rolling operations and any excavation/backfill activities should be observed by **MEG** representatives to document subgrade preparation.

Prior to fill placement, the exposed subgrade shall be prepared based on what option is selected from the foundation and pavement recommendations. The exposed subgrade should be prepared, moisture-conditioned by scarifying to a minimum depth as recommended in the foundation and pavement recommendations and recompacting to a minimum 98 percent of the maximum dry density as determined in accordance with ASTM

D 698, moisture-density relationship. The moisture content of the subgrade should be maintained within the range of zero (0) percentage points below optimum to plus four (+4) percentage points above the optimum moisture content until the fill is permanently covered. The soil should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.4 Select Fill Recommendations

Materials used for select fill shall meet the following requirements:

1. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base; Type A, Grades 1 through 3.
2. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base, Types B or C, Grades 1 through 5 with a minimum plasticity index of 7.
3. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base, Type E, Grade 4 with a plasticity index between and inclusive of 7 and 15. Type E material shall be defined as Caliche (argillaceous limestone, calcareous or calcareous clay particles) and may contain stone, conglomerate, gravel, sand or granular materials when these materials are in situ with the caliche. Flexible Base (Type E, Grade 4) shall conform to the following requirements:

Table 7.1. Type E, Grade 4 Requirements

Retained on Sq. Sieve	Percent Retained
2”	0
½”	20-60
No. 4	40-75
No. 40	70-90
Max. PI:	15
Max. Wet Ball PI:	15
Wet Ball Mill Max Amount:	50
Wet Ball Increase, Max Passing No. 40 sieve	20

4. Soils classified according to USCS as SM, SC, GM, GC, CL, ML and combinations of these soils. The soils shall be relatively free of organic matter. In addition to the USCS classification, select materials shall have a liquid limit of less than 40 and a plasticity index between and inclusive of 10 and 17.
5. Soils classified, as CH, MH, OH, OL and PT, under the USCS are not considered suitable for use as select fill materials at this site.

Select fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum 98 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within the range of minus two (-2) percentage points below optimum to plus two (+2) percentage

points above the optimum moisture content until the fill is permanently covered. The select fill should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.5 Site Fill Recommendations

Site fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum 98 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within the range of zero (0) percentage points below optimum to plus four (+4) percentage points above the optimum moisture content until the fill is permanently covered. The site fill should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.6 Back Fill Recommendations

Back fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum 95 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within the range of zero (0) percentage points below optimum to plus four (+4) percentage points above the optimum moisture content until the fill is permanently covered. The back fill should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.7 Utility Considerations

Utilities that project through the slab-on-grade, slab-on-fill, floating floor slabs, or any other rigid unit should be designed with some degree of flexibility or with sleeves. Such features will help reduce the risk of damage to utility facilities from soil movements related to shrinkage and expansion.

7.8 Utility Trench Recommendations

Bedding and initial backfill are buried around utility lines to support and protect the utility. The secondary backfill above the initial backfill also helps protect and support the foundation and/or pavement above. To ensure that settlement is not excessive in this secondary backfill we recommend the following:

1) If possible, trench and install utilities prior to work such as lime treatment and/or compaction of subgrade or placement of other fills or bases.
2) Place, moisture condition and compact the secondary backfill in accordance with the pertinent project requirements. Within the footprint of a building pad the secondary backfill should meet the same compaction requirements for select fill. Within the footprint of a pavement structure the secondary backfill should meet the same compaction requirements for the subgrade. When compaction of the subgrade is not specified it should meet the same compaction level of the adjacent natural ground. An alternative to compaction of secondary backfill is the use of

flowable fill where secondary backfill is to be placed. If properly designed, the flowable fill can be excavated easily at a later date if necessary. No compaction and no testing is required when properly designed flowable fill is used.

7.9 Excavation, Sloping and Benching Considerations

If trenches are to extend to or below a depth of five (5) ft., the contractor or persons doing the trenching should adhere to the current Occupational Health and Safety Administration (OSHA) guidelines on trench excavation safety and protection measures. Other industry standards may be applicable. The collection of specific geotechnical data and development of a plan for trench safety, sloping, benching or various types of temporary shoring, is beyond the scope of this study.

7.10 Shallow Foundation Excavation Considerations

The Geotechnical Engineer or his representative prior to the placement of reinforcing steel and concrete should observe shallow foundation excavations. This is necessary to verify that the bearing soils at the bottom of the excavations are similar to those encountered during the subsurface soil exploration phase and that excessive loose materials and water are not present in the excavations. If soft pockets of soil are encountered in the foundation excavations, they should be removed and replaced with a compacted non-expansive fill material or lean concrete up to the design foundation bearing elevation.

7.11 Landscaping Considerations

Even though landscaping is a vital aesthetic component of any project, the owner, client and design team should be aware that placing trees or large bushes adjacent to any structure may distress the structure in the future. It is recommended that if any landscaping is to be placed adjacent to the structure in this project, it should be limited to small plants and shrubs. Trees and large bushes should be placed at a distance such that at their mature height, their canopy or “drip line” does not extend over the structures. The owner, client and design team should also be aware that if any watering is to be done in connection with the landscaping for this project it should be controlled, consistent and timely. Excessive or prolonged watering is not recommended. If watering is part of the landscaping plan, termination of watering for any extended period of time may also be detrimental to the structure. It is important that the moisture level in the subsurface soils remain constant so that shrinking and swelling of soils may be mitigated.

7.12 Perimeter Foundation Cap

We recommend that a cap of impervious fill be placed around the perimeter of the foundation to mitigate the intrusion of moisture into the soils surrounding the foundation. The top eighteen inches of fill around the foundation structure should be a low permeance clay cap to keep surface water away from the foundation. The low permeance clay cap should be sloped away from the foundation at a minimum slope of 2% and the surrounding areas should have positive drainage. The low permeance clay shall meet the USCS

classification of CL and meeting the requirements in Tables 7.2 Gradation Requirements and Table 7.3 Atterberg Limits Requirements. The low permeance clay shall be compacted to minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the subgrade should be maintained within the range of optimum to four (4) percentage points above the optimum moisture. If plantings are intended, add 4 to 6 inches of loam on top of the clay cap.

Table 7.2. Gradation Requirements

Sieve Size	Percent Passing (by dry weight)
1/2 inch	100
No 4	70-100
No. 200	50 – 100

Table 7.3. Atterberg Limits Requirements

Test / ASTM	Requirement
Atterberg Limits D4318	LL ≤ 45 20 ≤ PI ≤ 30

8.0 PAVEMENT SECTION RECOMMENDATIONS

8.1 General Information

The study was also performed to determine recommendations for the construction of a flexible pavement and these recommendations are presented in this report. The pavement recommendations are limited to samples taken from the existing soils within the roadway areas present at the site. The pavement design implemented for this project should be evaluated the civil engineer based on a traffic and design analysis for this project.

Recommendations for both flexible and rigid pavements are presented in this report for further evaluation by the project civil engineer. Both pavement types are viable and the selection on the type to be used will depend on the specific needs and criteria of this project site. Generally, flexible pavements have a lower initial construction cost when compared to rigid pavements. On the other hand a rigid pavement has lower maintenance cost throughout the life of the pavement structure as compared to flexible pavements. Flexible pavements generally require more frequent repairs and overlays at intervals from 6 to 10 years to meet the structural and functional requirements of the pavement during the design life. All pavements are very dependent on the condition of the soil platform on which they are supported and thus moisture conditions will play an important role in the performance of the pavement during its structure life. Proper consideration to drainage of the pavement structure and the surrounding areas is essential to the successful performance of a pavement structure.

After proof rolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in the Site Preparation section of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

8.2 Sulfate Content of Existing Soils

TxDOT has identified Hidalgo County as an area with a high potential of sulfate rich soils. Sulfate testing was performed in accordance with TxDOT Tex-145-E as indicated below. A summary of these results are as follows:

Table 8.1 Sulfate Content in Parts Per Million

Location	Sulfate Content, (PPM)
P-1 at depth of 0.5' to 2'	140
P-2 at depth of 0.5' to 2'	640

Below are listed general exposure levels of potential harm to concrete structures exposed to soils containing sulfates. These levels fall into three ranges based on Sulfate Concentration (SC) in the soil.

- Level 1 - Mild: SC < 3,000 ppm
- Level 2 - Moderate: 3,000 < SC < 8,000 ppm
- Level 3 - Severe: SC > 8,000 ppm

Laboratory test results indicated that the existing soils have Level 1 or mild concentration of sulfates in the soils. Therefore, according to TxDOT policy, lime/cement treatment may be used for stabilization of the pavement subgrade for the levels indicated. ***Reference Section 9.7 for Mellowing Recommendations***. We also want to point out that results obtained are only for the locations indicated. Sulfate concentrations may change significantly at other locations within the project site. We also want to point out that when the proposed grading requires excavation and/or fill of the site we recommend that additional testing be performed when the site has been brought to final grade at the subgrade level to determine sulfate concentration in the soils and determine appropriate subgrade stabilization. The civil engineer should evaluate the sulfate levels to appropriately make recommendations for mitigating sulfate and lime/cement reactions producing expansive by products. We recommend following the TxDOT policies for subgrade treatment for soils containing sulfates. These policies can be found on the TxDOT Construction Division website entitled "Guidelines for Treatment of Sulfate-Rich Soils and Bases in Pavement Structures" September 2005.

8.3 Soil Stabilization Recommendations

The plasticity index of the surface soils at this site is approximately 24 to 33 percent. The existing subgrade soils require lime stabilization for soil shrink and swell mitigate. We recommend the addition of four and a half (4 ½) percent lime by weight to the existing surface soils. We recommend that the existing soils be tested after the pavement areas have been excavated or filled to the top of the subgrade elevation to verify the soil stabilization requirements. The natural ground should then be prepared as stated in the Site Preparation Recommendations of the pavement section. Proper consideration to drainage of the pavement structure and the surrounding areas is essential to the successful performance of a pavement structure.

8.4 Design Methodology and Traffic Information

Our engineering analysis of the pavement type considered the information obtained from our soil borings, the field and laboratory testing, our past experience with similar soils and site conditions. Design of new pavements for the project has been based on the procedures outlined in the 1993 Guide for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO). The client did not provide projected ESALs. We recommend that the project Civil Engineer or a Traffic Engineer review the project for the appropriate traffic levels and design periods to ensure that they are appropriate and consistent with the specific project site requirements. The assumptions for traffic used in the pavement design analysis are as follows:

Table 8.2. Flexible Pavement Traffic Criteria Utilized

Criteria	Value[1]
Reliability Level	80%
Standard Deviation	0.45
Initial Serviceability level	4.0
Terminal Serviceability level	2.0

Note 1: The above traffic criteria as per 1993 AASHTO Pavement Design Guidelines.

Table 8.3. Rigid Pavement Traffic Criteria Utilized

Criteria	Value[1]
Reliability Level	95%
Standard Deviation	0.35
Initial Serviceability level	4.0
Terminal Serviceability level	2.0

Note 1: The above traffic criteria as per 1993 AASHTO Pavement Design Guidelines.

8.5 Recommended Pavement Sections

The proposed pavement section for entrances, drives and parking areas may be chosen from one of the following options in the tables below.

The selection process of the appropriate pavement option should consider the following:

1. The client should consider the options presented as minimum pavement sections for the appropriate use and expected traffic levels. The civil engineer of record should evaluate the minimum pavement sections recommended with the appropriate class of pavement required for this project. The local government requirements should be met when they are more stringent than the minimum pavement sections recommended in our report.

Table 8.4. Flexible Pavement Options

Materials	Light Duty[1]	Heavy Duty[2]
Asphaltic Concrete (In)	2.0	3.0
Untreated Caliche Base (In)	8.0	12.0
Lime Treated Subgrade (In)[3]	6.0	10.0

Note 1: Light Duty Pavement (ESALs = 9,000)
Note 2: Heavy Duty Pavement (ESALs = 132,000)
Note 3: Please refer to Section 9.7 Mellowing Recommendation

Table 8.5. Rigid Concrete Pavement Options

Materials	Light Duty[1]	Heavy Duty[2]
Reinforced Concrete Pavement (In)	5.0	7.0
Lime Treated Subgrade (In)[3]	6.0	10.0

Note 1: Light Duty Pavement (ESALs =9,000)
Note 2: Heavy Duty Pavement (ESALs = 132,000)
Note 3: Please refer to Section 9.7 Mellowing Recommendation

It is recommended that concrete pavements be reinforced. At a minimum, the reinforcing bars should be placed as follows:

Table 8.6. Longitudinal Drives and Entrances

Thickness (in)	Bar Size	Longitudal Spacing (in)	Transverse Spacing (in)
<=6	3	12	24
<=7	4	12	24

Table 8.7. Parking Areas

Thickness (in)	Bar Size	Longitudal Spacing (in)	Transverse Spacing (in)
<=6	3	16	16
<=7	4	16	16

Longitudinal reinforcement should be placed at ½ the slab depth +/- ½ inch from the surface. At a longitudinal edge, the first two spacing's for longitudinal reinforcement shall be at ½ the normal longitudinal spacing. At transverse construction joints, additional longitudinal reinforcement shall be placed at a spacing one half the normal longitudinal spacing for a length of 42 inches. At transverse joints, the first two spacing's for transverse reinforcement shall be at ½ the normal transverse spacing. All reinforcement should be specified as deformed steel meeting the requirement of ASTM A-615 (Grade 60) or ASTM A-616 (Grade 60). Splices should be a minimum of 33 nominal bar diameters. Reinforcing should not extend across longitudinal and expansion joints. Dowels across longitudinal and expansion joints are recommended to be 7/8 inch diameter, smooth bars with a length of 42 inches and spaced at a maximum 24 inches on center.

Longitudinal and transverse joints are recommended at a maximum spacing of 10 feet for pavements with a thickness of less than 6 inches and at a maximum spacing of 15 feet for pavements with a thickness of 6 inches or greater. The longitudinal and transverse joints should be formed or saw cut to a depth of 1/3 of the slab depth for concrete containing siliceous coarse aggregate and ¼ of the slab depth for limestone aggregate. Sawing of joints should begin as soon as the concrete will not chip and ravel. It is

recommended that longitudinal and expansion joints be doweled to promote load transfer. Expansion joint spacings are not to exceed a maximum of 75 feet and no expansion or contraction joints should be located within a swale or drainage collection area. Expansion joints are also needed to separate the concrete slab from fixed objects such as inlets, light standards and buildings.

It is recommended that the concrete pavement surface have a minimum slope of 0.015 ft/ft to provide adequate surface drainage. It is recommended that the concrete pavement should cure a minimum 7 days before allowing any traffic provided that adequate concrete strength has been attained as determined by the project Civil Engineer.

The curb shall be constructed in lengths equal to the adjoining pavement slab lengths, and expansion joints shall be provided in the curb opposite each transverse expansion joint in the pavement. Expansion joint material shall be of the same thickness, type and quality as specified for the pavement and shall be of the section as shown for the curb. All expansion joints shall be carried through the curb. Transverse contraction joints shall be sawed across the curb at the same time as sawing of the transverse contraction joints in the pavement are sawed. The curb shall be placed monolithically with the pavement for edge support and reinforced with a minimum one (1) #5 rebar. A finish coat of mortar shall be applied on the exposed surfaces of monolithic curbs.

8.6 Garbage Dumpster Considerations

Within flexible pavement areas, it is recommended that reinforced concrete pads be provided in front of and beneath garbage dumpsters. Concrete paving is also recommended in areas where the dumpster trucks make turns with small radii to access the dumpsters. The pads should be a thickened concrete slab and reinforced similar to the concrete pavement recommendations or a minimum 10 inches thick.

9.0 PAVEMENT MATERIAL SPECIFICATION SECTIONS

9.1 Pavement Preparation Recommendations

Pavement areas should be stripped of all vegetation and organic topsoil up to a minimum of two (2) feet beyond the pavement perimeters. After stripping, remove at least six (6) inches of on-site soil as measured from existing grade when excavation of existing subgrade is not recommended in other sections of this report. The excavated material, if free of organic and/or deleterious material, may be stockpiled for use in the non-pavement areas of the site. Where excavation of the subgrade is recommended in this report, the bottom of the excavation will extend at least two (2) feet beyond the limits of the planned pavement perimeter including canopies and sidewalks. Exposed subgrades should be thoroughly proof rolled in order to locate and compact any weak, compressible and soft spots. Proof rolling shall be in accordance with TxDOT 2014 Specification Item 216. Proof rolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proof rolling or areas where large tree roots have been removed within the limits of excavation should be removed and replaced with a suitable, compacted fill in

accordance with the recommendations presented in TxDOT 2014 Specification Item 132 for density control and material requirements for Types A and B. If the fill is a clay it shall meet USCS Classification CL. Proof rolling operations and any excavation/backfill activities should be observed by MEG representatives to document subgrade preparation.

The exposed subgrade shall then be prepared based on what option is selected from the pavement recommendations. The soil should be worked in accordance with the recommendations and tested by MEG personnel for compaction as specified.

9.2 Hot Mix Asphaltic Concrete Surface

The asphaltic surface shall meet the requirements of the current TxDOT 2014 Specification Item 340 for Dense Graded Hot Mix Asphalt (small quantity) for projects with total production of less than 5,000 tons and TxDOT 2014 Specifications Item 341 Dense Graded Hot Mix Asphalt for projects with total production of 5,000 tons or greater. The hot mix asphaltic surface will be compacted to between 3.0 and 8.5 percent in place air voids in conformance with the specification. It is recommended that the testing required by this specification be performed during production.

Table 9.1. Dense Grade Hot Mix Asphalt Additional Requirements

Test Procedure	Requirement
Target Design Laboratory Density, %	97.0 (for light duty areas)
	96.5 (for heavy duty areas)

9.3 Reinforced Concrete

Concrete shall meet a minimum 28-day compressive strength of 3200 psi for light duty pavements and 4000 psi for medium and heavy duty pavements and a maximum water/cement ratio of 0.45. The concrete for concrete paving shall meet the requirements for Class P Concrete of TxDOT 2014 Specification Items 360 and 421. Aggregates used in the concrete design should meet the requirements of TxDOT 2014 Specification Item 421 or ASTM C33.

9.4 Untreated Caliche Base

The base shall be caliche base and meet the requirements of TxDOT 2014 Specification Item 247 Type E, Grade 3 or better and including the requirements of Table 9.2 shown below. The base shall be compacted to a minimum 98 percent of the maximum dry density as determined by the standard moisture density relation (ASTM D 698) at moisture contents ranging between minus two (-2) and plus two (+2) percentage points of the optimum moisture content. The base shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and not less than 5 ½ inches (4 inches compacted).

Table 9.2. Flexible Base Type E, Additional Requirements

Retained Procedure	Requirements
Max. PI:	12 (15 for treated base)
Max. Wet Ball PI:	12 (15 for treated base)
Wet Ball Mill Max Amount:	50
Wet Ball Increase, Max Passing No. 40 sieve	20

9.5 Lime Treated Caliche Base

The base shall meet all the requirements of untreated caliche base. In addition the base shall be treated with a minimum one and a half (1 ½) percent lime or Portland cement by weight. Lime shall meet the requirements of TxDOT 2014 Specification Item 260. Portland cement shall be Type I meeting ASTM C150 or Type IP meeting ASTM C595. Lime treatment will be in accordance with TxDOT 2014 Specification Item 260 or 263 for base courses and Item 260 for subgrades. Cement treatment shall be in accordance with TxDOT 2014 Specification Item 275 or 276. The base shall be compacted to a minimum 98 percent of the maximum dry density as determined by the standard moisture density relation (ASTM D 698) at moisture contents ranging between minus two (-2) and plus two (+2) percentage points of the optimum moisture content. The base shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and not less than 5 ½ inches (4 inches compacted).

9.6 Lime Treated Subgrade

Lime stabilization of the soils may be used for soil shrink and swell mitigation and to increase the structural capacity of the subgrade as platform for the pavement. It is recommended that the subgrade plasticity index be verified after the site is stripped of the loose topsoil and the subgrade is exposed up to the subgrade elevation. Stabilization treatment of the subgrade soils may also be utilized to provide a platform for the base for resistance to moisture intrusion and changes. Prevention of moisture intrusion is extremely important to the life of a pavement. Increases in moisture content of the subgrade and the base will significantly reduce the material's structural ability to carry loads. The optimum lime content should reduce the PI of the soil to 20 or less and should result in a soil lime mixture with a pH of at least 12.4 when tested in accordance with ASTM C 977, Appendix XI. The lime should be blended with a mixing device such as a pulvermixer to produce a soil mixture passing water added and be allowed to cure for at least 48 hours. After curing the lime soil mixture it shall pass the grading requirements of TxDOT 2014 Specification Item 260 and compacted to a minimum 98 percent of the maximum dry density determined in accordance with ASTM D 698 at moisture contents ranging from minus two (-2) percentage points below optimum to plus two (+2) percentage points above optimum moisture content. If the in place gradation requirements can be achieved during the initial mixing, the remixing after the curing period can be eliminated. Please note that there is a relationship between the time of mixing of the lime and soils with the maximum dry density. Any mixture older than three (3) days will require determination of new moisture density relationships.

Portland cement may be considered instead of lime to treat the subgrade. See the cement treated subgrade section of this report.

9.7 Mellowing Recommendation

Mellowing is a process in which the lime treatment soil is allowed to mean on an uncompacted state for a period of time to allow the lime to react with the subsurface soil particles and sulfates. The higher the sulfate levels, the more reaction time is required to lower the concentration of sulfates to the tolerable level of below 3,000 ppm. During this process, the moisture must be suitable to initiate and complete the reaction from the sulfate, soil, and lime. The moisture monitoring and controlling of this process can decrease the mellowing time and increase the reaction rate. If water is chosen to be added, this would require the material to be reworked to reach the optimum moisture for compaction. The amount of mellowing time and the required moisture content required for the specific subgrade can be estimated during the mix design process. **Reference Section 2 Material Mix Design and Mellowing and Moisture Control from TxDOT Construction Division website entitled "Guidelines for Treatment of Sulfate-Rich Soils and Bases in Pavement Structures" September 2005** for further detail.

MEG recommends this mellowing process for the lime treatment subgrade on the pavement site where lime treatment is recommended based on Table 8.4 Flexible Pavement Option and Tables 8.5 Rigid Concrete Pavement Option. MEG recommends that additional sulfate testing is to be completed during time of construction to further verify recommendation.

10.0 OTHER CONSIDERATIONS

10.1 Drainage

Adequate perimeter drainage is essential for long-term performance of any pavement structure. Infiltration of surface water from unpaved areas surrounding the pavement should be minimized. We do not recommend the placement of landscape beds on the paved areas. Such design features provide a potential for water to enter into the pavement section and the underlying soil subgrade. This is especially true with time in paved areas that have limited traffic and lead to accelerated asphalt oxidation and thus cracking. Water intrusion will result in the deterioration of the pavement materials with time as vehicular traffic passes over affected areas. Above grade planter boxes with drainage discharge onto the top of the pavement or directed into storm sewers should be considered if landscape features are to be used.

10.2 Curb & Gutters

Base material under curb and gutters and curbs shall be compacted to the same requirements as other areas. It is recommended that the base shall be placed below the curb & gutter and extended past the back of the curb & gutter a minimum of one and a half (1 ½) feet. The thickness of the base below the curb & gutter shall be the required pavement base thickness less six (6) inches. An adequate seal should be provided at all concrete- asphalt interfaces. It is recommended that a crack sealant compatible to both asphalt and concrete be used.

10.3 Maintenance

A maintenance plan is recommended for the long-term performance of the paved areas. Asphaltic pavements have a tendency to strip and become oxidized with exposure to the elements. Thus cracks may become present in the pavement. It is recommended that a maintenance schedule of crack sealing, fog seals and overlays be used over the life of the pavement.

11.0 PROJECT REVIEW AND QUALITY CONTROL

Each project site is unique and it is important that the appropriate design data, construction drawings, specifications, change orders and related documents be reviewed by the respective design and construction professionals participating in this project. The performance of foundations, construction building pads and/or parking areas for this project will depend on correct interpretation of our geotechnical engineering report and proper compliance of and adherence to our geotechnical recommendations and to the construction drawings and specifications.

It is important that **MEG** be provided the opportunity to review the final design and construction documents to check that our geotechnical recommendations are properly interpreted and incorporated in the design and construction documents. We cannot be responsible for misinterpretations of our geotechnical recommendations if we have not had the opportunity to review these documents. This review is an additional service and not part of our project scope.

MEG should be retained to provide construction materials testing and observation services during all phases of the construction process of this project. As the Geotechnical Engineer of Record, it is important to let our technical personnel provide these services to make certain that our recommendations are interpreted properly and to ensure that actual field conditions are those described in our geotechnical report. Since our personnel are familiar with this project, **MEG**'s participation during the construction phase of this project would help mitigate any problems resulting from variations or anomalies in subsurface conditions, which are among the most prevalent on construction projects and often lead to delays, changes, costs overruns, and disputes. If the client does not follow all of our recommendations presented in this report and/or addendums to this report, the client assumes the responsibility and liability of such actions and will hold our firm harmless and without responsibility and liability for client's actions.

A construction testing frequency plan and budget needs to be developed for the required construction materials engineering and testing services for this project. Before construction, we recommend that **MEG**, the project design team members and the project general contractor meet and jointly develop the testing plan and budget, as well as review the testing specifications as it pertains to this project. **A failure to implement a complete testing plan will negate the recommendations provided in this report.**

MEG looks forward to the opportunity to provide continued support on this project.

APPENDIX A
CUSTOM SOIL RESOURCE REPORT

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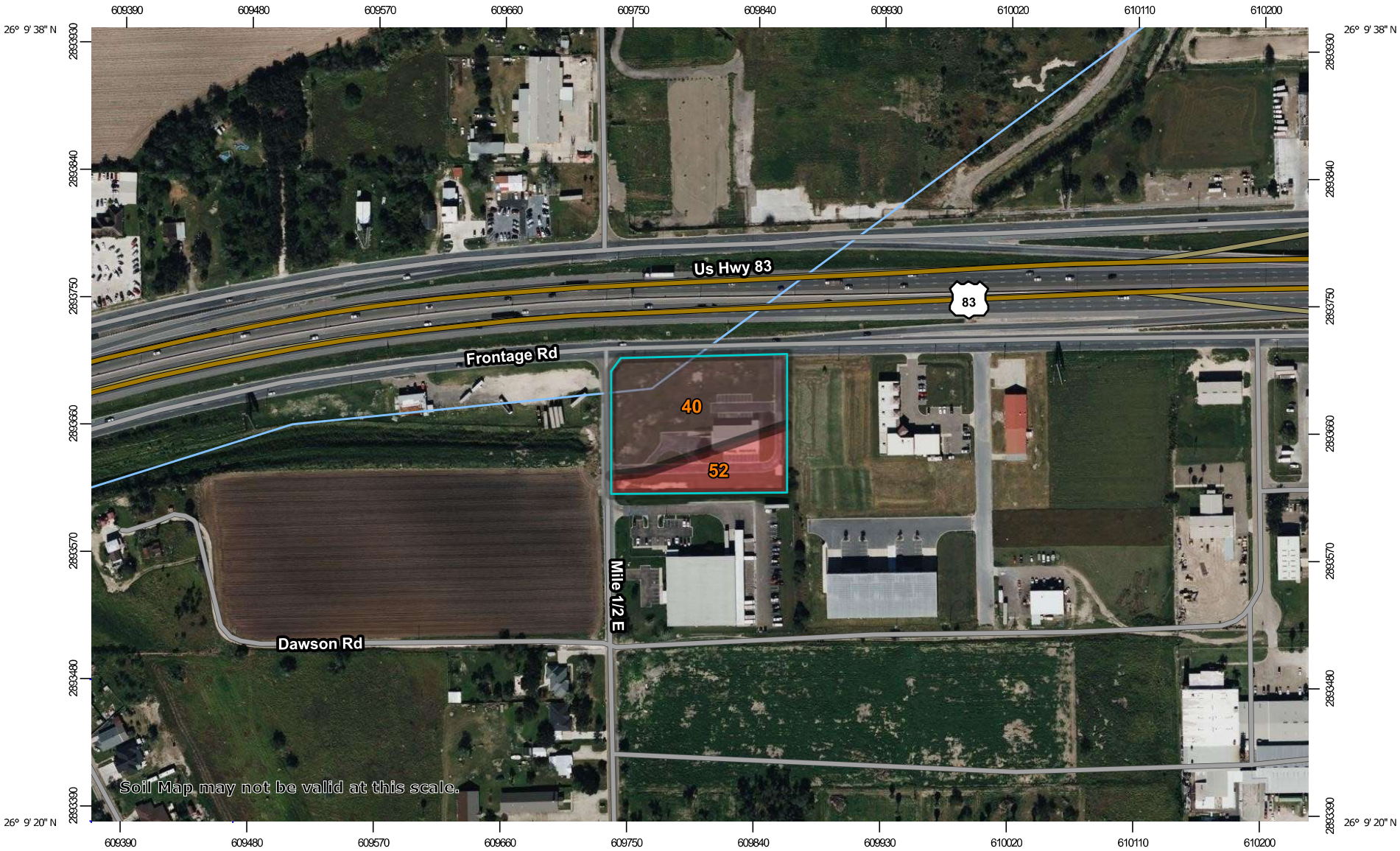
5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Map Unit Name—Hidalgo County, Texas
(01-23-29156 Triumph Public High School - Building Additions)



Map Scale: 1:3,960 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Mercedes clay, saline, 0 to 1 percent slopes

Raymondville clay loam, 0 to 1 percent slopes

Not rated or not available

Soil Rating Lines

Mercedes clay, saline, 0 to 1 percent slopes

Raymondville clay loam, 0 to 1 percent slopes

Not rated or not available

Soil Rating Points

Mercedes clay, saline, 0 to 1 percent slopes

Raymondville clay loam, 0 to 1 percent slopes

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 21, Aug 24, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 21, 2021—Mar 2, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Name

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
40	Mercedes clay, saline, 0 to 1 percent slopes	Mercedes clay, saline, 0 to 1 percent slopes	2.1	70.8%
52	Raymondville clay loam, 0 to 1 percent slopes	Raymondville clay loam, 0 to 1 percent slopes	0.9	29.2%
Totals for Area of Interest			**3.0**	**100.0%**

Description

A soil map unit is a collection of soil areas or nonsoil areas (miscellaneous areas) delineated in a soil survey. Each map unit is given a name that uniquely identifies the unit in a particular soil survey area.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

APPENDIX B
PROJECT LOCATION, TOPOGRAPHIC AND BOREHOLE LOCATION MAPS

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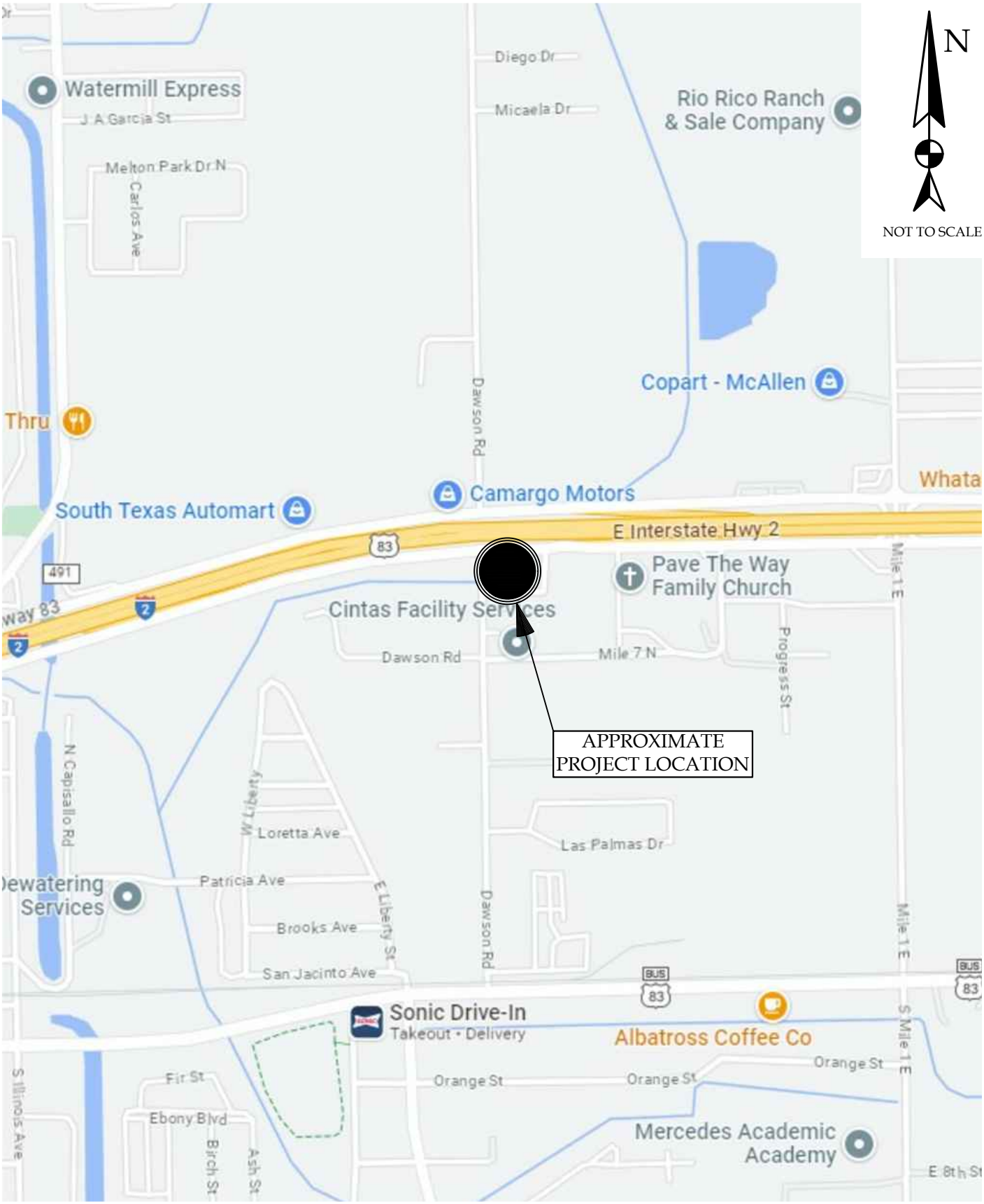
5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

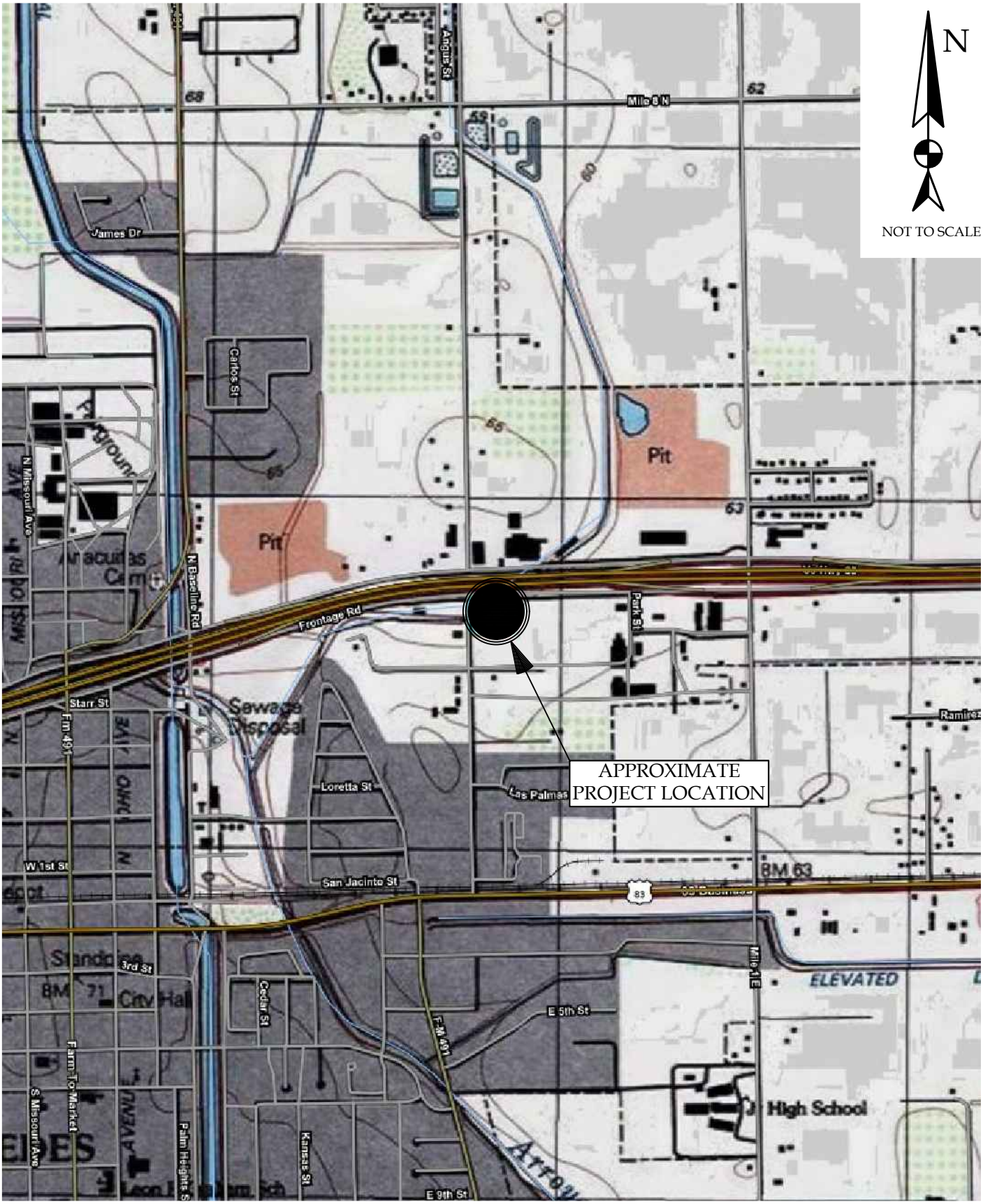


MEG PROJECT: 01-23-29156 / DATE: 8/25/2023 / APPROVED BY: A. PALMA / DRAWN BY: O. BOUNDS

PROJECT SITE LOCATION MAP

PROPOSED
TRIUMPH HIGH SCHOOL - BULDING ADDITIONS
MERCEDES, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

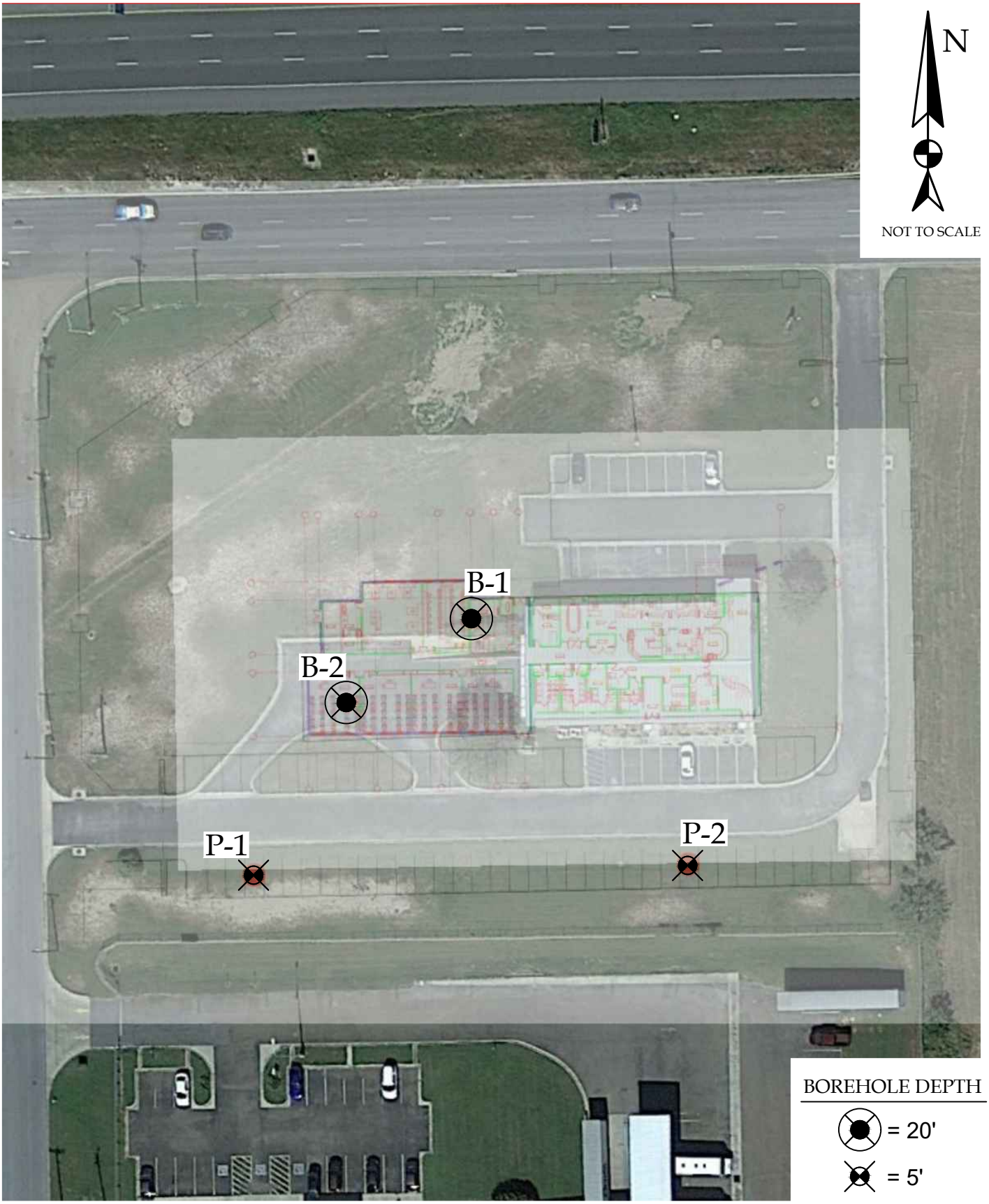


PROJECT TOPOGRAPHY MAP

PROPOSED
TRIUMPH HIGH SCHOOL - BULDING ADDITIONS
MERCEDES, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

MEG PROJECT: 01-23-29156 / DATE: 8/25/2023 / APPROVED BY: A. PALMA / DRAWN BY: O. BOUNDS



MEG PROJECT: 01-23-29156 / DATE: 8/25/2023 / APPROVED BY: A. PALMA / DRAWN BY: O. BOUNDS

PROJECT BOREHOLE LOCATION MAP

PROPOSED
TRIUMPH HIGH SCHOOL - BULDING ADDITIONS
MERCEDES, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

APPENDIX C
PROJECT BORING LOGS AND PROFILE

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5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Project: **Proposed Triumph Public High School - Building Additions** Project Location: **Mercedes, Texas** Project Number: **01-23-29156**	Log of Boring B-1 **Sheet 1 of 1**

Date(s) Drilled **8/7/2023**	Logged By **A. Guerrero**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **MEG Drilling**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **20 feet**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	Sulfate Content, ppm	REMARKS AND OTHER TESTS
	0				CL		lean CLAY w/ sand, dk. brown, dry to moist, med. stiff to very stiff						
	1		1	17				8	44	29			
	2												
	3		2	19				10					
	4												
	5		3	22				15			76		
	6												
	7		4	13				16	42	27			
	8												
	9		5	7				15					
	10												
	11												
	12				SC		clayey SAND, brown, moist to wet, loose to med. dense						
	13												
	14		6	4				19			34		
	15												
	16												
	17												
	18												
	19		7	12				21					
	20						Bottom of Boring						∇H2O @ ATD
	21												
	22												
	23												
	24												
	25												

Project: **Proposed Triumph Public High School - Building Additions** Project Location: **Mercedes, Texas** Project Number: **01-23-29156**	Log of Boring B-2 **Sheet 1 of 1**

Date(s) Drilled **8/7/2023**	Logged By **A. Guerrero**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **MEG Drilling**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **20 feet**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	Sulfate Content, ppm	REMARKS AND OTHER TESTS
	0				CH		fat CLAY w/ sand, dk. brown, moist, med. stiff						
	1		1	5				21					
	2												
	3		2	7				19	61	42			
	4												
	5		3	7				18					
	6				CL		sandy lean CLAY, brown to dk. brown, moist, med. stiff to stiff						
	7		4	8				16			52		
	8												
	9		5	10				16	30	18			
	10												
	11												
	12				SC		clayey SAND, brown, moist to wet, loose to med. dense						
	13												
	14		6	4				17	20	9			
	15												
	16												
	17												
	18												
	19		7	12				19			17		
	20						Bottom of Boring						∇H2O @ ATD
	21												
	22												
	23												
	24												
	25												

Project: **Proposed Triumph Public High School - Building Additions** Project Location: **Mercedes, Texas** Project Number: **01-23-29156**	Log of Boring P-1 **Sheet 1 of 1**

Date(s) Drilled **8/7/2023**	Logged By **A. Guerrero**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **6 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **MEG Drilling**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	Sulfate Content, ppm	REMARKS AND OTHER TESTS
	0				CL		lean CLAY w/ sand, dk. brown, dry to moist, very stiff						
	1		1	20				6	38	24		140	
	2												
	3		2	16				11					
	4												
	5		3	17				14			73		
	6						Bottom of Boring						
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
	17												
	18												
	19												
	20												
	21												
	22												
	23												
	24												
	25												

Project: **Proposed Triumph Public High School - Building Additions** Project Location: **Mercedes, Texas** Project Number: **01-23-29156**	Log of Boring P-2 **Sheet 1 of 1**

Date(s) Drilled **8/7/2023**	Logged By **A. Guerrero**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **6 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **MEG Drilling**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	Sulfate Content, ppm	REMARKS AND OTHER TESTS
	0				CL		lean CLAY w/ sand, dk. brown, dry to moist, med. stiff to very stiff						
	1		1	7				8	48	33		640	
	2												
	3		2	11				14			72		
	4												
	5		3	18				15					
	6						Bottom of Boring						
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
	17												
	18												
	19												
	20												
	21												
	22												
	23												
	24												
	25												

Project: **Proposed Triumph Public High School - Building Additions** Project Location: **Mercedes, Texas** Project Number: **01-23-29156**	Key to Log of Boring **Sheet 1 of 1**

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	Sulfate Content, ppm	
1	2	3	4	5	6	7	8	9	10	11	12	13	14

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6 Material Type: Type of material encountered.
7 Graphic Log: Graphic depiction of the subsurface material encountered.
8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9 Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
10 LL, %: Liquid Limit, expressed as a water content.
11 PI, %: Plasticity Index, expressed as a water content.
12 Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.
13 Sulfate Content, ppm: Sulfate Content in soil, in parts per million.
14 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)
Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
Clayey SAND (SC)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
CME Sampler
Pitcher Sample
Bulk Sample
Grab Sample
2-inch-OD unlined split spoon (SPT)
3-inch-OD California w/ brass rings
2.5-inch-OD Modified California w/ brass liners
Shelby Tube (Thin-walled, fixed head)

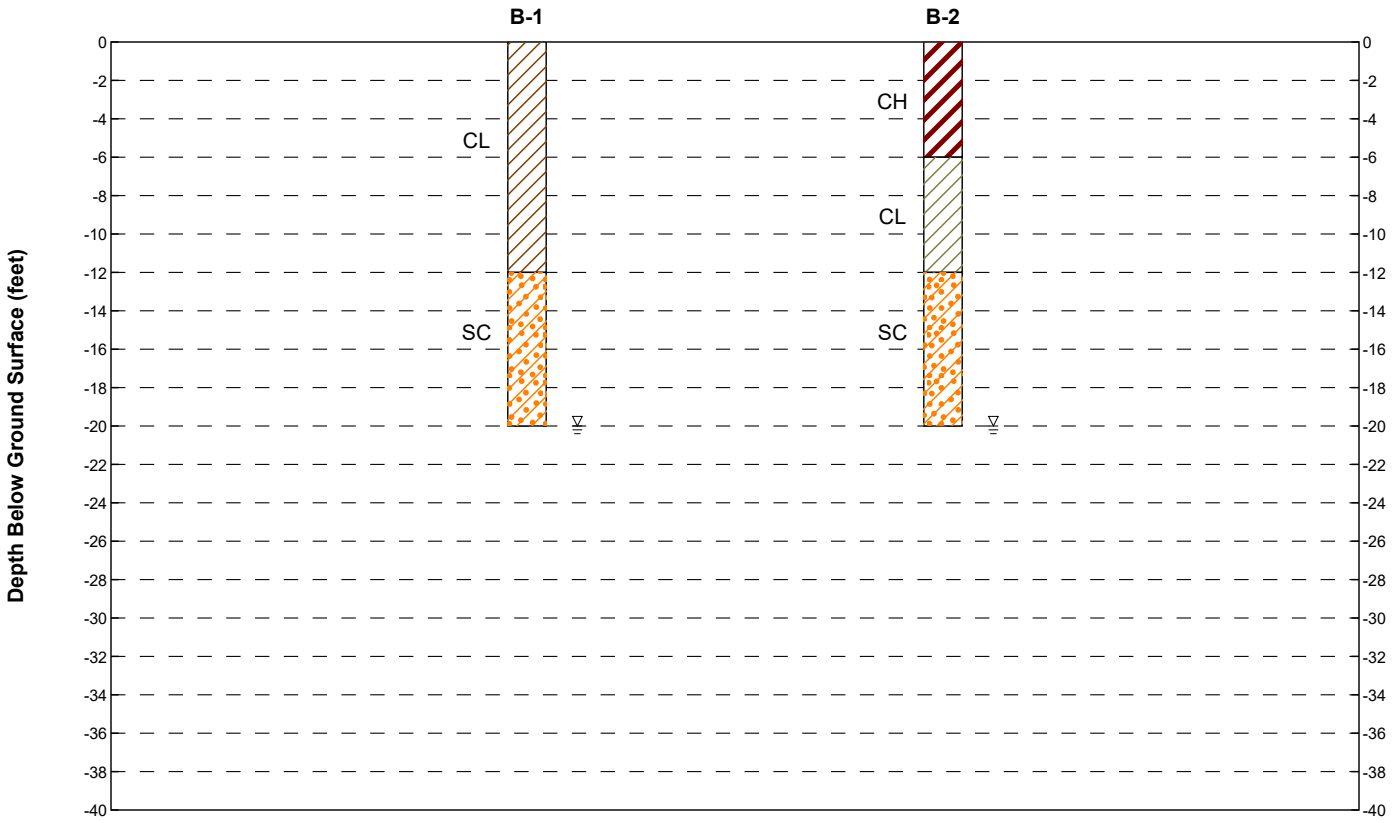
OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Figure B-1



MATERIAL GRAPHIC SYMBOLS

Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)

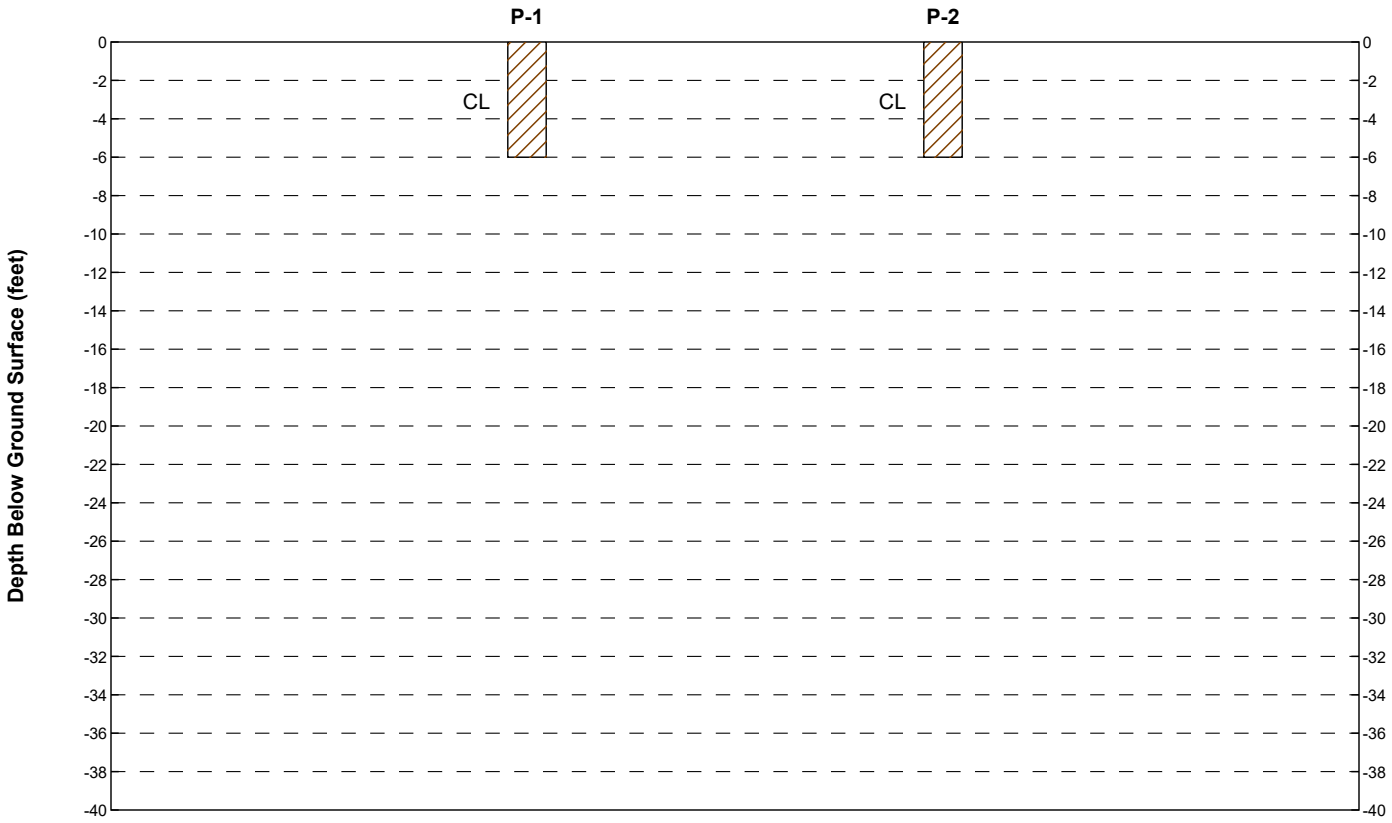
Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)

Clayey SAND (SC)

Millennium Engineers Group, Inc.

Proposed Triumph Public High Schools - Building Additions
Mercedes, Texas

Project No.	Figure No.
01-23-29156	C-1



MATERIAL GRAPHIC SYMBOLS

Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)

Millennium Engineers Group, Inc.	
Proposed Triumph Public High Schools - Building Additions Mercedes, Texas	
Project No.	Figure No.
01-23-29156	C-2

APPENDIX D
SUMMARY OF SOIL SAMPLE ANALYSIS

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Summary of Soil Sample Analyses

Project Name: Proposed Triumph Public High School – Building Additions

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Sulfate Content (ppm)	USCS
B-1	.5 - 2	17	8	44	15	29			CL
	2.5 - 4	19	10						
	4.5 - 6	22	15				76		
	6.5 - 8	13	16	42	15	27			
	8.5 - 10	7	15						
	13.5 - 15	4	19				34		SC
	18.5 - 20	12	21						
B-2	.5 - 2	5	21						CH
	2.5 - 4	7	19	61	19	42			
	4.5 - 6	7	18						
	6.5 - 8	8	16				52		CL
	8.5 - 10	10	16	30	12	18			
	13.5 - 15	4	17	20	11	9			SC
	18.5 - 20	12	19				17		
P-1	.5 - 2	20	6	38	14	24		140	CL
	2.5 - 4	16	11						
	4.5 - 6	17	14				73		
P-2	.5 - 2	7	8	48	15	33		640	CL
	2.5 - 4	11	14				72		
	4.5 - 6	18	15						

APPENDIX E
LABORATORY AND FIELD PROCEDURES

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5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Laboratory and Field Test Procedures

Soil Classification Per ASTM D2487-93:

This soil-testing standard was used for classifying soils according to the Unified Soil Classification System. The soil classifications of the earth materials encountered are as noted in the attached boring logs.

Soil Water Content Per ASTM D2216-92:

This test determines the water content of soil or rock expressed as a percentage of the solid mass of the soil. The test results are listed under **MC** in the attached boring logs.

Soil Liquid Limit Per ASTM D4318-93:

The soil Liquid Limit identifies the upper limit soil water content at which the soil changes from a moldable (plastic) physical state to a liquid state. The Liquid Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **LL** in the attached boring logs.

Soil Plastic Limit Per ASTM D4318-93:

The soil Plastic Limit identifies lower limit soil water content at which the soil changes from a moldable (plastic) physical state to a non-moldable (semi-solid) physical state. The Plastic Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **PL** in the attached boring logs.

Plasticity Index Per ASTM D4318-93:

This is the numeric difference between the Liquid Limit and Plastic Limit. This index also defines the range of water content over which the soil-water system acts as a moldable (plastic) material. Higher Plasticity Index (PI) values indicate that the soil has a greater ability to change in soil volume or shrink and swell with lower or higher water contents, respectively. The test results are listed under **PI** in the attached boring logs.

Standard Penetration Test (SPT) and Split Spoon Sampler (SS) per ASTM D 1586:

This is the standard test method for both the penetration test and split-barrel (spoon) sampling of soils. This sampling method is used for soils or rock too hard for sampling using Shelby Tubes. The method involves penetration of a split spoon sampler into the soil or rock through successive blows of a 140-pound hammer in a prescribed manner.

Blow Counts (N) per ASTM D 1586:

This is the number of blows required to drive a Split Spoon Sampler by means of a 140 pound hammer for a distance of 12 inches in accordance with the variables stated in the test procedures.

Shelby Tube (ST) per ASTM D 1587:

This procedure is for using a thin-walled metal tube to recover relatively undisturbed soil samples suitable for laboratory tests of physical properties.

Dry Density (DD) per ASTM D 2937:

This procedure is for the determination of in-place density of soil. The test results are measured in pounds per cubic foot, pcf.

Unconfined Compression Test (Uc) per ASTM D 2166:

This test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load.

Minus No. 200 Sieve per ASTM D 1140:

This test method covers determination of the amount of material finer than a Number 200 sieve by washing. The results are stated as a percent of the total dry weight of the sample.

Pocket Penetrometer (PP):

This test method is an accepted modification of ASTM D 1558 test method for establishing the moisture-penetration resistance relationships of fine-grained soils. The test results are measured in tons per square foot, tsf. The strength values provided by this method should be considered qualitatively.

Rock Quality Designation (RQD):

The measure of the quality of a rock mass defined by adding intact rock core pieces greater than four inches in length by the total length of core advance.

Recovery Ratio (REC):

The Recovery Ratio is equal to the total length of core recovered divided by the total length of core advance.

Boring Logs:

This is a summary of the above-described information at each boring location.

DOCUMENT 00 41 13
(CSP) COMPETITIVE SEALED PROPOSAL FORM

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: Triumph Public High Schools New Mercedes Campus

C. Project Location: 2000 East Expressway 83
Mercedes, Texas 78570

D.
Owner: Triumph Public High Schools
Contact: Frances Berrones – Johnson, Superintendent/ CEO
1208 South Presa
San Antonio, Texas 78210-2838

E. Architect: Laura Nassri Warren, AIA, NCARB/President, Principal, The Warren Group Architects, Inc., 804 S. Main Street, McAllen, Texas 78501.

F. Architect Project Number: 2012301.

1.2 CERTIFICATIONS AND BASE BID (WITH ALLOWANCES, IF ANY)

A. Competitive Sealed Proposal, Single-Prime (All Trades) Contract: The undersigned Respondent, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by The Warren Group Architects, Inc. and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

_____
(Company Name)

1. _____ Dollars

($_____).

Alternate 1_____Dollars

($_____).

1.3 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 90 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____Dollars

($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS AND SUPPLIERS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

1. General Conditions:

_____.

2. Site Work:

_____.

3. Concrete Scope:

_____.

4. Masonry Scope:

_____.

5. Structural Steel Work:

_____.

6. Carpentry:

_____.

7. Thermal & Moisture Protection Scope:

_____.

8. Doors, Windows, Glass & Hardware Work:

_____.

9. Painting (Finishes) Work:

_____.

10. Miscellaneous/Specialties:

_____.

11. Mechanical/Plumbing Work:

_____.

12. Electrical Work:

_____.

13. Roofing:

_____.

14. Fire Protection Work:

_____.

1.5 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work by October 31, 2024.

1.6 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.
5. Addendum No. 5, dated _____.
6. Addendum No. 6, dated _____.

1.7 BID SUPPLEMENTS

A. The following supplements are a part of this Competitive Sealed Proposal Form and are attached hereto.

1. Competitive Sealed Proposal Form Supplement - Instructions to Bidders (AIA Document A701).
2. Competitive Sealed Proposal Form Supplement - CSI Form 1.5C Substitution Request

1.8 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the State of Texas and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.9 DOCUMENT CONTINUES

1.10 SUBMISSION OF BID

Respectfully submitted this _____ day of _____, 2023.

Submitted By: _____
(Name of bidding firm or corporation)

Authorized Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President)

Witness By: _____
(Handwritten signature)

Attest: _____
(Handwritten signature)

By: _____
(Type or print name)

Title: _____
(Corporate Secretary or Assistant Secretary)

Street Address: _____

City, State, Zip _____

Phone: _____

License No.: _____

Federal ID No.: _____

(Affix Corporate Seal Here)

END OF DOCUMENT

DOCUMENT 00 43 21
ALLOWANCE FORM

1.1 BID INFORMATION

A. General Contractor: _____.

B. Project Name: Triumph Public High Schools New Mercedes Campus

C. Project Location: 2000 East US Expressway 83
Mercedes, Texas 78570

D. Owner: Triumph Public High Schools
Contact: Frances Berrones-Johnson, Superintendent CEO
1208 South Presa
San Antonio, Texas 78210-2838

E. Architect: Laura Nassri Warren, AIA, NCARB /Principal
The Warren Group Architects, Inc.
804 South Main Street
McAllen, Texas 78501
lwarren@twgarch.com
Cc: clopez@twgarch.com
admin@twgarch.com
Office 956.994.1900

F. Architect Project Number: 2012301

1.2 RESPONDENT BID FORM SUPPLEMENT

A. This form is required to be attached to the Proposal Form.

B. The undersigned Respondent certifies that Base Proposal submission to which this Respondent Proposal Supplement is attached includes those allowances described in the Contract Documents and scheduled in Section 01 21 00 "Allowances."

Allowance No. 1: Lump-Sum Allowance: General Contractor to include Owners Contingency Allowance in the amount of $25,000.00 (Twenty-Five Thousand U.S. Dollars).

Allowance No. 2: Lump-Sum Allowance: General Contractor to include Architect Design Contingency-Betterment Allowance in the amount of $25,000.00 (Twenty-Five Thousand U.S. Dollars).

Allowance No. 3: Lump-Sum Allowance: General Contractor to include Signage Contingency Allowance in the amount of $30,000.00 (Thirty Thousand U.S. Dollars).

1.3 SUBMISSION OF PROPOSAL BID SUPPLEMENT

A. Respectfully submitted this ____ day of _____, 2023.

Submitted By: _____
(Insert name of bidding firm or corporation)

Authorized Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President

END OF DOCUMENT

DOCUMENT 00 43 23
ALTERNATES FORM

1.1 BID INFORMATION

A. Bidder: _____.

B. Prime Contract: _____.

C. Project Name: Triumph Public Highschool New Mercedes Campus

D. Project Location: 2000 East US Expressway 83, Mercedes, TX 78570

E. Owner: Triumph Public High Schools
Contact: Ms. Frances Berrones-Johnson
2000 East US Expressway 83
Mercedes, Texas 78570

F. Architect: Laura Nassri Warren, AIA, NCARB/Principal, The Warren Group Architects, Inc., 804 South Mian Street, McAllen, Texas 78501.

G. Architect Project Number: 2012301.

1.2 PROPOSAL FORM SUPPLEMENT

A. This form is required to be attached to the Competitive Sealed Proposal Form.

1.3 DESCRIPTION

A. The undersigned Respondent proposes the amount below be added to or deducted from the Base Proposal if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.

1. Cost-Plus-Fee Contract: Alternate price given below includes adjustment to Contractor's Fee.

B. If the alternate does not affect the Contract Sum, the Respondent shall indicate "NO CHANGE."

C. If the alternate does not affect the Work of this Contract, the Respondent shall indicate "NOT APPLICABLE."

D. The Respondent shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.

E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within 60 days of the Notice of Award unless otherwise indicated in the Contract Documents.

F. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

1.4 SCHEDULE OF ALTERNATES

Alternate No. 1: General Contractor to provide add on price to remove and replace existing metal roof, gutters, and insulation. New roof Is to be MBCI Standing Seam Metal Roof W/30 Reinforced Vinyl Faced Insulation Downspouts and gutter to match existing size and configuration.

A Roofing Inspection Report for proposed Triumph Public High School-Building Addition, Mercedes, Hidalgo County, Texas, prepared by TADCO Roofing and Waterproofing, is included following this form.

1. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
2. _____Dollars

   ($_____).
3. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

1.5 SUBMISSION OF BID SUPPLEMENT

Respectfully submitted this ____ day of _____, 2023.

Submitted By: _____
(Name of bidding firm or corporation)

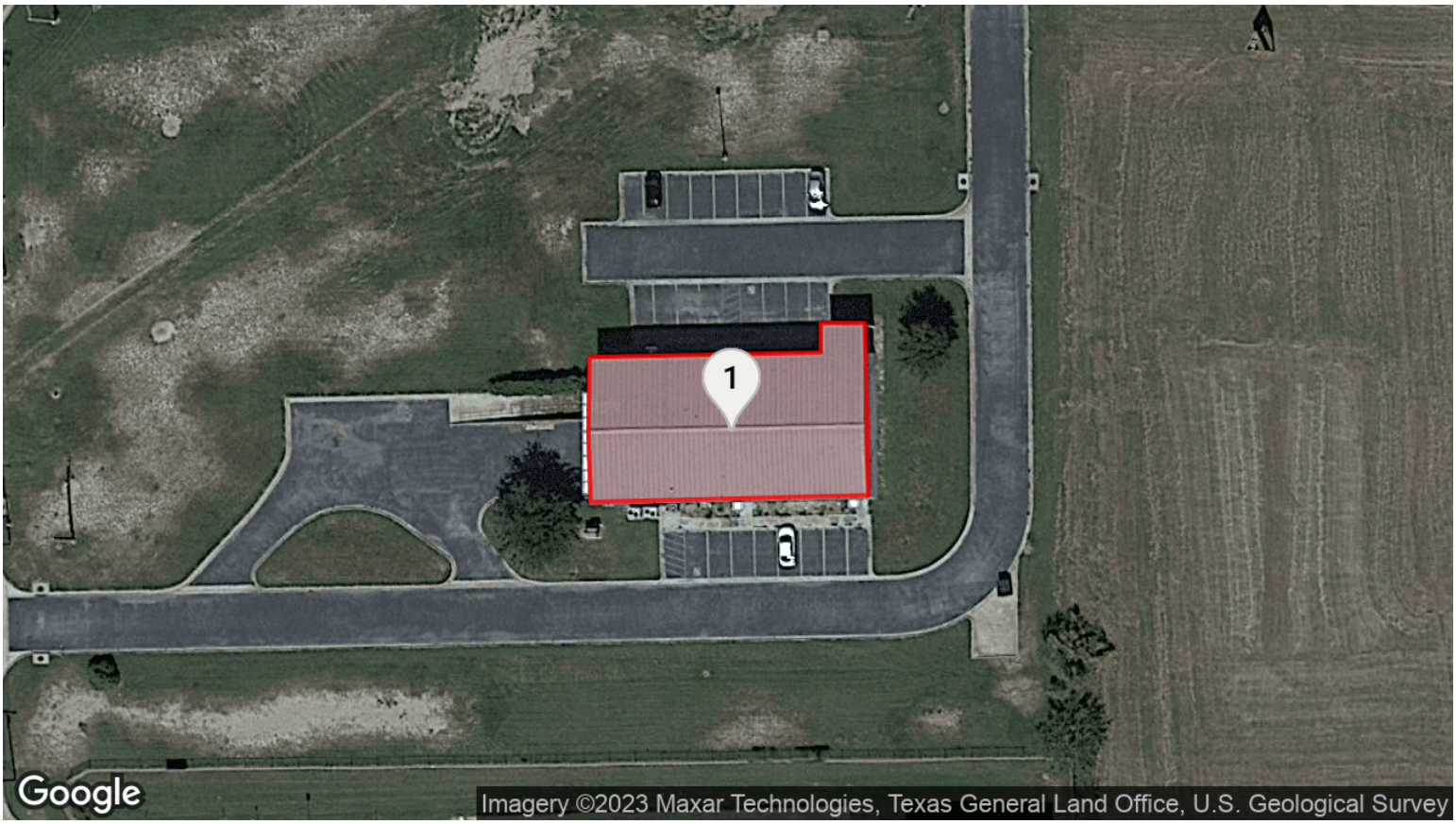
Authorized Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President)

END OF DOCUMENT

Inspection Report



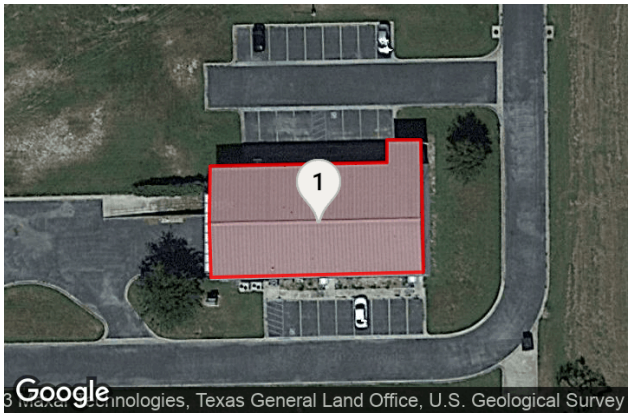
Prepared For:

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Site Overview

Total Sections: 1
Total Sq/Ft: 6,232



Map	Section Name	Sq/Ft	Grade
1	Section 1	6,232	C-

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Section Overview

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

Overview

Overview

Overview

Overview

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

Unit - Sealant Failure (Emergency)

Quantity: 8 LF
Deficiency:
The perimeter of the unit is showing signs of rust and the existing sealant has deteriorated and is no longer a watertight seal.
Corrective Action:
Remove existing sealant. Clean and prep the area to install a reinforced coating system.
Estimated Repair Cost:
$275

Unit - Rusted (Emergency)

Quantity: 1 EA
Deficiency:
Existing vent is rusted and damaged which is allowing water to infiltrate the building.
Corrective Action:
Remove and replace vent per industry standards.
Estimated Repair Cost:
$550

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

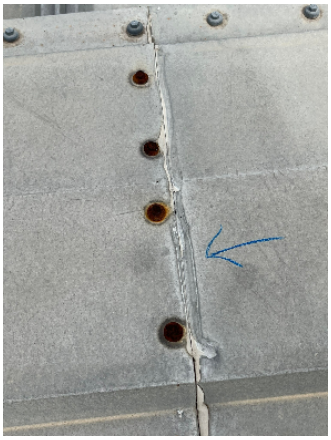
Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

Penetration - Flashing Failure (Emergency)

Quantity: 5 EA
Deficiency:
Existing flashing at penetrations are showing signs of rust and deterioration.
Corrective Action:
Remove existing sealant. Clean and prep the area to install a reinforced coating system.
Estimated Repair Cost:
$1,625



Ridge - Fasteners (Emergency)

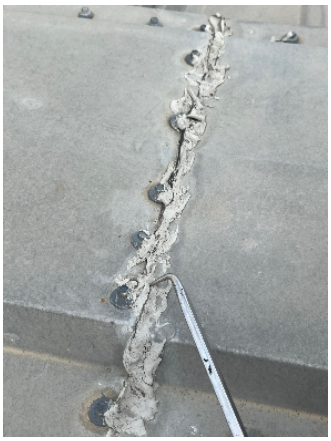
Quantity: 40 LF
Deficiency:
Fasteners along the ridge have rusted and are no longer a watertight seal.
Corrective Action:
Clean and prep the area to install a reinforced coating system.
Estimated Repair Cost:
$650

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

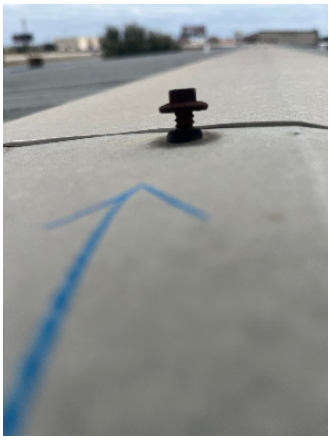
Inspection Date:
Inspected By:



5

Ridge - Sealant Failure (Additional Photo) (Emergency)

Quantity: 40 LF
Deficiency:
Existing sealant along the seams at the ridge has deteriorated and is no longer a watertight seal.
Corrective Action:
Price included above.
Estimated Repair Cost:
$0



6

Ridge - Fastners (Additional Photo) (Emergency)

Quantity: 40 EA
Deficiency:
Existing fasteners have rusted and backed out.
Corrective Action:
Price included above.
Estimated Repair Cost:
$0

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

7

Metal - Rusted (Additional Photo) (Emergency)

Quantity: 200 LF
Deficiency:
Metal panels are showing signs of rust towards the drainage area which will continue to spread and degrade the integrity of the panels.
Corrective Action:
Clean and prep the area to apply a rust inhibitor and install a reinforced coating system.
Estimated Repair Cost:
$3,250

8

Coping - Fasteners (Emergency)

Quantity: 40 EA
Deficiency:
Fasteners along the cap have rusted and are no longer a watertight seal.
Corrective Action:
Remove existing fasteners. Replace fasteners to create a watertight seal.
Estimated Repair Cost:
$220

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

9

Field - Puncture (Emergency)

Quantity: 2 SF
Deficiency:
A puncture was found on the field allowing water to infiltrate the building.
Corrective Action:
Clean and prep the area to install a reinforced coating system to ensure a watertight seal.
Estimated Repair Cost:
$175

10

Drainage - Gutter Clog (Emergency)

Quantity: 200 LF
Deficiency:
Debris in gutter is inhibiting water flow.
Corrective Action:
Remove debris and clean gutters to create proper drainage.
Estimated Repair Cost:
$2,165

Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

11

Drainage - Sealant Failure (Emergency)

Quantity: 50 LF
Deficiency:
Existing sealant at the gutter seams has failed, allowing ponding water and debris to degrade the integrity of the gutters.
Corrective Action:
Remove existing sealant. Clean and prep the area to install a new bead of sealant and ensure a watertight seal.
Estimated Repair Cost:
$550

12

Drainage - Sealant Failure (Emergency)

Quantity: 9 EA
Deficiency:
Transition from downspouts to gutter area is showing signs of failure.
Corrective Action:
Remove and replace existing fasteners. Clean and prep the area to install a new bead of sealant.
Estimated Repair Cost:
$425

Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

Canopy - Brace (Emergency)

Quantity: 6 EA
Deficiency:
Canopy bracing is rusted and damaged which is a potential hazard in the near future.
Corrective Action:
Contact structural personnel.
Estimated Repair Cost:
$0

Canopy - Brace (Additional Photo) (Emergency)

Quantity: 6 EA
Deficiency:
Canopy bracing is rusted and damaged which is a potential safety hazard in the near future.
Corrective Action:
Price included above.
Estimated Repair Cost:
$0

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Deficiencies

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

Support Beams - Rusted (Emergency)

Quantity: 40 SF
Deficiency:
Support beams located in the entrance are showing significant signs of rust, which could become a potential safety hazard in the near future.
Corrective Action:
Contact qualified personnel.
Estimated Repair Cost:
$0

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Summary

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

Condition Summary

Membrane:
Flashings:
Sheet Metal:

Overall:	C-
Estimated Replace:	2027

Recommendations:

Estimated Repair Cost: $9,885

Estimated Replacement Cost: $0

A **Roof is "New" or in "Like New" condition.** Continue to monitor and maintain.

B **Roof is "Good" condition.** General repairs may be required and a maintenance program may minimize unnecessary leaks

C **Roof is in "Fair" condition.** The roof is beginning to show age-related deficiencies, or is a newer roof that is not performing as expected. A maintenence program may help prevent unnecessary leaks and minimize repair costs.

D **Roof is in "Poor" condition and is nearing the end of its useful life.** Repairs could help reduce unexpected leaks, depending on the severity.

F **Roof has failed.** The roof has exceeded its expected service life. While it may be possible to address active leaks, it should be assumed that leaks will continue to develop.

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Budget Module

Section: Section 1
Size: 6,232
Overall Grade: C-

Inspection Date:
Inspected By:

1 - Section 1 (6,232 SF) Grade C-

Deficiencies	Qty	Emergency	Proactive	Replacement
Unit - Sealant Failure	8 LF	$275		
Unit - Rusted	1 EA	$550		
Penetration - Flashing Failure	5 EA	$1,625		
Ridge - Fasteners	40 LF	$650		
Ridge - Sealant Failure (Additional Photo)	40 LF	$0		
Ridge - Fastners (Additional Photo)	40 EA	$0		
Metal - Rusted (Additional Photo)	200 LF	$3,250		
Coping - Fasteners	40 EA	$220		
Field - Puncture	2 SF	$175		
Drainage - Gutter Clog	200 LF	$2,165		
Drainage - Sealant Failure	50 LF	$550		
Drainage - Sealant Failure	9 EA	$425		
Canopy - Brace	6 EA	$0		
Canopy - Brace (Additional Photo)	6 EA	$0		
Support Beams - Rusted	40 SF	$0		
Full Replacement	6,232 SF			$0
Total		$9,885	$0	$0

Triumph Public High Schools
Laser Lux
2000 E Expressway 83
Mercedes, TX 78570

Site Overview

Total Sections: 1

Total Sq/Ft: 6,232

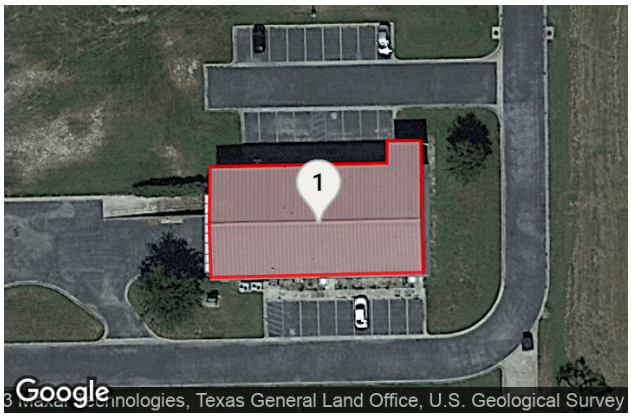
A **Roof is "New" or in "Like New" condition.** Continue to monitor and maintain.

B **Roof is "Good" condition.** General repairs may be required and a maintenance program may minimize unnecessary leaks

C **Roof is in "Fair" condition.** The roof is beginning to show age-related deficiencies, or is a newer roof that is not performing as expected. A maintenence program may help prevent unnecessary leaks and minimize repair costs.

D **Roof is in "Poor" condition and is nearing the end of its useful life.** Repairs could help reduce unexpected leaks, depending on the severity.

F **Roof has failed.** The roof has exceeded its expected service life. While it may be possible to address active leaks, it should be assumed that leaks will continue to develop.



1 - Section 1 (6,232 SF) Grade C-

Deficiencies	Qty	Emergency	Proactive	Replacement
Unit - Sealant Failure	8 LF	$275		
Unit - Rusted	1 EA	$550		
Penetration - Flashing Failure	5 EA	$1,625		
Ridge - Fasteners	40 LF	$650		
Ridge - Sealant Failure (Additional Photo)	40 LF	$0		
Ridge - Fastners (Additional Photo)	40 EA	$0		
Metal - Rusted (Additional Photo)	200 LF	$3,250		
Coping - Fasteners	40 EA	$220		
Field - Puncture	2 SF	$175		
Drainage - Gutter Clog	200 LF	$2,165		
Drainage - Sealant Failure	50 LF	$550		
Drainage - Sealant Failure	9 EA	$425		
Canopy - Brace	6 EA	$0		
Canopy - Brace (Additional Photo)	6 EA	$0		
Support Beams - Rusted	40 SF	$0		
Full Replacement	6,232 SF			$0
Total		$9,885	$0	$0

	Emergency	Proactive	Replacement
Budget Totals	$9,885	$0	$0

DOCUMENT 00 43 93
BID SUBMITTAL CHECKLIST

1.1 BID INFORMATION

A. Bidder: _____.

B. Prime Contract: _____.

C. Project Name: **Triumph Public High School, New Mercedes Campus**

D. Project Location: **2000 East US Expressway 83**

E. Owner: **Triumph Public High School**

F. Architect: **The Warren Group Architects, Inc., Laura Warren, AIA, NCARB / President**

G. Architect Project Number: **2012301**

1.2 BIDDER'S CHECKLIST

A. In an effort to assist the Bidder in properly completing all documentation required, the following checklist is provided for the Bidder's convenience. The Bidder is solely responsible for verifying compliance with bid submittal requirements.

B. Attach this completed checklist to the outside of the Submittal envelope.

- ☐ Used the Bid Proposal Form provided in the Project Manual.
- ☐ Prepared the Bid Form as required by the Instructions to Bidders.
- ☐ Indicated on the Bid Form the Addenda received.
- ☐ Attached to the Bid Form: Bid Supplement Form - Allowances.
- ☐ Attached to the Bid Form: Bid Supplement Form - Alternates.
- ☐ Attached to the Bid Form: Proposed Schedule of Values Form.
- ☐ Attached to the Bid Form: Bid Bond OR a certified check for the amount required.
- ☐ Bid Packet shows name and address of the Bidder.
- ☐ Bid Packet shows the Bidder's Contractor's License Number.
- ☐ Bid Packet shows name of Project Number and Project name being bid.
- ☐ Bid Packet shows name of Prime Contract being bid, if applicable.
- ☐ Bid Packet shows time and day of Bid Opening.
- ☐ Verified that the Bidder can provide executed Performance Bond and Labor and Material Bond.
- ☐ Verified that the Bidder can provide Certificates of Insurance in the amounts indicated.

END OF DOCUMENT

DOCUMENT 00 43 73
PROPOSED SCHEDULE OF VALUES FORM

1.1 BID FORM SUPPLEMENT

A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form.

1.2 PROPOSED SCHEDULE OF VALUES FORM

A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual Table of Contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum.

B. Arrange schedule of values consistent with format of AIA Document G703 Continuation Sheet.

1. Copies of AIA standard forms may be obtained from the American Institute of Architects; http://www.aia.org/contractdocs/purchase/index.htm; docspurchases@aia.org; (800) 942-7732.

END OF DOCUMENT

SECTION 00 45 00
BID BOND

PART 1 - GENERAL

1.1 SECTION INCLUDES

This section describes the standardized bid bond form to be submitted with the bid on the project.

1.2 REFERENCES – Not Used

1.3 DEFINTIONS – Section 07 00 00

1.4 BID BOND FORMS

Bidder is to inset an original bid bond or a copy of cashier's check provided for bid bond Purposes. Original check is to be submitted along with bid.

PART 2 - PRODUCT – Not Used

PART 3 - EXECUTION

STANDARIZED FORMS FOLLOW

END OF SECTION

DOCUMENT 00 60 00
FORMS

1.1 1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:

1. AIA Document A105, "Standard Short Form of Agreement between Owner and Contractor, as modified by the Owner."

a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."

2. The General Conditions are included in the Project Manual.

3. The Supplementary Conditions for Project are separately prepared and included in the Project Manual.

4. Owner's document(s) bound following this Document.

1.2 ADMINISTRATIVE FORMS

A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

B. Copies of AIA standard forms may be obtained from the American Institute of Architects; http://www.aia.org/contractdocs/purchase/index.htm; docspurchases@aia.org.

C. Forms:

1. Form of Performance Bond and Labor and Material Bond: AIA Document A312, "Performance Bond and Payment Bond."

2. Form of Certificate of Insurance: AIA Document G715, "Supplemental Attachment for ACORD Certificate of Insurance 25-S."

D. Information and Modification Forms to be provided by General Contractor:

1. Form for Requests for Information (RFIs): AIA Document G716, "Request for Information (RFI)."

2. Form of Request for Proposal: AIA Document G709, "Work Changes Proposal Request."

3. Change Order Form: AIA Document G701, "Change Order."

4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G707, "Architect's Supplemental Instructions."

5. Form of Change Directive: AIA Document G714, "Construction Change Directive."

E. Payment Forms:

1. Schedule of Values Form: AIA Document G703, "Continuation Sheet."

2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."

3. Form of Contractor's Affidavit: AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

4. Form of Affidavit of Release of Liens: AIA Document G706A, "Contractor's Affidavit of Payment of Release of Liens."

5. Form of Consent of Surety: AIA Document G707, "Consent of Surety to Final Payment."

END OF DOCUMENT

DOCUMENT 00 72 00
GENERAL CONDITIONS NOTICE

1.01 FORM OF GENERAL CONDITIONS

A. The “General Conditions of the Contract for Construction”, American Institute of Architects’ A.I.A. Document A201, Latest Edition, and “Supplementary Conditions” on file in the offices of the Architect and the Owner’s Supervising Engineer, are hereby a part of these Specifications and shall apply and be binding to all Contractors as though written in full herein.

B. The Contractors shall be held to have examined and become familiar with all provisions of the above-referenced documents.

C. Certain provisions of these standard “General Conditions of the Contract for Construction” have been revised or modified by portions of this “NOTICE” and the “SUPPLEMENTARY CONDITIONS”. In all such cases, the provisions of the “NOTICE” and the “SUPPLEMENTARY CONDITIONS” shall take precedence, to the extent of any conflict or inconsistency, over these standard “General Conditions of the Contract for Construction”.

D. Wherever the word “Owner” appears in such “General Conditions”, and elsewhere in these documents, it shall be interpreted as “Triumph Public High Schools”, so that the word “Board” is hereby substituted for the word “Owner” throughout these documents.

E. Wherever the word “Contractor” or “Subcontractor” appears in these documents, it shall be interpreted to mean the Contractor whose Proposal has been accepted for that respective Section of the Work.

1.02 SUPPLEMENTARY CONDITIONS

A. Refer to Section 00 73 00 for amendments to these General Conditions.

END OF SECTION

DOCUMENT 00 73 00
SUPPLEMENTARY CONDITIONS

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

The Agreement takes precedence over all other Contract Documents.

1.2 EXECUTION, CORRELATION AND INTENT

No allowance shall subsequently be made on behalf of the Contractor on account of an error on his part or his negligence or failure to acquaint himself with the conditions of the site.

1.2.2.1. Before submitting proposal for this work, each bidder shall be held responsible for having examined the premises and satisfied himself as to the existing conditions under which he will be obliged to operate and that will, in any manner, affect the work under this Contract. No allowance shall be made subsequently in the connection on behalf of the contractor for any error or negligence on his part, nor for slight discrepancies on drawings as to grades, slopes and elevations.

1.2.2.2 In case the bidder finds any discrepancy between the conditions at the site and the requirements of these plans and specifications, he shall notify the Owner in writing before the opening of bids and the Owner will issue the necessary instructions to all bidders.

1.2.2.2.1 In the event of inconsistencies within or between parts of the Contract Documents, or between the Contract Documents and applicable standards, codes, and ordinances, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement; either or both in accordance with the Architect's reasonable interpretation. The terms and conditions of this paragraph 1.2.3, however, shall not relieve the Contractor of any obligations set forth in Paragraphs 3.2 and 3.7. Before ordering any materials or doing any Work, the Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. Any difference, which may be found, shall be submitted to the Architect for resolution before proceeding with the Work.

Add the following to Paragraph 1.2.4:

Such separations shall not operate to make the Architect an arbiter to establish subcontract limits.

Add the following after Paragraph 1.2.5:

1.2.6 Titles of Sections and Articles in these Specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of material and/or work. The Contractor shall be solely responsible for omissions or duplications by the Contractor or any Subcontractors due to real or alleged error, either direct or implied, in arrangement of matter in the Contract Documents.

1.2.7 Contractor shall check Drawings and Specifications immediately upon their receipt, and shall notify Architect in writing not later than ten (10) days after receipt of them, of errors, discrepancies, or omissions. Contractor shall verify dimensions and details before ordering materials for laying out work and shall be responsible for errors that might have been avoided by such check. Deviations from Drawings and dimensions shall be made only with the Architect's permission. No exchange or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the Drawings. Any difference, which may be found, shall be submitted to the Architect for instructions before proceeding with the work.

1.2.8 Specifications and Drawings are intended to be complementary and in agreement each with the other. All work or materials called for by either shall be Performed and/or furnished as if called for by both. In cases of discrepancy concerning dimensions, quantities, and location, the contractor shall, in writing, call to the attention of the Architect any discrepancies between Specifications, Plans, Details or Schedules. The Architect will then inform the Contractor, in writing, which document takes precedence. Should the Contractor not notify the Architect as per the prior instructions, the greater amount of work, cost and/or materials shall be included in the base bid or alternate bid amount as part of this agreement.

1.2.9 These Specifications are intended to supplement the Drawings, the two being considered cooperative and, therefore, it will not be the province of these Specifications to mention any portion of the construction which the Drawings are competent to explain, and such omission will not relieve the Contractor from carrying out such portions as are only indicated from the Drawings, and should items be required by these Specifications which are not indicated on the Drawings, they are to be supplied.

1.2.10 The Contractor shall supply all labor, materials, transportation, apparatus, light, energy, scaffolding, and tools necessary for the entire proper completion of the Work.

1.2.11 Unless specified otherwise, all of the materials incorporated in the work shall be new and of the best of the kind of grades specified and all workmanship be up to the best recognized standard known to the various trades.

1.3.1 The Drawings, Specifications, and other similar or related documents and copies thereof are furnished to the Contractor for the purpose of performing the Work and are, and shall remain, the property of the Architect.

ARTICLE 2 - OWNER

2.2 INFORMATION AND SERVICE REQUIRED OF THE OWNER

Architect will furnish Contractor Online Procurement and Contracting Documents: Contact Crystal Lopez at clopez@twgarch.com for a download link. Files are available for download after 2:00 p.m. Central Time on Thursday, December 7, 2023. Any other questions to be in written/e-mailed format to the attention of Laura Nassri Warren at lwarren@twgarch.com and a copy to Crystal Lopez at clopez@twgarch.com . Online access will be provided to prime bidders

only. A hard copy of the Construction Document set, and any Addendums can be reproduced at the General Contractors expense, at RGV Reprographics, Inc., 956-686-1525, located at 519 S Broadway St, McAllen, TX 78501. Please note the Notices of Addendums are to be issued digitally.

2.2.7 OWNER'S RIGHT TO SEPARATE CONTRACT

Although it is contemplated that this Contract shall include all of the work intended to be done at this time, it is possible that the Owner may let other Contract in connection with the work herein specified. In any event, the Owner reserves the right to do so, in which case the Contractor shall afford reasonable opportunity for the storage of materials and the execution of work by others.

ARTICLE 3 - CONTRACTOR

3.2 VIEW OF CONTRACT DOCUMENTS

3.2.1 Contractor shall carefully study and compare the Agreement, Conditions of the Contract, Drawings, Specifications, Addenda, and Modifications and shall at once report, in writing, to the Architect any error, inconsistency, or omission he may discover. Contractor shall be liable for any damage to Owner for failure to so report any error, inconsistency, or omission he may discover or should have discovered, but he shall not be liable to Owner or Architect for any damage resulting from any such error, inconsistency or omission he should not have discovered or which he did discover and at once so reported. Contractor shall do no work without approved Drawings and Specifications.

3.2.4 Should the Specifications and Drawings fail to particularly describe the material or kind of goods to be used in any place, then it shall be the duty of the Contractor to make inquiry of the Architect as to what is best-suited. The material that would normally be used in this place to produce first quality finished Work shall be considered a part of the Contract.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.5 In laying out the work, the Contractor shall verify all measurements and dimensions and shall immediately report any errors to the Architect. The Contractor shall employ an experienced and competent instrument person to lay out the structure and establish a permanent and accessible bench mark from which the grades may be established and checked from time to time during the progress of the work. Contractors shall lay out building corners accurately and secure approval of the Architect before proceeding with excavation.

3.4 LABOR AND MATERIALS

3.4.1.1 Not later than ten (10) days from the Contract Date, the Contractor shall provide a list of the names of the manufacturers proposed to be used for each of the following products listed in the Instruction to Bidders and, where applicable, the name of the installing subcontractor. The Architect will promptly reply in writing to the Contractor stating whether the Owner or the Architect have any reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner or the Architect to

reply promptly shall not constitute a waiver of any of the requirements of the Contract Documents and all products furnished by the listed manufacturer must conform thereto.

3.4.1.2 Products are generally specified by ASTM and other reference standard, and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer combination listed, but may not substitute others except as provided in Paragraph 4.4.1.3 below. When only one product and manufacturer is Specified, this is the basis of the Contract, without substitution or exception.

3.4.1.3 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified, under the following conditions:

The request complies with requirements of Section 016000 and Section 012500 and additionally complies with the following:

The request is accompanied by complete data on the proposed substitution substantiating compliance with the Contract Documents including product identification and description, performance and test data, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified with data relating to Contract time schedule, design and artistic effect where applicable, and its relationship to any separate contracts."

The request is accompanied by accurate cost data on the proposed substitution with the product specified, whether or not modification of the Contract sum is to be a consideration.

3.4.1.4 By making requests for substitutions based on Paragraph 3.4.1.3 above, when forwarded by the Contractor to the Architect, the Contractor:

Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified. Will provide the same guarantee for the substitution that he would for that specified.

Certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under any separate contracts and the Architect's redesign costs, and that he waives all claims for additional costs related to the substitution which subsequently become apparent.

Will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

States that the proposed substitution is in full compliance with the Contract Documents and applicable codes.

Will provide a list of other trades, (if any), which may be affected by the substitution. Shall be responsible for any effect upon related work in the Project

of any substitution and shall pay any additional costs generated by any substitutions.

3.4.1.5 Substitutions will not be considered if:

They are indicated or implied on Shop Drawings, Product Data or Sample submissions without the formal request required in paragraph 3.4.1.3 above.

For their implementation, they require a substantial revision of the Contract Documents or work of the owner or separate Contractors in order to accommodate their use.

3.4.4 After the Contract has been executed, the owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth herein and in the Contract Documents. By making request for substitution, the Contractor (a) represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified; (b) represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified; (c) certifies that the cost data presented is complete and includes all related costs under this Contract but excludes cost under separate contracts and excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and (d) will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

3.5 WARRANTY

3.5.2 Guarantees:

Contractor shall guarantee all work performed under this Contract as specified, delivering written guarantees to Owner, through Architect, upon completion in accordance with Section 017000.

For the convenience of the General Contractor, the following is a summary including, but not limited to, releases, warranties, and the guarantees mentioned in the various Section of these Specifications to be furnished to the Owner, through the Architect, upon completion of the Project. Where the requirements listed herein conflict with those in the various sections of these Specifications, the stricter requirements will take precedence.

General Contractor's notarized affidavit that all bills for labor and materials have been paid in full.

General Contractor's guarantee for ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THE WORK against defective materials and/or workmanship.

Roofing subcontractor shall furnish a TEN YEAR written certificate guaranteeing that all roofing materials are installed in accordance with Plans and specifications, that all roofing work is free from faulty 'materials and workmanship, that pitch will not leak or drip or stain any part of the building, and providing for repair and replacement of any faulty materials and/or workmanship.

The Flashing subcontractor's guarantee for a period of FIVE YEARS against defective materials and/or workmanship.

Caulking subcontractor's guarantee for a period of TWO YEARS from the date of final acceptance of the work.

Electrical subcontractor's guarantee for a period of ONE YEAR from time his work is accepted, against defective materials and/or workmanship.

All other guarantees not listed above but specified in the technical portion of the Specifications shall be furnished to the Owner upon completion of the Project.

3.5.3 Without limiting any other warranty, the Contractor shall warrant for a period of twelve (12) months that the buildings shall be watertight and leak proof at every point and in every area, except where leaks can be attributed to damage to the building by external forces beyond Contractor's control. The Contractor shall, immediately upon notification by the Owner of water penetration, determine the source of water penetration and, at its own expense, do any work necessary to make the building watertight. Contractor shall also, at its own expense, repair or replace any other damaged material, finishes, and furnishings, damaged as a result of this water penetration, to return the building to its original condition.

ARTICLE 3.6 - TAXES

3.6.2 This project is exempt from state taxes. A sales tax exemption certificate may be obtained from the State Comptroller.

3.7 - PERMITS, FEES AND NOTICES

3.7.5 Upon completion of the work, Contractor shall deliver to the owner through the Architect, all required Certificates of Inspection.

3.7.6 Any reference in the Specifications text to codes, standard specifications or manufacturer's instructions shall mean the latest printed edition of each in effect at the contract date.

3.9 - SUPERINTENDENT

3.9.1 Contractor and his prime subcontractors shall employ competent superintendents and necessary assistants who shall be in attendance at the Project site during the progress of the work. The superintendents shall be satisfactory to the Architect and shall not be changed except with the consent of the Architect, unless the superintendents leave the employ of the Contractor or the prime subcontractor.

3.9.2 At the beginning of Project, Contractor shall submit, in writing, to the Architect the name of his superintendent and the names of the superintendents of his prime subcontractors, this to include a list of past projects on which each superintendent has worked or been in charge of.

3.9.3 Superintendents shall not be removed from the Project by Contractor or his prime subcontractor without written requests and approval by the Architect.

3.9.4 Superintendent shall represent Contractor and all communications given superintendent shall be as binding as if given Contractor. Important communications will be confirmed in writing. Other communications will be so confirmed on written request in each case.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULE

3.10.3 The progress schedule shall be of a type similar to the CPM, PERT, DYliA-PERT schedules or their equivalent in the opinion of the Architect. The number of activities and structure of the progress schedule shall be adequate to explain the various stages of construction. Completed progress schedule shall be submitted to Architect no later than thirty (30) calendar days after date of Agreement and shall be updated during construction as required to keep it current. Nothing in this requirement shall be deemed to be usurpation of the Contractor's authority and responsibility to plan and schedule the work as he sees fit, subject to all other requirements of the Contract Documents.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.11 Submission of Shop Drawings and Samples to Architect required for ONLY those times specifically mentioned in the Specification Sections. If Contractor submits Shop Drawings for items other than the above, Architect will not be obliged to review them. Contractor shall be responsible or procuring Shop Drawings for his own use as he may require for the progress of the work.

3.12.12 The term "shop drawing" as used herein also includes, but is not limited to, fabrication, erection, layout and setting drawings, manufacturer's standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams, all other drawings and descriptive data pertaining to materials, equipment or systems and the position thereof conforms to the Contract requirements. As used herein, the term "manufactured" applied to standard units usually mass produced; and "fabricate" means items specifically assemble or made out of selected materials to meet individual design requirements. Shop Drawings shall establish the actual detail of all manufactured or fabricated items; indicate proper relation to adjoining work; amplify design details or mechanical and electrical equipment in proper relation to physical spaces in the structure; and incorporate minor changes of design or construction to suit actual conditions.

3.12.13 Following Contractor's review and approval, he shall submit to the Architect shop drawings and submittals in the quantities listed in Section 01300. Architect, at Owner's expense, will make prints for himself, Owner and Project Representative and then return the reproducible copy to Contractor in order that as many additional prints may be made, at Contractor's expense, as he may require for the remaining parties concerned.

3.12.14 Manufacturers instructions: Where any item of work is required by specification to be furnished, installed or performed in accordance with a specified product

manufacturer's instructions, contractor shall procure and distribute the necessary copies of such instructions to all concerned parties.

3.12.15 Materials in the Specifications may be followed by the words "or as approved by the Architect". In these cases, wherever the name or brand of a manufacturer's article is specified, it is used as a measure of quality and utility or a standard. If Contractor desires to use any other brand or manufacturer of same quality, appearance and utility to that specified, he shall request substitution as provided in paragraph 4.4.

3.13 USE OF THE SITE

3.13.2 The Contractor shall arrange and maintain material and equipment in orderly manner keeping walks, drives, roads and entrances unencumbered.

3.15 CLEANING UP

3.15.3 Besides the "broom cleaning", the following special cleaning is required just prior to acceptance:

Remove stains; wash and polish glass, inside and outside. This work shall be done by persons skilled and equipped for such work.

Remove foreign matter, marks, stains, foreign paint, fingerprints, soil and dirt from (and have in a polished condition where appropriate) the following:
Painted, decorated and stained work.

All hardware, fixtures and incorporated equipment.

All finished surface and metal surfaces, whether interior or exterior.

All doors and windows.

3.15.4 In addition to clean-up provisions of the Specifications, Contractor shall take appropriate steps to prevent air-borne dust due to work under this contract. Water shall be applied wherever practical to settle and hold dust to a minimum, particularly during the excavation and moving of materials.

3.18 INDEMNIFICATION

3.18.3 The obligations of the Contractor under this paragraph 3.18.3 shall not extend to the liability of the Architect, his agents or employees arising out of (1) the preparation of approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications or (2) the giving of direction or instructions by the Architect, his agents or employees provided such giving is the primary cause of the injury or damage.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

4.2 ARCHITECT’S ADMINISTRATION OF THE CONTRACT

The term 'aesthetic effect' as used herein refers to color, texture, profile and juxtaposition of masses. The Architect shall be the sole interpreter of the design intent with respect to such matters, but the Architect's authority with respect thereto shall not contravene any other rights of either the Owner or the Contractor ascribed to them by other provisions of the Contract.

ARTICLE 5 - SUBCONTRACTORS

5.5 No subcontractor shall be let until the list of proposed subcontractors as submitted at the bid opening is approved, in writing, by the Owner.

5.6 The General Contractor shall bind all Subcontractors, the Mechanical Contractor and the Electrical Contractor to the terms of the Contract Documents.

5.7 The General Contractor agrees that he is as fully responsible to the Owner or the acts and omissions of his Subcontractors and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.

5.8 Nothing contained in the Contract Documents shall create any contractual relations between any Subcontractor and the owner.

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.2 MUTUAL RESPONSIBILITY

6.2.7 Contractor shall be responsible for the proper fitting of all work and for the coordination of the operations of the trades, other contractors, subcontractors, and material suppliers engaged upon or in connection with the work as well as those of his own employees, and he shall exercise every effort to assure a harmonious cooperative working relationship on the part of all concerned. He shall be prepared to guarantee to each of his subcontractors and foremen all of the dimensions which they may require for the fitting of their own to adjoining work and shall do or shall cause his agents to do, all fitting and adjusting necessary to make the several parts of the work come together properly and fit the work to receive or be received by, the work of other Contractors.

ARTICLE 7 - CHANGES IN THE WORK

7.2 CHANGE ORDERS

7.2.2 Any adjustment to contract sum shall be determined by methods described in 7.3.3, 7.3.10 and 7.3.11.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.3.5 In subparagraphs 7.3.3.1 and 7.3.3.3 the allowance for overhead and profit combined, included in the total cost to the Owner shall be based on the schedule in the Bid Form.

7.3.6 In allowance for overhead and profit in accordance with the schedule the Contractor is to provider – “In the Bid Form.”

7.3.10 Cost to which overhead and profit is to be applied shall be determined in accordance with subparagraph 7.3.6.

7.3.11 In order to facilitate checking of quotations for extras or credit, all proposals, except those so minor that their property can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontractors. 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 involving over $100.00 be approved without such itemization. Every change itemization shall be submitted on attached Change in work/Cost Analysis forms.

ARTICLE 8 - TIME

8.1 DEFINITIONS

8.1.5 Contract Time commences at the time of Notice to Proceed.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.4 Contractor shall have all materials delivered at the site in such quantities as required for the uninterrupted progress of the work and the least obstruction of the premises and the adjoining property. No extension of time or extra cost will be allowed for failure by Contractor to order the material on time or in insufficient quantities.

WEATHER DELAY

8.3.5 For the purpose of calculating extensions of time due to inclement weather, the local climatological data will be used.

8.3.6 Unless the Owner considers that unusual circumstances warrant consideration, extensions of time because of inclement weather will be granted for any work only to the extent that the number of days of precipitation (.04" or more) and/or the number of days of freezing weather (32 degrees and below) exceeds the mean for that month; provided that no one day will be counted more than once; and provided further, that if a day lost because of weather falls immediately before a non working day or days, such as a holiday or weekend, such working days shall be considered as lost time. The mean number of days of Precipitation and freezing weather shall be established by the tabulation of normals, means and extremes published by National Oceanic and Atmospheric Administration in the most recent Local Climatological Data for the closest reporting station to the site of the work. No claim will be considered unless it is accompanied by the attached "Time Extension Request" form completed within two weeks of the time referenced inclement period.

LIQUIDATED DAMAGES

For each day after Substantial Completion that the work remains incomplete, a penalty of $1,000.00 per day will be charged to the Contractor.

FINAL CLOSEOUT

For each day final close out is not achieved within 60 days of the scheduled Substantial Completion date, a penalty of $200.00 per day will be charged to the Contractor.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.2 All costs of overtime work require by the nature of this work, except emergencies as covered in Article 10.3.1 shall be included in the Bid.

9.3 APPLICATIONS FOR PAYMENTS

9.3.1 In each Application for Payment, the Contractor shall certify that such Application for Payment represents a just estimate of cost reimbursable to the Contractor and also shall certify as follows:

(a) There are no known mechanic's or materialmen's liens outstanding at the date of this requisition, that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application, and that, except for such bills not paid but so included, there is no known basis for the filing of any mechanic's or materialmen's liens on the Work, and that waivers from all Subcontractors and materialmen's have been obtained in such form as to constitute an effective waiver of lien under the laws of the location of the Project.

(b) The Contractor shall within thirty (30) days of receipt of notice of the existence of any lien filed against the Project by any subcontractor, supplier of materials or any other person or entity claiming to be a creditor of the Contractor, cause the same to be removed as of record or provide a bond to indemnify or a cash deposit to the Title Company in an amount equal to the lien.

9.3.1.3 Along with the Progress Schedule, specified herein before, Contractor shall submit to Architect a schedule of the anticipated amount of each monthly payment that will become due the Contractor in accordance with the Progress Schedule. On or about the tenth of each month, the Owner agrees to pay to the Contractor an amount to be determined by taking ninety percent (90%) of the value of labor and materials incorporated in the work, plus material not incorporated in the work, but approved by the Architect under the provisions of the Contract Documents, up to the date of payment proposed to be made, less the aggregate of all previous payments and deductions provided for in the Contract Documents.

The five percent (5%) retention shall be paid thirty-five (35) calendar days after the date of recording by the Owner of the Notice Completion of all the work to be done under this contract, providing there are no undercharged or unsecured liens, attachments or claims in connection with the work.

9.3.2 Payments made on account of materials not incorporated in the work shall only be made on material which has been worked to a special design according to the Drawings and specifications. No payment shall be made on standard manufactured items. The Architect's decision as to which category a specific item qualifies under shall be final.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Substantial Completion. Triumph Public Highschool, Mercedes, Texas.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.8 Protection of Plant Life: Solvents, oils and any other material which may be harmful to plant life shall be disposed of in containers as directed by the Architect and removed from the site. At completion of work, any contaminated soil shall be removed and replaced with good soil by this Contractor at no expense to the Owner.

10.2.9 The Contractor shall secure and pay for all necessary permits and shall comply with all ordinances pertaining to his work. He shall provide and maintain suitable temporary walkways, where needed, fences and other structures required by law and city ordinances in such a manner as not to interfere with traffic in public streets. He shall leave access to fire hydrants and protect the public and adjacent property at all times during the progress of the Contract. The proper signs shall be posted at truck entrances, and all other possible safety precautions observed.

10.2.10 The Contractor shall, as a cost of the Work, provide and maintain in good order, any firefighting equipment required by local authorities during Contract operations.

10.2.11 The Contractor shall immediately report to the Owner all accidents arising out of the Work and involving injury to employees of the Contractor, any member of the public or property damage to the property. The Owner's liability insurance will not be responsible for claims, accidents and losses arising out of the Contractor's operations.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTORS LIABILITY INSURANCE

11.1.1.8 The liability insurance required shall be on a comprehensive basis, including:

Premises - Operations

Independent Contractor's Protective

Products and Completed Operations.

Add the following to Paragraph 11.1.2:

1. Workmen's Compensation - Statutory
   Employer's Liability - $1,000,000 per accident, $1,000,000 disease policy limit, $1,000,000 disease each employee.

2. Commercial General Liability - $5,000,000 combined single limit, policy aggregate $1,000,000 combined single limit each occurrence.

3. Automobile Liability:

   a. Bodily injury - $ 1,000,000 each person,
      $ 1,000,000 each occurrence,

   b. Property damage - deductible not to exceed $500 per occurrence

4. Independent Contractors: Same limits as above.

5. Products and Completed Operations: same limits as above for one year, commencing with issuance of the Final Certificate for Payment.

6. Contractual Liability: Same limits as above.

7. Umbrella Liability: $5,000,000 each occurrence, $5,000,000 policy aggregate.

8. Builder's All Risk: The Contractor shall provide and maintain Builder's All Risk Insurance with minimum coverage consisting of fire, extended coverage, vandalism and malicious protection sufficient to amply indemnify himself, the Owner and the Architect against loss or damage that may occur to the premises and improvements supplied by the Contractor until final completion and acceptance by the Owner.

11.1.3.1 Furnish one copy of the Certificates herein required for each copy of the Agreement; specifically set forth evidence of all coverage required by paragraphs 11.1.1 and 11.1.2. The form of the Certificate shall be AIA Document G705. Furnish the owner copies of any endorsements that are subsequently issued amending.

11.4 PERFORMANCE BOND AND PAYMENT BOND

Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.2 CORRECTION OF WORK

Add the following to Paragraph 12.2.2:

The above stated ONE YEAR guarantee by the General Contractor may be extended to longer periods if stated in the Specific Section of the Specifications".

Substitute "Date of Final Acceptance of the Project" in lieu of "Date of Substantial Completion" or "Substantial Completion". The date of Final Acceptance shall be the date of the Final Application of Payment is approved by the Architect.

12.3 ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK

Add the following after Paragraph 12.3.1:

"Appropriate reduction" is hereby defined as an amount equal to the entire cost of replacing the work to make it as originally shown or specified.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1 AHERA

Pursuant to Federal Public Law 99-519, otherwise known as the Asbestos Hazard Emergency Response Act (AHERA) there shall be no asbestos containing products and/or materials used in this project.

OTHER CONDITIONS OR PROVISIONS

Contractor understands and agrees that time is of the essence hereof and in order to comply with Article 3 and meet all applicable completion dates, Contractor warrants and represents that Contractor will undertake proper coordination of the Work so as to not interfere, disrupt, delay or adversely affect in any way the on-going business functions and operations of the owner. Contractor understands and agrees that in order to comply herewith, it may be necessary for work to continue under this Contract on holidays, weekends and other calendar days on which Work is not ordinarily performed; cost of which shall be by the Contractor.

All risk insurance described in Article 11, Section 11.3.1.1 shall be purchased and carried by the contractor. The additional cost for this insurance will be paid by the Owner.

The term Products is utilized throughout this Specification Manual to encompass the many other words often used in specifications they are defined in the paragraph below:

1. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

2. Furnish or Supply: To supply and deliver, unload, inspect for damage.

3. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and ready for use.

4. Provide: To furnish or supply, plus install.

END OF DOCUMENT

Project No. ASF23-012-00
March 10, 2023

12821 W. Golden Lane
San Antonio, TX 78249

PO Box 690287
San Antonio, TX 78269

P 210.699.9090
F 210.699.6426
TBPE Firm F-3257

WWW.RKCI.COM

Ms. Frances Berrones-Johnson
Superintendent / CEO
Triumph Public High Schools
1218 S. Presa
San Antonio, Texas 78210-2838

RE: Environmental Services
2 Acres
2000 East Expressway 83
Mercedes, Texas

Dear Ms. Berrones-Johnson:

Raba Kistner, Inc. (RKI) is pleased to forward the attached Limited Asbestos-Containing Materials and Lead Paint Survey for the above-referenced property. This report was prepared on behalf of Triumph Public High Schools (CLIENT) and may not provide sufficient information for other parties. If other parties wish to rely on this report, please have them contact us so that a mutual understanding and agreement of the terms and conditions for our services can be established prior to their use of this information.

We appreciate the opportunity to be of professional service to you on this important project. Should there be any questions or additional information required, please contact our office at your earliest convenience.

Very truly yours,

RABA KISTNER, INC.

Brian D. Strye, M.S.
Environmental Project Manager

BDS/srw

Attachment

Copies submitted: Above (1 Electronic PDF Copy)

Martinez Asbestos and Environmental Consulting, LLC
9738 Sandie
Helotes, Texas 78023
MartinezEnvironmental@gmail.com

March 09, 2023

Ms. Frances Berrones-Johnson
Superintendent / CEO
Triumph Public High Schools
1218 South Presa
San Antonio, Texas 78210-2838

RE: Environmental Services
2 Acres
2000 East Expressway 83
Mercedes, Texas

RKI Project No. ASF23-012-00

Ms. Berrones-Johnson:

Martinez Asbestos and Environmental Consulting, LLC (MAEC) in conjunction with **Raba Kistner, Inc (RKI)** is pleased to forward this report documenting the results of the Asbestos-Containing Materials (ACM) and Lead Based Paint (LBP) surveys performed at the above-referenced location. All sampling and lab analysis were done in compliance with AHERA protocols and regulations. **MAEC** and **RKI** understand ACM and LBP surveys are required for future renovation or demolition activities at the referenced location.

ASBESTOS CONTAINING MATERIALS SURVEY

PURPOSE AND SCOPE OF WORK

The purpose of the ACM Survey was to identify and sample suspect ACM at the above-referenced location for laboratory analysis for asbestos content and prepare a report documenting the results of the survey. This report may be used for purposes of notification and permitting with respect to renovation activities at this location.

SURVEY METHODOLOGY

The survey was conducted on February 14, 2023 by Mr. James Garcia **(MAEC)**, a State-licensed Asbestos Consultant (TDSHS license No. 602222) authorized through the Texas Department of State Health Services (TDSHS). The survey was performed pursuant to the *Texas Asbestos Health Protection Rules, March 2003,* regulated in the State of Texas by the TDSHS.

Mr. Garcia's sampling strategy was to locate homogeneous materials and collect bulk samples of suspect ACM for laboratory analysis for asbestos content. The term "homogeneous," as defined by Environmental Protection Agency (EPA) 40 CFR Part 763, means any material having the same color and texture and having been installed in the same general time period. The homogeneous materials were then assessed in terms of friability, condition, and quantity. The term "friable", as defined by the EPA, means a material that when dry can be reduced to a powder using hand pressure.

Suspect ACM observed and sampled includes (30 total ACM samples): 12" x 12" off-white floor tile with yellow adhesive, sheetrock and associated joint compound, CMU and associated grout, 2' x 2' white ceiling tile, fiberglass insulation, brown cove base with associated glue, green wall tile and associated grout, white ceramic floor tile and associated grout, ceiling sheetrock and associated joint compound and exterior CMU and associated grout.

The Material Sampling Log is attached hereto as ***Attachment A*** and sampling locations are identified in ***Attachment B***.

All samples were submitted for analysis to Steve Moody Micro Services, LLC., of Farmers Branch, Texas, which is accredited by the National Voluntary Accreditation Program (NVLAP) and licensed by the TDSHS under License No. 30-3084. The bulk samples were analyzed for asbestos content by Polarized Light Microscopy (PLM) coupled with Dispersion Staining in accordance with the EPA method outlined in 40 CFR Part 763, Subpart F, Appendix A. The Laboratory Report of Analyses and Chain of Custody are attached hereto as ***Attachment C***. Relevant **MAEC** and **RKI** staff licenses and certifications are attached as ***Attachment D***.

RESULTS

The EPA 40 CFR Part 763 defines ACM as any material or product, which contains more than one (1) percent asbestos by weight or volume. **Based on the report of analyses, NONE of the suspect materials sampled were determined to contain asbestos fibers.**

RECOMMENDATIONS

If during the renovation or demolition activities other suspect materials are observed that have not been sampled, work should cease, and suspect materials sampled for ACM.

LIMITATIONS

It should be noted that during its prime, asbestos was used in over 3,000 different products and can still be found in some today. An attempt to locate and identify "all" asbestos was beyond the scope

of this survey. Consequently, there may be materials and/or areas containing asbestos or other hazardous materials, which were inaccessible and require destructive sampling techniques to access.

LEAD BASED PAINT SURVEY

SURVEY METHODOLOGY

LBP sampling activities were conducted on February 14, 2023 by Mr. James Garcia of **MAEC**, an experienced LBP inspector. A total of six (06) bulk samples of the suspect LBP were collected from facility structures targeted for demolition/renovation and submitted for laboratory analysis. Representative samples were collected at each location down to the underlying substrate (iron or wood) to evaluate total lead content in paint coatings. A Sampling Location Map and associated LBP Sampling Log are included as ***Attachments A and B***, respectively.

All samples were submitted for analysis to EMC Labs, Inc, of Phoenix, Arizona, which is accredited by the National Voluntary Accreditation Program (NVLAP). The bulk samples were analyzed for total Lead content by Atomic Absorption (AA) EPA SW-846 Method 7420. The Laboratory Report of Analyses and accompanying Chain-of-Custody documentation are provided in ***Attachment C***.

SAMPLES COLLECTED

Mr. Garcia collected a total of 11 bulk paint chip samples for laboratory analysis for total lead. The primary painted surfaces appeared limited to (color-location):

SAMPLE NO.	SAMPLE LOCATION	MATERIAL SAMPLED	COLOR
L-01	Waiting Area, Room #100	Stucco Wall	Grey
L-02	Recharge, Room #115	Metal Wall	Grey
L-03	South Exit Door	Stucco Wall	Off-White
L-04	Office, Room #105	CMU Wall	Blue
L-05	North and Northwest Areas	CMU Wall	Yellow
L-06	Exterior Wall	Stucco Wall	Beige

The U.S. Department of Housing and Urban Development (HUD) considers paint to be lead-based if the concentration is greater than 0.5% by weight. Therefore, **based on this criterion, concentrations of LBP in the samples collected, none exceeded this level**. All no lead concentrations were detected in any of the samples collected.

RECOMMENDATIONS

The mission of the Occupational Safety and Health Administration (OSHA), with respect to LBP, is to protect workers during construction activities that may generate elevated airborne lead concentrations. OSHA states that construction work (including renovation, maintenance, and

demolition) carried out on structures coated with paints that have lead concentrations lower than the HUD limits can still result in airborne lead concentrations in excess of regulatory limits.

For this reason, OSHA has not defined LBP, but states that paint having any measurable level of lead may pose exposure hazard during construction work, depending upon the work performed. Therefore, any sanding, grinding or dry scraping that could create airborne lead is prohibited. The owner or employers must be aware of the OSHA Lead Construction Standard (29 CFR 1926.62) and the Respiratory Protection Standard (29 CFR 1910.134).

A contractor must perform a Toxicity Characteristics Leachate Procedure (TCLP) of any lead painted building materials before these materials can be transported to a licensed landfill for disposal. The contractor should contact the licensed landfill that will be receiving the waste for directions on the number of samples required for this waste stream.

If during the removal other suspect materials are observed that have not been sampled, work should cease, and suspect materials sampled for LBP content.

CLOSING

We appreciate the opportunity to be of professional service to you on this important project. Should you have questions regarding this report or require additional information, please contact our office at your convenience.

Very truly yours,

Martinez Asbestos and Environmental Consulting, LLC

Fernando A. Martinez, Ph.D.

Asbestos Individual Consultant

TDSHS License No. 10-5762

ATTACHMENT A
ACM AND LBP MATERIAL SAMPLING LOGS

RABA KISTNER

ASBESTOS BULK MATERIAL SAMPLING LOG

PROJECT INFORMATION			COLLECTION INFORMATION
DATE: 2/14/2023	PROJECT NUMBER: ASF23-012-00	CLIENT: Triumph Public High Schools	INSPECTOR: James Garcia
PROJECT ADDRESS: 2000 East Expressway 83, Mercedes, Texas 78570			LICENSE NUMBER: 60-2222
BUILDING: Laser Lux			

SAMPLE NO.	SAMPLE LOCATION	MATERIAL SAMPLED	MATERIAL TYPE		CONDITION				FRIABLE		RESULTS
LL-01	Room 100 – Waiting Room	12”x12” Off White Floor Tile with Yellow Adhesive	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Floor Tile None Detected – Yellow Adhesive
LL-02	Room 106 - Break Room, West Exit Doorway	12”x12” Off White Floor Tile with Yellow Adhesive	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Floor Tile None Detected – Yellow Adhesive
LL-03	South Exit Doorway	12”x12” Off White Floor Tile with Yellow Adhesive	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Floor Tile None Detected – Yellow Adhesive
LL-04	Room 100 – Waiting Room, West Wall	Sheetrock and Joint Compound	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – Drywall Material None Detected – Joint Compound
LL-05	Room 104 – Office, Behind Wall Receptacle	Sheetrock and Joint Compound	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – Drywall Material None Detected – Joint Compound
LL-06	Room 106 – Break Room, Behind Wall Receptacle	Sheetrock and Joint Compound	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – Drywall Material None Detected – Joint Compound
LL-07	Room 105 – Office, North Wall	CMU/Grout	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – CMU None Detected – Grout None Detected - Filler
LL-08	Room 117 – Warehouse, West Wall	CMU/Grout	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – CMU None Detected – Grout None Detected - Filler
LL-09	Room 112 – Test/Packing Area, South End	CMU/Grout	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – CMU None Detected – Grout None Detected - Filler

CATEGORY: S-Surface Sprayed-on or Troweled-on, T-Thermal, M-Miscellaneous (floor tile, ceiling tile, mastic, etc.)
CONDITION: ND-No Damage, MD-Minor Damage (small dents, tears), D-Damage (less than 3 sq. ft. of total area), SD-Significant Damage (greater than 3 sq. ft. of total area or heavy damage in local area)

RABA KISTNER

ASBESTOS BULK MATERIAL SAMPLING LOG

PROJECT INFORMATION			COLLECTION INFORMATION
DATE: 2/14/2023	PROJECT NUMBER: ASF23-012-00	CLIENT: Triumph Public High Schools	INSPECTOR: James Garcia
PROJECT ADDRESS: 2000 East Expressway 83, Mercedes, Texas 78570			LICENSE NUMBER: 60-2222
BUILDING: Laser Lux			

SAMPLE NO.	SAMPLE LOCATION	MATERIAL SAMPLED	MATERIAL TYPE		CONDITION				FRIABLE		RESULTS
LL-10	Room 100 – Waiting Room	2'x2' White Ceiling Tile	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Acoustic Tile
LL-11	Hallway 102, West End	2'x2' White Ceiling Tile	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Acoustic Tile
LL-12	Room 103 – Office	2'x2' White Ceiling Tile	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Acoustic Tile
LL-13	Room 100 – Waiting Room, Above Drop Ceiling	Fiberglass Insulation	S T M	☐ ☒ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Insulation None Detected – Paper/Foil Wrap
LL-14	Room 119 – Mechanical	Fiberglass Insulation	S T M	☐ ☒ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Insulation None Detected – Paper/Foil Wrap
LL-15	Room 119 – Mechanical	Fiberglass Insulation	S T M	☐ ☒ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Insulation None Detected – Paper/Foil Wrap
LL-16	Room 101 - Retail, Base Board	Brown Cove Base with Glue	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Cove Base None Detected – Yellow Glue
LL-17	Room 112 – Test/Packing, Northwest Area	Brown Cove Base with Glue	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Cove Base None Detected – Yellow Glue
LL-18	Room 114 – Repair	Brown Cove Base with Glue	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Cove Base None Detected – Yellow Glue

CATEGORY: S-Surface Sprayed-on or Troweled-on, T-Thermal, M-Miscellaneous (floor tile, ceiling tile, mastic, etc.)
CONDITION: ND-No Damage, MD-Minor Damage (small dents, tears), D-Damage (less than 3 sq. ft. of total area), SD-Significant Damage (greater than 3 sq. ft. of total area or heavy damage in local area)

RABA KISTNER

ASBESTOS BULK MATERIAL SAMPLING LOG

PROJECT INFORMATION			COLLECTION INFORMATION
DATE: 2/14/2023	PROJECT NUMBER: ASF23-012-00	CLIENT: Triumph Public High Schools	INSPECTOR: James Garcia
PROJECT ADDRESS: 2000 East Expressway 83, Mercedes, Texas 78570			LICENSE NUMBER: 60-2222
BUILDING: Laser Lux			

SAMPLE NO.	SAMPLE LOCATION	MATERIAL SAMPLED	MATERIAL TYPE		CONDITION				FRIABLE		RESULTS
LL-19	Room 110 – Women's Restroom, Southeast Corner	Green Wall Tile	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	No Wall Tile None Detected – Grout
LL-20	Room 111 – Men's Restroom, Southeast Corner	Green Wall Tile	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	No Wall Tile None Detected – Grout
LL-21	Room 118 – Warehouse Restroom, Northwest Corner	Green Wall Tile	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	No Wall Tile None Detected – Grout
LL-22	Room 110 – Women's Restroom, Doorway	White Ceramic Floor Tile	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Ceramic Tile None Detected – Grout None Detected – Mortar
LL-23	Room 111 – Men's Restroom, Doorway	White Ceramic Floor Tile	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Ceramic Tile None Detected – Grout None Detected – Mortar
LL-24	Room 118 – Warehouse Restroom, Doorway	White Ceramic Floor Tile	S T M	☐ ☐ ☒	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Ceramic Tile None Detected – Grout None Detected – Mortar
LL-25	Room 118 – Warehouse Restroom	Ceiling Sheetrock and Joint Compound	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Drywall Material None Detected – Joint Compound
LL-26	Room 115 – Recharge	Ceiling Sheetrock and Joint Compound	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Drywall Material None Detected – Joint Compound
LL-27	Room 110 – Women's Restroom	Ceiling Sheetrock and Joint Compound	S T M	☒ ☐ ☐	ND MD	☒ ☐	D SD	☐ ☐	Y N	☐ ☒	None Detected – Drywall Material None Detected – Joint Compound None Detected – Texture

CATEGORY: S-Surface Sprayed-on or Troweled-on, T-Thermal, M-Miscellaneous (floor tile, ceiling tile, mastic, etc.)
CONDITION: ND-No Damage, MD-Minor Damage (small dents, tears), D-Damage (less than 3 sq. ft. of total area), SD-Significant Damage (greater than 3 sq. ft. of total area or heavy damage in local area)

RABA KISTNER

ASBESTOS BULK MATERIAL SAMPLING LOG

PROJECT INFORMATION			COLLECTION INFORMATION
DATE: 2/14/2023	PROJECT NUMBER: ASF23-012-00	CLIENT: Triumph Public High Schools	INSPECTOR: James Garcia
PROJECT ADDRESS: 2000 East Expressway 83, Mercedes, Texas 78570			LICENSE NUMBER: 60-2222
BUILDING: Laser Lux			

SAMPLE NO.	SAMPLE LOCATION	MATERIAL SAMPLED	MATERIAL TYPE		CONDITION				FRIABLE		RESULTS
A-28	Exterior – North Side	CMU/Grout	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – CMU None Detected – Grout None Detected - Filler
A-29	Exterior – Northwest Corner	CMU/Grout	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – CMU None Detected – Grout None Detected - Filler
A-30	Exterior – Southeast Corner	CMU/Grout	S T M	☒ ☐ ☐	ND MD	☐ ☒	D SD	☐ ☐	Y N	☐ ☒	None Detected – CMU None Detected – Grout None Detected - Filler

CATEGORY: S-Surface Sprayed-on or Troweled-on, T-Thermal, M-Miscellaneous (floor tile, ceiling tile, mastic, etc.)
CONDITION: ND-No Damage, MD-Minor Damage (small dents, tears), D-Damage (less than 3 sq. ft. of total area), SD-Significant Damage (greater than 3 sq. ft. of total area or heavy damage in local area)

RABA KISTNER

LEAD SAMPLING LOG

PROJECT NO.: ASF23-012-00

SAMPLED BY: James Garcia

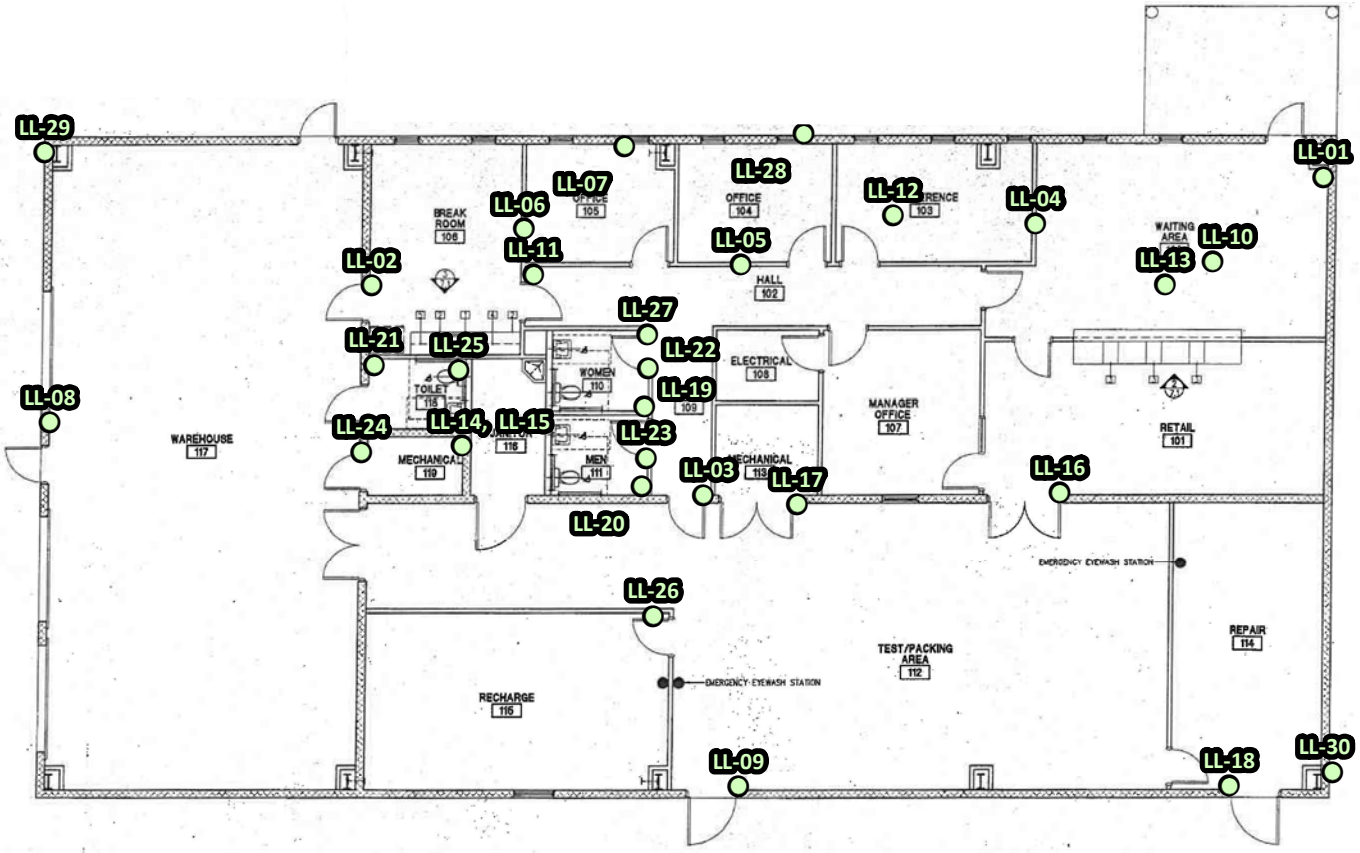
CLIENT: Triumph Public High Schools

ANALYZED BY: EMC Labs, Inc.

DATE	SAMPLE NO.	SAMPLE LOCATION	MATERIAL SAMPLED	COLOR	CONDITION	RESULTS (%)
Laser Lux Building, 2000 East Expressway 83						
2/14/2023	L-1	Waiting Area, Room #100	Stucco Wall	Grey	MD	Below Reporting Limits (BRL)
2/14/2023	L-2	Recharge, Room #115	Metal Wall	Grey	MD	BRL
2/14/2023	L-3	South Exit Door	Stucco Wall	Off-White	MD	BRL
2/14/2023	L-4	Office, Room #105	CMU Wall	Blue	MD	BRL
2/14/2023	L-5	North and Northwest Areas	CMU Wall	Yellow	MD	BRL
2/14/2023	L-6	Exterior Wall	Stucco Wall	Beige	ND	BRL

CONDITION: ND-No Damage, MD-Minor Damage (small dents, tears), D-Damage (less than 3 sq. ft. of total area), SD-Significant Damage (greater than 3 sq. ft. of total area or heavy damage in local area)

ATTACHMENT B
ACM AND LBP SAMPLING LOCATIONS - LAYOUTS



RABA KISTNER

Legend

LL-01 Suspect Asbestos-Containing Material (ACM) Sample Location and Identifier

N W E S

0 4 8 16 Feet

1 INCH = 16 FEET

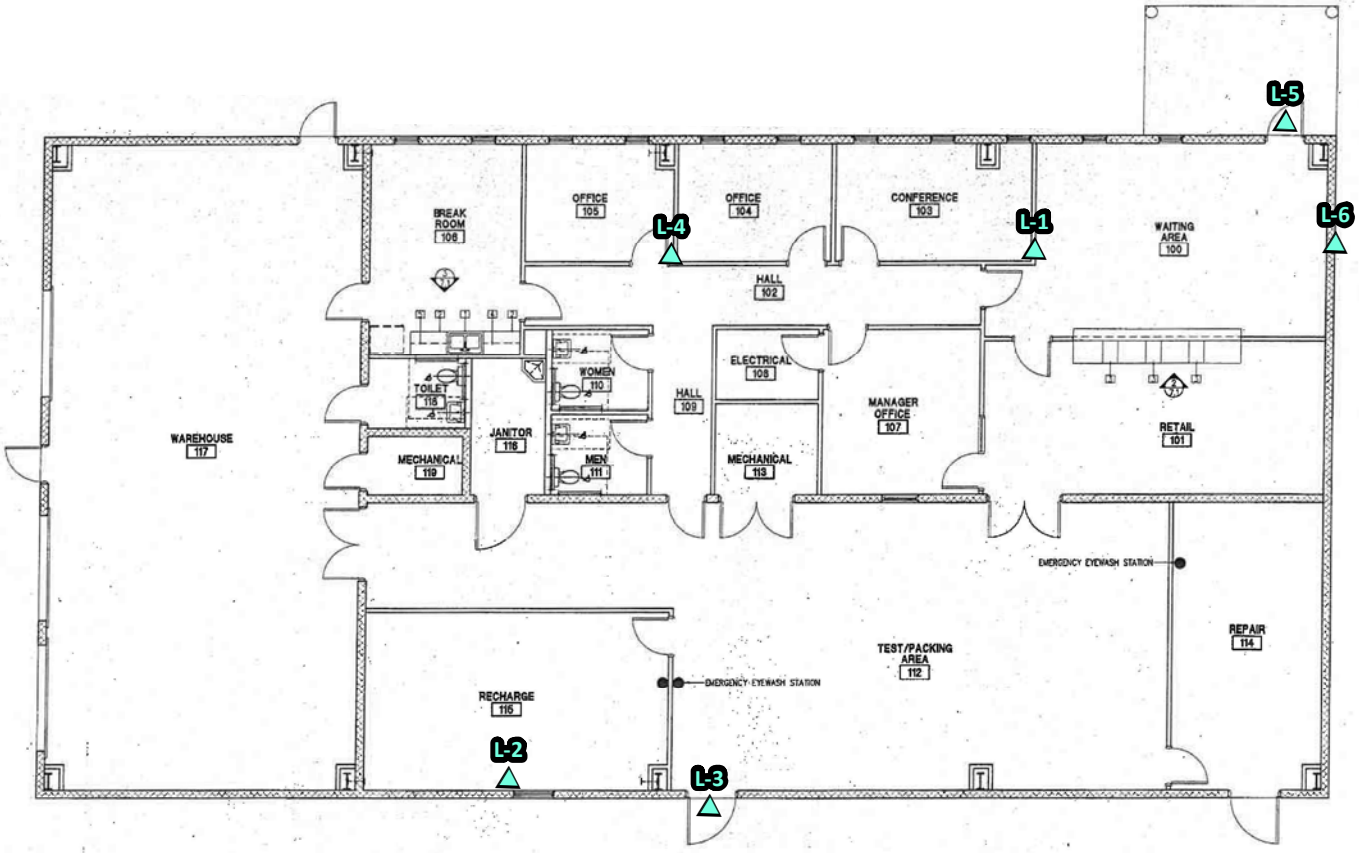
ACM SAMPLE LOCATION MAP

LASER LUX

2000 EAST EXPRESSWAY 83

MERCEDES, TEXAS

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes



Note: Building layout provided CLIENT.

RABA KISTNER

Legend

L-1 Suspect Lead-Based Paint (LBP) Sample Location and Identifier

N W E S

0 4 8 16 Feet

1 INCH = 16 FEET

LBP SAMPLE LOCATION MAP

LASER LUX
2000 EAST EXPRESSWAY 83
MERCEDES, TEXAS

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

ATTACHMENT C
LABORATORY REPORT OF ANALYSIS,
AND
CHAIN-OF-CUSTODY

PLM Summary Report

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client :	Raba Kistner Environmental, Inc. - SA	Lab Job No. :	23B-01860
Project :	2000 E Expwy 83, Mercedes	Report Date :	02/21/2023
Project # :	ASF23-012-00	Sample Date :	02/14/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 2/17/2023, thirty (30) bulk material samples were submitted by Brian Strye of Raba Kistner Environmental, Inc. - SA for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
LL-01	12" x 12" Floor Tile / Adhesive (Yellow)	None Detected - Floor Tile None Detected - Yellow Adhesive
LL-02	12" x 12" Floor Tile / Adhesive (Yellow)	None Detected - Floor Tile None Detected - Yellow Adhesive
LL-03	12" x 12" Floor Tile / Adhesive (Yellow)	None Detected - Floor Tile None Detected - Yellow Adhesive
LL-04	Sheetrock / Joint Compound	None Detected - Drywall Material None Detected - Joint Compound
LL-05	Sheetrock / Joint Compound	None Detected - Drywall Material None Detected - Joint Compound
LL-06	Sheetrock / Joint Compound	None Detected - Drywall Material None Detected - Joint Compound
LL-07	CMU / Grout	None Detected - CMU None Detected - Grout None Detected - Filler
LL-08	CMU / Grout	None Detected - CMU None Detected - Grout None Detected - Filler
LL-09	CMU / Grout	None Detected - CMU None Detected - Grout None Detected - Filler
LL-10	2' x 2' Ceiling Tile (White)	None Detected - Acoustic Tile
LL-11	2' x 2' Ceiling Tile (White)	None Detected - Acoustic Tile
LL-12	2' x 2' Ceiling Tile (White)	None Detected - Acoustic Tile
LL-13	Fiberglass Insulation	None Detected - Insulation None Detected - Paper / Foil Wrap
LL-14	Fiberglass Insulation	None Detected - Insulation None Detected - Paper / Foil Wrap

PLM Summary Report

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client :	Raba Kistner Environmental, Inc. - SA	Lab Job No. :	23B-01860
Project :	2000 E Expwy 83, Mercedes	Report Date :	02/21/2023
Project # :	ASF23-012-00	Sample Date :	02/14/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 2/17/2023, thirty (30) bulk material samples were submitted by Brian Strye of Raba Kistner Environmental, Inc. - SA for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
LL-15	Fiberglass Insulation	None Detected - Insulation None Detected - Paper / Foil Wrap
LL-16	Cove Base (Brown) / Glue	None Detected - Cove Base None Detected - Yellow Glue
LL-17	Cove Base (Brown) / Glue	None Detected - Cove Base None Detected - Yellow Glue
LL-18	Cove Base (Brown) / Glue	None Detected - Cove Base None Detected - Yellow Glue
LL-19	Wall Tile (Green)	No Wall Tile None Detected - Grout
LL-20	Wall Tile (Green)	No Wall Tile None Detected - Grout
LL-21	Wall Tile (Green)	No Wall Tile None Detected - Grout
LL-22	Ceramic Floor Tile (White)	None Detected - Ceramic Tile None Detected - Grout None Detected - Mortar
LL-23	Ceramic Floor Tile (White)	None Detected - Ceramic Tile None Detected - Grout None Detected - Mortar
LL-24	Ceramic Floor Tile (White)	None Detected - Ceramic Tile None Detected - Grout None Detected - Mortar
LL-25	Sheetrock / Joint Compound	None Detected - Drywall Material None Detected - Joint Compound
LL-26	Sheetrock / Joint Compound	None Detected - Drywall Material None Detected - Joint Compound

PLM Summary Report

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client :	Raba Kistner Environmental, Inc. - SA	Lab Job No. :	23B-01860
Project :	2000 E Expwy 83, Mercedes	Report Date :	02/21/2023
Project # :	ASF23-012-00	Sample Date :	02/14/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 2/17/2023, thirty (30) bulk material samples were submitted by Brian Strye of Raba Kistner Environmental, Inc. - SA for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
LL-27	Sheetrock / Joint Compound	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
LL-28	CMU / Grout, Exterior Walls	None Detected - CMU None Detected - Grout None Detected - Filler
LL-29	CMU / Grout, Exterior Walls	None Detected - CMU None Detected - Grout None Detected - Filler
LL-30	CMU / Grout, Exterior Walls	None Detected - CMU None Detected - Grout None Detected - Filler

These samples were analyzed by layers. Quantification, unless otherwise noted, is performed by calibrated visual estimate. The test report shall not be reproduced except in full without written approval of the laboratory. The results relate only to the items tested. These test results do not imply endorsement by NVLAP or any agency of the U.S. Government. Accredited by the National Voluntary Laboratory Accreditation Program for Bulk Asbestos Fiber Analysis under Lab Code 102056-0.

Analyst(s): Shaun Wilkerson

Lab Manager : Heather Lopez — Approved Signatory : Heather Lopez

Lab Director : Bruce Crabb — Approved Signatory : Bruce Crabb

Thank you for choosing Moody Labs

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Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client : Raba Kistner Environmental, Inc. - SA
Project : 2000 E Expwy 83, Mercedes
Project # : ASF23-012-00

Lab Job No. : 23B-01860
Report Date : 02/21/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
LL-01	Floor Tile (Light Tan)	95%	Calcite / Vinyl Binders	100%	02/21	SW
	Yellow Adhesive (Yellow)	5%	Glue Binders	100%		
LL-02	Floor Tile (Light Tan)	95%	Calcite / Vinyl Binders	100%	02/21	SW
	Yellow Adhesive (Yellow)	5%	Glue Binders	100%		
LL-03	Floor Tile (Light Tan)	95%	Calcite / Vinyl Binders	100%	02/21	SW
	Yellow Adhesive (Yellow)	5%	Glue Binders	100%		
LL-04	Drywall Material (White)	25%	Glass Wool Fibers	2%	02/21	SW
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	10%	Cellulose Fibers	100%		
	Joint Compound (White)	65%	Calcite / Talc / Binders	100%		
LL-05	Drywall Material (White)	75%	Glass Wool Fibers	2%	02/21	SW
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	10%	Cellulose Fibers	100%		
	Joint Compound (White)	15%	Calcite / Talc / Binders	100%		
LL-06	Drywall Material (White)	25%	Glass Wool Fibers	2%	02/21	SW
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	55%	Cellulose Fibers	100%		
	Joint Compound (White)	20%	Calcite / Talc / Binders	100%		
LL-07	CMU (Grey)	89%	Aggregate	65%	02/21	SW
			Cement Binders	35%		
	Grout (Grey)	10%	Aggregate	65%		
			Cement Binders	35%		
	Filler (White)	1%	Calcite / Binders	100%		

Moody Labs
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Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client : Raba Kistner Environmental, Inc. - SA
Project : 2000 E Expwy 83, Mercedes
Project # : ASF23-012-00

Lab Job No. : 23B-01860
Report Date : 02/21/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
LL-08	CMU (Grey)	49%	Aggregate	65%	02/21	SW
			Cement Binders	35%		
	Grout (Grey)	50%	Aggregate	65%		
			Cement Binders	35%		
	Filler (White)	1%	Calcite / Binders	100%		
LL-09	CMU (Grey)	49%	Aggregate	65%	02/21	SW
			Cement Binders	35%		
	Grout (Grey)	50%	Aggregate	65%		
			Cement Binders	35%		
	Filler (White)	1%	Calcite / Binders	100%		
LL-10	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	02/21	SW
			Mineral Wool Fibers	30%		
			Perlite	20%		
LL-11	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	02/21	SW
			Mineral Wool Fibers	30%		
			Perlite	20%		
LL-12	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	02/21	SW
			Mineral Wool Fibers	30%		
			Perlite	20%		
LL-13	Insulation (Pink)	90%	Mineral Wool Fibers	95%	02/21	SW
			Resin Binders	5%		
	Paper / Foil Wrap (Tan / Silver)	10%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		
LL-14	Insulation (Pink)	90%	Mineral Wool Fibers	95%	02/21	SW
			Resin Binders	5%		
	Paper / Foil Wrap (Tan / Silver)	10%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		

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2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client : Raba Kistner Environmental, Inc. - SA
Project : 2000 E Expwy 83, Mercedes
Project # : ASF23-012-00

Lab Job No. : 23B-01860
Report Date : 02/21/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
LL-15	Insulation (Pink)	90%	Mineral Wool Fibers	95%	02/21	SW
			Resin Binders	5%		
	Paper / Foil Wrap (Tan / Silver)	10%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		
LL-16	Cove Base (Brown)	95%	Vinyl Binders	100%	02/21	SW
	Yellow Glue (Yellow)	5%	Glue Binders	100%		
LL-17	Cove Base (Brown)	95%	Vinyl Binders	100%	02/21	SW
	Yellow Glue (Yellow)	5%	Glue Binders	100%		
LL-18	Cove Base (Brown)	95%	Vinyl Binders	100%	02/21	SW
	Yellow Glue (Yellow)	5%	Glue Binders	100%		
LL-19	No Wall Tile				02/21	SW
	Grout (Tan)	100%	Calcite / Binders	100%		
LL-20	No Wall Tile				02/21	SW
	Grout (Tan)	100%	Calcite / Binders	100%		
LL-21	No Wall Tile				02/21	SW
	Grout (Tan)	100%	Calcite / Binders	100%		
LL-22	Ceramic Tile (White)	83%	Sintered Clays	100%	02/21	SW
	Grout (Tan)	2%	Calcite / Binders	100%		
	Mortar (Grey)	15%	Aggregate	65%		
			Cement Binders	35%		
LL-23	Ceramic Tile (White)	40%	Sintered Clays	100%	02/21	SW
	Grout (Tan)	20%	Calcite / Binders	100%		
	Mortar (Grey)	40%	Aggregate	65%		
			Cement Binders	35%		
LL-24	Ceramic Tile (White)	70%	Sintered Clays	100%	02/21	SW
	Grout (Tan)	10%	Calcite / Binders	100%		
	Mortar (Grey)	20%	Aggregate	65%		
			Cement Binders	35%		

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Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client : Raba Kistner Environmental, Inc. - SA
Project : 2000 E Expwy 83, Mercedes
Project # : ASF23-012-00

Lab Job No. : 23B-01860
Report Date : 02/21/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
LL-25	Drywall Material (White)	75%	Glass Wool Fibers	2%	02/21	SW
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	10%	Cellulose Fibers	100%		
	Joint Compound (White)	15%	Calcite / Talc / Binders	100%		
LL-26	Drywall Material (White)	75%	Glass Wool Fibers	2%	02/21	SW
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	10%	Cellulose Fibers	100%		
	Joint Compound (White)	15%	Calcite / Talc / Binders	100%		
LL-27	Drywall Material (White)	55%	Glass Wool Fibers	2%	02/21	SW
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	25%	Cellulose Fibers	100%		
	Joint Compound (White)	10%	Calcite / Talc / Binders	100%		
	Texture (White)	10%	Calcite / Talc / Binders	100%		
LL-28	CMU (Grey)	10%	Aggregate	65%	02/21	SW
			Cement Binders	35%		
	Grout (Grey)	89%	Aggregate	65%		
			Cement Binders	35%		
	Filler (White)	1%	Calcite / Binders	100%		
LL-29	CMU (Grey)	10%	Aggregate	65%	02/21	SW
			Cement Binders	35%		
	Grout (Grey)	89%	Aggregate	65%		
			Cement Binders	35%		
	Filler (White)	1%	Calcite / Binders	100%		

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2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 300084

Client : Raba Kistner Environmental, Inc. - SA
Project : 2000 E Expwy 83, Mercedes
Project # : ASF23-012-00

Lab Job No. : 23B-01860
Report Date : 02/21/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
LL-30	CMU (Grey)	89%	Aggregate	65%	02/21	SW
			Cement Binders	35%		
	Grout (Grey)	10%	Aggregate	65%		
			Cement Binders	35%		
	Filler (White)	1%	Calcite / Binders	100%		

SMMS LABS

Chain of Custody

Lab Job # 23B-01860
Lab Job # 30 PLM
Lab Job #

Please call in advance for immediate, after-hour, & weekend pricing &availability.

Page ___ of ___

ASBESTOS PLM

Bulk ☐ Immediate ☐ 1 day ☐ 2 day ☒ 3 day ☐ 5 day
☐ **Analyze All** ☒ **Positive Stop**

PCM Air (7400)

☐ Immediate ☐ 1 day ☐ 2 day ☐ 3 day ☐ 5 day

TOTAL DUST (0500/0600)

☐ 1 day ☐ 2 day

ASBESTOS TEM

Air AHERA Method	☐ 6 hr	☐ 12 hr	☐ 24 hr	
Air 7402 (Modified)	☐ 1 day	☐ 2 day	☐ 3 day	
Bulk/Wipe/Micro Vac	☐ 1 day	☐ 2 day	☐ 3 day	☐ 5 day
Water	☐ 1 day	☐ 2 day	☐ 3 day	
Analyze Blanks	☐ **Yes**	☐ **No**		

MOLD

Direct Exam	☐ Immediate	☐ 1 day	☐ 2 day
Standard Air	☐ Immediate	☐ 1 day	☐ 2 day
Expanded Air	☐ Immediate	☐ 1 day	☐ 2 day
Culture**	☐ 10-14 days		
Analyze Blanks	☐ **Yes**	☐ **No**	

****Turnaround of Culture Samples subject to Culture Growth****

BACTERIA*

Total Colony Counts (CC)	☐ 3 day	☐ 5 day
CC + Gram Stain	☐ 3 day	☐ 5 day
Total Coliform & E. coli (P/A)	☐ 2-3 day	

OTHER: _____

Billing Company / City: Raba Kistner
Submitter's Company:
Submitter's Name: Brian Strye
Project: 2000 East Expressway 83, Mercedes
Contact Information: Name: Brian Strye
E-mail Results to: bstrye@rkci.com
Invoice Address:

# of Samples: 30
Sample Date: 2-14-2023
Project #: ASF-23-012-00
Phone #: 210-699-9090
Mobile #:
Fax #:
P.O. #:

Please review paperwork and samples before submitting to lab. Unsealed / improperly packaged / damaged / expired samples or excessive administrative requests may incur additional fees

Notes:

Sample #	Sample Description	Vol. / Area (if applicable)	Location / Notes
LL-01	12x12" Floor Tile / yellow adhesive		
LL-02	↓		
LL-03	↓		
LL-04	Sheetrock / Joint Compound		
LL-05	↓		
LL-06	↓		
LL-07	CMU / Grout		
LL-08	↓		
LL-09	↓		
LL-10	2x2' White Ceiling Tiles		
LL-11	↓		
LL-12	↓		
LL-13	Fiberglass Insulation		
LL-14	↓		
LL-15	↓		

Released By:	Date / Time:	Received By:	Date / Time:
[signature]	2-16-23	[signature]	2/17/23 9:52
Released By:	Date / Time:	Received By:	Date / Time:

SMMS LABS

Chain of Custody

Lab Job # 236-01866
Lab Job #
Lab Job #

Project: Laser Lux

Project #: ASF-23-012-00

Sample #	Sample Description	Vol. / Area (if applicable)	Location / Notes
LL-16	Cove Base (Brown) / Glue		
LL-17	↓		
LL-18	↓		
LL-19	Green Wall Tile		
LL-20	↓		
LL-21	↓		
LL-22	Ceramic white floor tile		
LL-23	↓		
LL-24	↓		
LL-25	Sheetrock / Joint Compound		
LL-26	↓		
LL-27	↓		
LL-28	CMU / Grout (exterior walls)		
LL-29	↓		
LL-30	↓		

Steve Moody Micro Services, LLC ♦ *2051 Valley View Ln.* ♦ *Farmers Branch, TX 75234* ♦ *Phone (972) 241-8460* ♦ *Fax (972) 241-8461*
www.moodylabs.com

EMC LABS, INC.

9830 South 51st Street, Suite B-109 / PHOENIX, ARIZONA 85044 / 480-940-5294 or 800-362-3373 / FAX 480-893-1726
emclab@emclabs.com

LEAD (Pb) IN PAINT CHIP SAMPLES

EMC SOP METHOD #L01/1 EPA SW-846 METHOD 7420

EMC LAB #:	L96172	**DATE RECEIVED:**	02/20/23
CLIENT:	Raba Kistner	**REPORT DATE:**	02/27/23
		DATE OF ANALYSIS:	02/27/23
CLIENT ADDRESS:	12821 W. Golden Lane San Antonio, TX 78249	**P.O. NO.:**	
PROJECT NAME:	2000 East Expressway	**PROJECT NO.:**	ASF23-012-00

EMC # L96172-	SAMPLE DATE /23	CLIENT SAMPLE #	DESCRIPTION	REPORTING LIMIT (%Pb by weight)	%Pb BY WEIGHT
1	2/14	L-1	Sheetrock/Green	0.019	BRL
2	2/14	L-2	CMU/Off-White	0.039	BRL
3	2/14	L-3	Metal Door/Lt. Brown	0.015	BRL
4	2/14	L-4	Sheetrock/Off-White	0.022	BRL
5	2/14	L-5	Metal Door/Blue	0.096	BRL
6	2/14	L-6	CMU/Brick/Off-White	0.023	BRL

^ = Dilution Factor Changed * = Excessive Substrate May Bias Sample Results **BRL** = Below Reportable Limits **#** = Very Small Amount Of Sample Submitted, May Affect Result

This report applies to the standards or procedures identified and to the samples tested only. The test results are not necessarily indicative or representative of the qualities of the lot from which the sample was taken or of apparently identical or similar products, nor do they represent an ongoing quality assurance program unless so noted. Unless otherwise noted, all quality control analyses for the samples noted above were within acceptable limits.

Where it is noted that a sample with excessive substrate was submitted for laboratory analysis, such analysis may be biased. The lead content of such sample may, in actuality, be greater than reported. EMC makes no warranty, express or implied, as to the accuracy of the analysis of samples noted to have been submitted with excessive substrate. Resampling is recommended in such situations to verify original laboratory results. EMC Labs, Inc. (ID 101586) is accredited by the AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC) in the Environmental Lead accreditation program(s) for Paint, Settled Dust by Wipe, Soil and Airborne Dust Fields of Testing as documented by the Scope of Accreditation Certificate and associated Scope. AIHA-LAP, LLC accreditation complies with the ISO/IEC Standard 17025:**2017** requirements. The customer provides the Project number, name, address, sampling date, identification, and description. EMC Labs, Inc. is an EPA Recognized Testing Lab.

These reports are for the exclusive use of the addressed client and are rendered upon the condition that they will not be reproduced wholly or in part for advertising or other purposes over our signature or in connection with our name without special written permission. Samples not destroyed in testing are retained a maximum of sixty (60) days.

ANALYST: Jason Thompson

QA COORDINATOR: Kurt Kettler

Ver. 11/30/08 Revision 08/14/2021

Page ___ of ___

CHAIN OF CUSTODY

EMC Labs, Inc.
9830 S. 51st St., Ste B-109
Phoenix, AZ 85044
(480) 940-5294 Fax (480) 893-1726

LAB#: L96172
TAT: 3-4-5 days
Rec'd: ~~FEB 1 8 2023~~ DB
FEB 2 0 2023

COMPANY NAME: Raba Kistner
Address: 12821 W. Golden Lane
San Antonio, TX 78249
CONTACT: Brian Stryc
Phone/Fax: 210-699-9090
Email: bstrye@rkci.com

BILL TO: (If Different Location)

Now Accepting: VISA – MASTERCARD

Price Quoted: $_____ / Sample $____ / Layers

COMPLETE ITEMS 1-4: (Failure to complete any items may cause a delay in processing or analyzing your samples)

1. TURNAROUND TIME: [Same Day Rush] [1-2 Days] [3-4-5 Days] [6-10 Days]

****Prior confirmation of turnaround time is required
****Additional charges for rush analysis (please call marketing department for pricing details)
****Laboratory analysis may be subject to delay if credit terms are not met

2. TYPE OF ANALYSIS: [Bulk-PLM] [Air-PCM] [Lead] [Point Count] [Fungi: AOC, W-C, Bulk, Swab, Tape]

3. DISPOSAL INSTRUCTIONS: [Dispose of samples at EMC] / [Return samples to me at my expense]
(If you do not indicate preference, EMC will dispose of samples 30 days from analysis.)

4. Project Name: 2000 East Expressway
P.O. Number: _____ **Project Number:** ASF23-012-00

EMC SAMPLE #	CLIENT SAMPLE #	DATE & TIME SAMPLED	LOCATION/MATERIAL TYPE	Samples Accepted Yes / No	AIR SAMPLE INFO / COMMENTS ON	OFF	FLOW RATE
1	L-1	2-14-23	Sheetrock / Green	Y N			
2	L-2		CMU / off white	Y N			
3	L-3		metal door / Lt. Brown	Y N			
4	L-4		Sheetrock / off white	Y N			
5	L-5		metal door / blue	Y N			
6	L-6		CMU / Brick / off white	Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			

SPECIAL INSTRUCTIONS:
Sample Collector: (Print) Brian Stryc (Signature)

Relinquished by: [signature] Date/Time: 2-16-23 Received by: Angela Caudle Date/Time: 2/20/23 9:15 am
Relinquished by: Angela Caudle Date/Time: 2/20/23 5 pm Received by: [signature] Date/Time: 2/20/23 5 pm
Relinquished by: _____ Date/Time _____ Received by: _____ Date/Time: _____

** In the event of any dispute between the above parties for these services or otherwise, parties agree that jurisdiction and venue will be in Phoenix, Arizona and prevailing party will be entitled to attorney's fees and court costs.

Rev. 09/01/08

ATTACHMENT D
FIRM LICENSE AND CERTIFICATION

Texas Department of State Health Services

MARTINEZ ASBESTOS AND ENVIRONMENTAL CONSULTING LLC

is certified to perform as an

Asbestos Consultant Agency

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 100570

Expiration Date: 01/09/2025

Jennifer Shuford, MD, MPH,
Commissioner of Health

Control Number: 97543

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

Texas Department of State Health Services

Asbestos Individual Consultant

FERNANDO A MARTINEZ

License No. 105762

Control No. 97892

Expiration Date: 18-Oct-2023

Texas Department of
State Health Services
Asbestos Inspector
JAMES T GARCIA
License No. 602222
Control No. 99967
Expiration Date: 15-Oct-2023

Phase I Environmental Site Assessment

REPORT DATE: February 23, 2023

PROPERTY INFORMATION:
Triumph Public High Schools
2000 East Express 83
Mercedes, Hidalgo County, Texas 78570

PROJECT INFORMATION:
AEI Project No. 474878
Site Assessment Date: February 17, 2023

PREPARED FOR:
Triumph Public High Schools
707 Lindberg Avenue
McAllen , Texas 78501

PREPARED BY:
AEI Consultants - Corporate Headquarters
2500 Camino Diablo
Walnut Creek, California 94597

1.800.801.3224
www.aeiconsultants.com

February 23, 2023

Frances Berrones-Johnson
Triumph Public High Schools
707 Lindberg Avenue
McAllen , Texas 78501

Subject: **Phase I Environmental Site Assessment**
Triumph Public High Schools
2000 East Express 83
Mercedes, Texas 78570
AEI Project No. 474878

Dear Frances Berrones-Johnson:

AEI Consultants is pleased to provide the *Phase I Environmental Site Assessment* of the above referenced property. This assessment was authorized and performed in accordance with the scope of services engaged.

We appreciate the opportunity to provide services to you. If you have any questions concerning this report, or if we can assist you in any other matter, please contact me at (201) 332-5070 or jcopman@aeiconsultants.com.

Sincerely,

John Copman
Vice President
AEI Consultants

PROJECT SUMMARY

2000 East Express 83, Mercedes, Hidalgo County, Texas 78570
AEI Project No. 474878

Report Section		REC	CREC	HREC	OEC	Recommended Action
1.0	Introduction					None
2.0	Site and Vicinity Description					None
3.0	Historical Records Review					None
4.0	Regulatory Agency Records Review					None
5.0	Regulatory Database Records Review					None
6.0	Interviews and User Provided Information					None
7.0	Site Reconnaissance					None
8.1	Asbestos-Containing Building Materials					None
8.2	Lead-Based Paint					None
8.3	Naturally-Occurring Radon					None
8.4	Suspect Mold or Microbial Growth Conditions				✔	None

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APPENDIX H: COMMONLY USED ACRONYMS & ABBREVIATIONS

REPORT VIABILITY

Site Visit	February 17, 2023
Regulatory Database Review	February 7, 2023
Interview(s)	Property Owner: February 22, 2023 Key Site Manager: February 17, 2023
EP Declaration	February 23, 2023
Environmental Lien Search (if conducted by AEI)	N/A
Report Viability per ASTM E1527-21	August 6, 2023

The dates listed are required for Users who are using the report in connection with CERCLA liability protections. The User may have their own criteria when the report is being used for business risk purposes, and not CERCLA liability protections.

EXECUTIVE SUMMARY

AEI Consultants (AEI) was retained by Triumph Public High Schools to conduct a Phase I ESA in conformance with AEI's contract and the scope and limitations of ASTM Standard Practice E1527-13 and E1527-21 and the EPA Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), for the property located at 2000 East Express 83, Mercedes, Hidalgo County, Texas (the "subject property"). Any exceptions to, or deletions from, this practice are described in Sections 1.4, 1.5, and 1.6 of this report.

Pertinent subject property information is noted below:

Property Information	
Site Address(es)	2000 East Express 83, Mercedes, Hidalgo County, Texas 78570
Property ID (APN or Block/Lot)	D0447-00-000-0008-00; C1400-00-065-0015-07; C1400-00-065-0015-02
Location	Southeast corner of the intersection of East Expressway 83 and Dawson Road
Property Type	Commercial
Site and Building Information	
Approximate Site Acreage/Source	2.81/Assessor
Number of Buildings	1
Building Construction Date(s)/Source	2007/Assessor
Building Square Footage (SF)/Source	5,936/Assessor
Number of Floors/Stories	1
Basement or Subgrade Area(s)	None identified
Number of Units	One
Additional Improvements	Concrete-paved parking areas and associated landscaping
On-site Occupant(s)	Laser Lux
Current On-site Operations/Use	Office space and printing operations
Current Use of Hazardous Substances	None identified
Regulatory Information	
Regulatory Database Listing(s)	None identified

A chronological summary of historical subject property information is as follows:

Date Range	Subject Property Description and Occupancy (Historical Addresses)	Source(s)
1939-2002	Agricultural land	Aerial photographs
2007-Present	Current building constructed for commercial use (2000 East Expressway 83) occupied by: 2014: Laserlux 2017: Laserlux; Neuhaus & Co LTD	Agency records, aerial photographs, city directories, site reconnaissance

The immediately surrounding properties consist of the following:

Direction	Tenant/Use (Address)	Regulatory Database Listing(s)
North	East Interstate Highway 2 followed by: Vacant land (3001 East Expressway 83)	None identified
East	Dawson Road followed by: Vacant land	None identified

Direction	Tenant/Use (Address)	Regulatory Database Listing(s)
South	Dawson Road followed by: Cintas Facility Services (700 Dawson Road)	None identified
West	Dawson Road followed by: Zerimar Lighting Solutions (1730 East Expressway Highway 2) Vacant land (689 Dawson Road)	None identified

FINDINGS AND OPINIONS

Significant Data Gap(s) is defined by the current ASTM Standard E1527 as a data gap that affects the ability of the environmental professional to identify a recognized environmental condition.

AEI did not identify significant data gaps which affected our ability to identify RECs.

Recognized Environmental Condition (REC) is defined by the current ASTM Standard E1527 as the (1) the presence of hazardous substances or petroleum products in, on, or at the subject property due to a release to the environment; (2) the likely presence of hazardous substances or petroleum products in, on, or at the subject property due to a release or likely release to the environment; or (3) the presence of hazardous substances or petroleum products in, on, or at the subject property under conditions that pose a material threat of a future release to the environment.

- AEI did not identify evidence of RECs during the course of this assessment.

Controlled Recognized Environmental Condition (CREC) is defined by the current ASTM Standard E1527 as a recognized environmental condition affecting the subject property that has been addressed to the satisfaction of the applicable regulatory authority or authorities with hazardous substances or petroleum products allowed to remain in place subject to implementation of required controls (for example, activity and use limitations or other property use limitations).

- AEI did not identify evidence of CRECs during the course of this assessment.

Historical Recognized Environmental Condition (HREC) is defined by the current ASTM Standard E1527 as a previous release of hazardous substances or petroleum products affecting the subject property that has been addressed to the satisfaction of the applicable regulatory authority or authorities and meeting unrestricted use criteria established by the applicable regulatory authority or authorities without subjecting the subject property to any controls (for example, activity and use limitations or other property use limitations).

- AEI did not identify evidence of HRECs during the course of this assessment.

Other Environmental Considerations (OEC) warrant discussion, but do not qualify as RECs as defined by the current ASTM Standard E1527. These include, but are not limited to, de minimis conditions and/or environmental considerations such as the presence of ACMs, LBP, radon, mold, and lead in drinking water, which can affect the liabilities and financial obligations of

the client, the health and safety of site occupants, and the value and marketability of the subject property. A de minimis condition is defined by the ASTM Standard as a condition that generally does not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

- AEI observed interior areas of the subject property building in order to identify the presence of mold. AEI did not note obvious visual or olfactory indications of the presence of mold. However, several water stained ceiling tiles were observed in the office area of the subject property building. Based upon our observations, AEI recommends replacing stained ceiling tiles and confirming that the source of water intrusion has been addressed.

CONCLUSIONS

We have performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Standard Practice E1527-13 and E1527-21, of 2000 East Express 83, Mercedes, Hidalgo County, Texas, the *subject property*. Any exceptions to, or deletions from, this practice are described in Sections 1.4, 1.5, and 1.6 of this report.

This assessment has revealed no evidence of recognized environmental conditions, controlled recognized environmental conditions, or significant data gaps in connection with the subject property.

RECOMMENDATIONS

AEI recommends no further investigation for the subject property at this time.

1.0 INTRODUCTION

This report documents the methods and findings of the Phase I Environmental Site Assessment performed in conformance with AEI's contract and scope and limitations of ASTM Standard Practice E1527-13 and E1527-21 and the EPA Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), for the property located at 2000 East Express 83, Mercedes, Hidalgo County, Texas (Appendix A: Figures and Appendix B: Property Photographs).

1.1 Scope of Work

The purpose of the Phase I ESA is to assist the client in identifying potential RECs, in accordance with the most current ASTM E1527 Standard associated with the presence of any hazardous substances or petroleum products, their use, storage, and disposal at and in the vicinity of the subject property. Property assessment activities focused on: 1) a review of federal, state, tribal, and local databases that identify and describe underground fuel tank sites, leaking underground fuel tank sites, hazardous waste generation sites, and hazardous waste storage and disposal facility sites within the ASTM approximate minimum search distance; 2) a property and surrounding site reconnaissance, and interviews with the past and present owners and current occupants and operators to identify potential environmental contamination; and 3) a review of historical sources to help ascertain previous land use at the site and in the surrounding area.

1.2 Additional Services

Other Environmental Considerations such as ACMs, LBP, lead in drinking water, radon, mold, and wetlands can result in business environmental risks for property owners which may disrupt current or planned operations or cash flow and are generally beyond the scope of a Phase I assessment as defined by the current ASTM Standard E1527. Based upon the agreed-on scope of services this ESA did not include subsurface or other invasive assessments, business environmental risks, or other services not specifically identified and discussed herein.

1.3 Significant Assumptions

The following assumptions are made by AEI in this report. AEI relied on information derived from secondary sources including governmental agencies, the client, designated representatives of the client, property contact, property owner, property owner representatives, computer databases, and personal interviews. AEI has reviewed and evaluated the thoroughness and reliability of the information derived from secondary sources including government agencies, the client, designated representatives of the client, property contact, property owner, property owner representatives, computer databases, or personal interviews. It appears that all information obtained from outside sources and reviewed for this assessment is thorough and reliable. However, AEI cannot guarantee the thoroughness or reliability of this information.

Groundwater flow, unless otherwise specified by on-site well data or well data from the subject property or nearby sites, is inferred from contour information depicted on the USGS topographic maps. AEI assumes the property has been correctly and accurately identified by the client, designated representative of the client, property contact, property owner, and property owner's representatives.

1.4 LIMITATIONS

Property conditions, as well as local, state, tribal, and federal regulations can change significantly over time. Therefore, the recommendations and conclusions presented as a result of this assessment apply strictly to the environmental regulations and property conditions existing at the time the assessment was performed. Available information has been analyzed using currently accepted assessment techniques and it is believed that the inferences made are reasonably representative of the property. AEI makes no warranty, expressed or implied, except that the services have been performed in accordance with generally accepted environmental property assessment practices applicable at the time and location of the assessment.

Considerations identified by ASTM as beyond the scope of a Phase I ESA that may affect business environmental risk at a given property include the following: ACMs, radon, LBP, lead in drinking water, wetlands, regulatory compliance, cultural and historical resources, industrial hygiene, health and safety, ecological resources, endangered species, indoor air quality, mold, and high voltage lines. These environmental issues or conditions may warrant assessment based on the type of the property transaction; however, they are considered non-scope issues under the current ASTM Standard E1527.

If requested by the client, these non-scope issues are discussed herein. Otherwise, the purpose of this assessment is solely to satisfy one of the requirements for qualification of the innocent landowner defense, contiguous property owner or bona fide prospective purchaser under CERCLA. The current ASTM Standard E1527 and the United States EPA Standards and Practices for All Appropriate Inquiries (40 CFR Part 312) constitute the "all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice" as defined in:

1. 42 U.S.C. § 9601(35)(B), referenced in the current ASTM Standard E1527.
2. Sections 101(35)(B) (ii) and (iii) of CERCLA and referenced in the EPA Standards and Practices for All Appropriate Inquiries (40 CFR Part 312).
3. 42 U.S.C. § 9601(40) and 42 U.S.C. § 9607(q).

The Phase I Environmental Site Assessment is not, and should not be construed as, a warranty or guarantee about the presence or absence of environmental contaminants that may affect the property. Neither is the assessment intended to assure clear title to the property in question. The sole purpose of assessment into property title records is to ascertain a historical basis of prior land use. All findings, conclusions, and recommendations stated in this report are based upon facts, circumstances, and industry-accepted procedures for such services as they existed at the time this report was prepared (i.e., federal, state, and local laws, rules, regulations, market conditions, economic conditions, political climate, and other applicable matters). All findings, conclusions, and recommendations stated in this report are based on the data and information provided, current subject property use, and observations and conditions that existed on the date and time of the property reconnaissance.

Responses received from local, state, or federal agencies or other secondary sources of information after the issuance of this report may change certain facts, findings, conclusions, or circumstances to the report. A change in any fact, circumstance, or industry-accepted procedure upon which this report was based may adversely affect the findings, conclusions, and recommendations expressed in this report.

AEI's limited radon screening, if included, is intended to provide a preliminary screening to evaluate the potential presence of elevated radon concentrations at the site. The proposed scope is not intended to define the full extent of the presence of radon at the subject property. As such, the results should be used for lending purposes only. The recommendations and conclusions presented as a result of the limited preliminary radon screening apply strictly to the property conditions existing at the time the sampling was performed. The sample analytical results are only valid for the time, place, and condition of the site at the time of collection and AEI does not warrant that the results will be repeatable or are representative of past or future conditions.

1.5 Limiting Conditions/Deviations

The performance of this assessment was limited by the following:

- The City of Mercedes Environmental Services Department, City of Mercedes Fire Department, City of Mercedes Public Works Department and City of Mercedes Planning Department were contacted for information on the subject property in order to identify historical tenants/use, property development, and/or hazardous substance/ petroleum product handling. Due to the time frame of this assessment, records were not available for review. However, based on the quality of information obtained from other sources including aerial photographs, city directories, interviews and site reconnaissance, this limitation is not expected to significantly alter the findings of this assessment.
- While additional assessments may have been conducted on the subject property, these documents must be provided for AEI's review in order for the information to be summarized/included in this report. Please refer to Section 6.3 for a summary of previous reports and other documentation provided to AEI during this assessment.
- The User did not complete the ASTM User Questionnaire or provide the User information to AEI. AEI assumes that qualification for the LLPs is being established by the User in documentation outside of this assessment.

1.6 Data Failure and Data Gaps

According to the current ASTM Standard E1527, data gaps occur when the Environmental Professional is unable to obtain information required by the Standard, despite good faith efforts to gather such information. Pursuant to the current ASTM Standard E1527, only significant data gaps, defined as those that affect the ability of the Environmental Professional to identify RECs, need to be documented.

Data failure is one type of data gap. According to the current ASTM Standard E1527, data failure occurs when all of the standard historical sources that are reasonably ascertainable and likely to be useful have been reviewed and yet the objectives have not been met. Pursuant to the current ASTM Standard E1527, historical sources are required to document property use back to the property's first developed use or back to 1940, whichever is earlier, or periods of five years or greater.

1.6.1 Data Failure

AEI did not identify evidence of data failure during the course of this assessment.

1.6.2 Significant Data Gaps

AEI did not identify significant data gaps which affected our ability to identify RECs.

1.7 Reliance

All reports, both verbal and written, are for the benefit of Triumph Public High Schools . This report has no other purpose and may not be relied upon by any other person or entity without the written consent of AEI. Either verbally or in writing, third parties may come into possession of this report or all or part of the information generated as a result of this work. In the absence of a written agreement with AEI granting such rights, no third parties shall have rights of recourse or recovery whatsoever under any course of action against AEI, its officers, employees, vendors, successors or assigns. Reliance is provided in accordance with AEI's contract and Terms and Conditions executed by Triumph Public High Schools on February 6, 2023. The limitation of liability defined in the Terms and Conditions is the aggregate limit of AEI's liability to the client and all relying parties.

2.0 SITE AND VICINITY DESCRIPTION

2.1 Site Location and Description

Property Information	
Site Address(es)	2000 East Express 83, Mercedes, Hidalgo County, Texas 78570
Property ID (APN or Block/Lot)	D0447-00-000-0008-00; C1400-00-065-0015-07; C1400-00-065-0015-02
Location	Southeast corner of the intersection of East Expressway 83 and Dawson Road
Property Type	Commercial
Site and Building Information	
Approximate Site Acreage/Source	2.81/Assessor
Number of Buildings	1
Building Construction Date(s)/Source	2007/Assessor
Building Square Footage (SF)/Source	5,936/Assessor
Number of Floors/Stories	1
Basement or Subgrade Area(s)	None identified
Number of Units	One
Additional Improvements	Concrete-paved parking areas and associated landscaping
On-site Occupant(s)	Laser Lux
Current On-site Operations/Use	Office space and printing operations
Current Use of Hazardous Substances	None identified
Regulatory Information	
Regulatory Database Listing(s)	None identified

2.2 On-Site Utilities

Utility	Source/System Information
Heating System	Electricity
Cooling System	Electricity
Potable Water	City of Mercedes
Sewage Disposal/Treatment	City of Mercedes

Utility source/system information listed in the table above is provided by Ms. Linda Orsack, Office Administrator, unless otherwise noted above.

2.3 Site and Vicinity Characteristics

The subject property is located in a commercial and light industrial area of Mercedes, Texas. The immediately surrounding properties consist of the following:

Direction	Tenant/Use (Address)	Regulatory Database Listing(s)
North	East Interstate Highway 2 followed by: Vacant land (3001 East Expressway 83)	None identified
East	Dawson Road followed by: Vacant land	None identified
South	Dawson Road followed by: Cintas Facility Services (700 Dawson Road)	None identified

Direction	Tenant/Use (Address)	Regulatory Database Listing(s)
West	Dawson Road followed by: Zerimar Lighting Solutions (1730 East Expressway Highway 2) Vacant land (689 Dawson Road)	None identified

2.4 Physical Setting

Geologic Unit: Description/Source	Qas: Alluvium - floodplain deposits, lower course of Rio Grande divided into areas dominantly silt and sand/USGS and United States Department of the Interior
Soil Series: Description/Source	Mercedes clay, saline, 0 to 1 percent slopes - delta plains consisting of moderately well drained soil with high permeability made up of calcareous clayey alluvium/USDA Soil Survey
Groundwater Flow Direction/Source	West/Topographic map interpretation
Estimated Depth to Groundwater/Source	~20 feet bgs/Texas Water Development Board
Surface waters on the subject property or adjoining sites	None
Additional notes	None

Note: Groundwater flow direction can be influenced locally and regionally by the presence of local wetland features, surface topography, recharge and discharge areas, horizontal and vertical inconsistencies in the types and location of subsurface soils, and proximity to water pumping wells. Depth and gradient of the water table can change seasonally in response to variation in precipitation and recharge, and over time, in response to urban development such as storm water controls, impervious surfaces, pumping wells, cleanup activities, dewatering, seawater intrusion barrier projects near the coast, and other factors.

3.0 HISTORICAL RECORDS REVIEW

Reasonably ascertainable standard historical sources as outlined in the current ASTM Standard E1527 were used to determine previous uses and occupancies of the subject property that are likely to have led to RECs in connection with the subject property. A chronological summary of historical data found, including but not limited to aerial photographs, historical city directories, Sanborn fire insurance maps, and agency records, is as follows:

Date Range	Subject Property Description and Occupancy (Historical Addresses)	Source(s)
1939-2002	Agricultural land	Aerial photographs
2007-Present	Current building constructed for commercial use (2000 East Expressway 83) occupied by: 2014: Laserlux 2017: Laserlux; Neuhaus & Co LTD	Agency records, aerial photographs, city directories, site reconnaissance

The subject property was historically used for agricultural purposes. There is a potential that agricultural chemicals, such as pesticides, herbicides and fertilizers, were used on site. The entire area of the subject property is either paved over or covered by improvements that make direct contact with any potential remaining concentrations in the soil unlikely. Furthermore, the subject property is developed and used for commercial and/or light industrial purposes and thus no further action related to the former agricultural use of the subject property is warranted at this time.

If available, copies of historical sources are provided in Appendix D.

3.1 AERIAL PHOTOGRAPHS

AEI reviewed aerial photographs of the subject property and surrounding area. A search was made of the EDR collection of aerial photographs. Aerial photographs were reviewed for the following years (1939-2020, non-inclusive):

Year(s)	Subject Property Description	Adjoining Site Descriptions
1939, 1950	Agricultural land with a creek passing through the northwest corner	NORTH: Creek followed by what appears to be an orchard EAST: Agricultural land SOUTH: Developed by what appears to be an orchard and farmstead WEST: Roadway followed by vacant land and creek
1953	No significant changes	NORTH: Creek followed by agricultural land EAST: No significant changes SOUTH: Developed with a single-family residence and agricultural land WEST: No significant changes
1967	No significant changes	NORTH: Highway followed by vacant land and an industrial building EAST: No significant changes SOUTH: Developed with two single-family residence and agricultural land WEST: Roadway followed by what appears to be a parking area, creek, and agricultural land

Year(s)	Subject Property Description	Adjoining Site Descriptions
1975, 1977	No significant changes	NORTH: Highway followed by a commercial building and an industrial building EAST: No significant changes SOUTH: Vacant land WEST: No significant changes
1983, 1996, 2002	No significant changes	NORTH: No significant changes EAST: No significant changes SOUTH: No significant changes WEST: Roadway followed by a storage yard with commercial building, creek, and commercial building
2006	Developed with the current commercial building	NORTH: No significant changes EAST: Roadway followed by vacant land SOUTH: Roadway followed by the current commercial building WEST: Roadway followed by a storage yard with commercial building, creek, and cleared building area
2012	No significant changes	NORTH: No significant changes EAST: No significant changes SOUTH: No significant changes WEST: Roadway followed by the current commercial building and agricultural land
2016, 2020	No significant changes	NORTH: Highway followed by vacant land EAST: No significant changes SOUTH: No significant changes WEST: No significant changes

Subject property:

- No potential environmental concerns identified

Adjoining Sites:

- No potential environmental concerns identified

3.2 Sanborn Fire Insurance Maps

Sanborn Fire Insurance maps were developed in the late 1800s and early 1900s for use as an assessment tool for fire insurance rates in urbanized areas. A search was made of the EDR collection of Sanborn Fire Insurance maps.

Sanborn map coverage was not available for the subject property.

3.3 City Directories

A search of historical city directories was conducted for the subject property utilizing EDR. No potential tenants of concern were identified based on AEI's review of the historical city directories. Directories were reviewed in approximate five-year increments from 1959-2017, non-inclusive. The first listing for the subject property appeared in 2014. The following table summarizes the results of the city directory search.

Subject Property

Year(s)	Address - Occupant Listed
2014	2000 E Expressway 83 - Laserlux
2017	2000 E Expressway 83 - Laserlux; Neuhaus & Co LTD

If listed above, XXXX indicates that the address is valid but there is no occupancy information available.

A search of historical city directories was also conducted for the adjoining sites noted below utilizing EDR. No potential occupants of concern were identified based on AEI's review of the historical city directories. Please refer to the appendices for a complete list of historical adjoining occupants identified by EDR.

Adjoining Site Addresses

Direction	Address(es)
North	3001 East Expressway 83
East	Vacant land
South	700 Dawson Road
West	1730 East Expressway Highway 2 689 Dawson Road

Subject property:

- No potential environmental concerns identified

Adjoining Sites:

- No potential environmental concerns identified

3.4 Historical Topographic Maps

In an attempt to close any data failure, AEI reviewed historical topographic maps utilizing NETR Online (www.historicaerials.com). Historical topographic maps were reviewed for the years 1959-2019, non-inclusive. No additional historical information was obtained from available topographic maps.

3.5 Chain of Title

A chain of title search was not performed as part of this assessment.

4.0 REGULATORY AGENCY RECORDS REVIEW

Local and state agencies, such as environmental health departments, fire prevention bureaus, and building and planning departments are contacted to identify any current or previous reports of hazardous substance use, storage, and/or unauthorized releases that may have impacted the subject property. In addition, information pertaining to AULs, defined as legal or physical restrictions, or limitations on the use of, or access to, a site or facility, is requested.

4.1 Local Environmental Health Department and/or State Environmental Agency

Agency	Date Contacted	Method of Contact	Name & Title of Contact	Agency Response
City of Mercedes Environmental Services Department (ESD)	February 7, 2023	Email	N/A	Response pending, refer to Section 1.5

Agency	Date Contacted	Method of Contact	Name & Title of Contact	Agency Response
Texas Commission on Environmental Quality (TCEQ)	Feburary 7, 2023	Online	N/A	No records on file

4.2 Fire Department

Agency	Date Contacted	Method of Contact	Name & Title of Contact	Agency Response
City of Mercedes Fire Department (FD)	February 7, 2023	Email	N/A	Response pending, refer to Section 1.5

4.3 Building Department

Agency	Date Contacted	Method of Contact	Name & Title of Contact	Agency Response
City of Mercedes Public Works Department (PWD)	February 7, 2023	Email	N/A	Response pending, refer to Section 1.5

4.4 Planning Department

Agency	Date Contacted	Method of Contact	Name & Title of Contact	Agency Response
City of Mercedes Planning Department (PD)	February 7, 2023	Email	N/A	Response pending, refer to Section 1.5

4.5 Assessor's Office

Agency	Date Contacted	Method of Contact	Name & Title of Contact	Agency Response
Hidalgo County Assessor's Office	February 7, 2023	Online	N/A	Information obtained is discussed below

Records Summary

APN	D0447-00-000-0008-00; C1400-00-065-0015-07; C1400-00-065-0015-02
Acreage	2.81 acres
Construction Date	2007

Building Square Footage	5,936 square feet
Current Owner	C&L Business Adventures Inc; HIDALGO & CAMERON CO DIST #9; SALINAS RICHARD
Additional Information	N/A

4.6 Other Agencies Searched

No other agencies were contacted during the course of this assessment.

4.7 Oil and Gas Wells

Agency	Date Referenced	Resource	Oil or gas wells located within 500 feet of the subject property
Railroad Commission of Texas (RRC)	February 22, 2023	RRC Map	No

4.8 Oil and Gas Pipelines

Agency	Date Referenced	Resource	Pipelines located within 500 feet of the subject property
National Pipeline Mapping System (NPMS)	February 22, 2023	NPMS Public Map Viewer	No

4.9 State Environmental Superliens

In accordance with our approved scope of services, AEI did not assess whether the subject property is subject to any state environmental superliens.

4.10 State Property Transfer Laws

In accordance with our approved scope of services, AEI did not assess whether the subject property is subject to any state property transfer laws.

5.0 REGULATORY DATABASE RECORDS REVIEW

AEI contracted EDR to conduct a search of publicly available information from federal, state, tribal, and local databases containing known and suspected sites of environmental contamination and sites of potential environmental significance. Data gathered during the current regulatory database search is compiled by EDR into one regulatory database report. Location information for listed sites is designated using geocoded information provided by federal, state, or local agencies and commonly used mapping databases with the exception of "Orphan" sites. Due to poor or inadequate address information, Orphan sites are identified but not geocoded/mapped by EDR, rather, information is provided based upon vicinity zip codes, city name, and state. The minimum search distance from the federal and state environmental records database listings specified in the current ASTM Standard E1527 is included in Section 5.1. A copy of the regulatory database report, which includes detailed descriptions of the databases noted below as well as the total number of sites identified, is included in Appendix C of this report.

In determining if a listed site is a potential environmental concern to the subject property, AEI generally applies the following criteria to classify the site as lower potential environmental concern: 1) the site only holds an operating permit (which does not imply a release), 2) the site's distance from, and/or topographic position relative to, the subject property, and/or 3) the site has recently been granted "No Further Action" by the appropriate regulatory agency.

Regulatory database listings associated with the subject property, adjoining site(s) and/or nearby sites of concern that were determined to warrant additional discussion are identified and further discussed in Section 5.1.

5.1 RECORDS SUMMARY

Database	Search Distance (Miles)	Subject Property	Adjoining Site(s)	Other Nearby Sites of Concern
Federal NPL (Superfund) sites	1.0			
Federal Delisted NPL sites	0.5			
Federal CERCLA removals/orders sites	0.5			
Federal CERCLA sites with NFRAP	0.5			
Federal RCRA facilities undergoing Corrective Action	1.0			
Federal RCRA TSD facilities	0.5			
Federal RCRA generators (LQG, SQG, VSQG)	SP/ADJ			
Federal RCRA NonGen/NLR sites	SP/ADJ			
Federal IC/EC sites	SP			
Federal ERNS sites	SP			
State- and tribal "Superfund" equivalent sites	1.0			
State- and tribal hazardous waste facilities	0.5			
State/Tribal landfill and solid waste disposal facilities	0.5			
State/Tribal leaking storage tanks	0.5			
State/Tribal registered storage tanks	SP/ADJ			
State/Tribal voluntary cleanup sites	0.5			

Database	Search Distance (Miles)	Subject Property	Adjoining Site(s)	Other Nearby Sites of Concern
State/Tribal EC/IC registries	SP			
State/Tribal brownfield sites	0.5			
Orphans	N/A			
Additional Environmental Record lists	SP/ADJ			

5.2 Vapor Migration

AEI reviewed reasonably ascertainable information for the subject and nearby properties, including a regulatory database, files for nearby release sites, and/or historical documentation, to determine if potential vapor-phase migration concerns may be present which could impact the subject property.

AEI did not identify significant on-site concerns and/or regulated listings from nearby sites which suggest that a vapor-phase migration concern currently exists at the subject property.

6.0 INTERVIEWS AND USER PROVIDED INFORMATION

6.1 INTERVIEWS

Pursuant to the current ASTM Standard E1527, the following interviews were performed during this assessment in order to obtain information indicating RECs in connection with the subject property.

6.1.1 OWNER AND KEY SITE MANAGER

Relation to Property	Name	Date Interviewed	Method of Contact	Year First Associated w/ Property	Notes
Owner/Owner Representative	Mr. Cruz Lopez, Owner	February 22, 2023	Telephone	2016	Interviewed; see Interview Summary table below
Key Site Manager	Ms. Linda Orsack, Office Administrator, Laser Lux	February 17, 2023	In Person	2022	Interviewed; see Interview Summary table below

INTERVIEW SUMMARY

Question	Owner (Representative) Response/ Comment	Key Site Manager Response/ Comment
Do you have any knowledge of USTs, clarifiers or oil/water separators, sumps, or other subsurface features?	No	No
Do you have any knowledge of previous environmental investigations conducted on site?	No	No
Do you have any knowledge of current or past industrial operations and/or other operations which would involve the use of hazardous substances and/or petroleum products?	No	No
Are you aware of any known plans for site redevelopment or change in site use?	No	No
Are you aware of any pending, threatened, or past litigation relevant to hazardous substances or petroleum products in, on, at, or from the subject property?	No	No
Are you aware of any pending, threatened or past administrative proceedings relevant to hazardous substances or petroleum products in, on, at, or from the subject property?	No	No
Are you aware of any notices from any governmental entity regarding any possible violation of environmental laws or possible liability relating to hazardous substances or petroleum products?	No	No
Are you aware of any incidents of flooding, leaks, or other water intrusion, and/or complaints related to indoor air quality?	No	No

6.1.2 PAST OWNERS, OPERATORS, AND OCCUPANTS

AEI did not attempt to interview past owners, operators, and occupants of the subject property because information from these sources would likely be duplicative of information already obtained from other sources.

6.1.3 Interview with Others

Information obtained during interviews with local government officials is incorporated into the appropriate segments of this report.

6.2 User Provided Information

User provided information is intended to help identify the possibility of RECs in connection with the subject property. According to the current ASTM Standard E1527 and the EPA Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), certain items should be researched by the prospective landowner or grantee, and the results of such inquiries may be provided to the Environmental Professional. The responsibility for qualifying for LLPs by conducting the inquiries ultimately rests with the User, and providing the information to the Environmental Professional would be prudent if such information is available.

The User did not complete the ASTM User Questionnaire or provide the User information to AEI. AEI assumes that qualification for the LLPs is being established by the User in documentation outside of this assessment.

Question	Response/ Comment
1. Environmental liens that are filed or recorded against the property (40 CFR 312.25) Did a search of recorded land title records (or judicial records where appropriate) identify any environmental liens filed or recorded against the property under federal, tribal, state or local law?	Information not provided
2. Activity and use limitations that are in place on the property or that have been filed or recorded against the property (40 CFR 312.26(a)(1)(v) and vi)). Did a search of recorded land title records (or judicial records where appropriate) identify any AULs, such as engineering controls, land use restrictions or institutional controls that are in place at the property and/or have been filed or recorded against the property under federal, tribal, state or local law?	Information not provided
3. Specialized knowledge or experience of the person seeking to qualify for the LLP (40 CFR 312.28). Do you have any specialized knowledge or experience related to the property or nearby properties? For example, are you involved in the same line of business as the current or former occupants of the property or an adjoining property so that you would have specialized knowledge of the chemicals and processes used by this type of business?	Information not provided
4. Relationship of the purchase price to the fair market value of the property if it were not contaminated (40 CFR 312.29). Does the purchase price being paid for this property reasonably reflect the fair market value of the property? If you conclude that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the property?	Information not provided
5. Commonly known or reasonably ascertainable information about the property (40 CFR 312.30). Are you aware of commonly known or reasonably ascertainable information about the property that would help the environmental professional to identify conditions indicative of releases or threatened releases? For example: (a) Do you know the past uses of the property? (b) Do you know of specific chemicals that are present or once were present at the	Information not provided

Question	Response/ Comment
property? (c) Do you know of spills or other chemical releases that have taken place at the property? (d) Do you know of any environmental cleanups that have taken place at the property?	
6. The degree of obviousness of the presence or likely presence of contamination at the property, and the ability to detect the contamination by appropriate investigation (40 CFR 312.31). Based on your knowledge and experience related to the property, are there any obvious indicators that point to the presence or likely presence of contamination at the property?	Information not provided

6.3 Previous Reports and Other Provided Documentation

No prior reports or other relevant documentation in association with the subject property was made available to AEI during the course of this assessment.

6.4 Environmental Lien Search

In accordance with our approved scope of services, an environmental lien search was not performed as part of this assessment.

7.0 SITE RECONNAISSANCE

Site Reconnaissance Date	February 17, 2023
AEI Site Assessor(s)	Alicia Sanchez
Property Escort(s)/ Relationship(s) to Property	Ms. Linda Orsack, Office Administrator
Units/Areas Observed	Interior of office spaces, break room, warehouse, and workshop; exterior boundaries of the subject property
Area(s) not accessed and reason(s)	None
Other Physical Constraints	None
General Observations	This property includes a commercial building with small-scale printing operations on site.

Reconnaissance Findings Summary

Feature	Observed on Subject Property (see Section 7.1)	Observed on Adjoining Property (see Section 7.2)
Regulated Hazardous Substances/Wastes and/or Petroleum Products in Connection with Property Use		
Aboveground/Underground Hazardous Substance or Petroleum Product Storage Tanks (ASTs/USTs)		
Hazardous Substance and Petroleum Product Containers Not in Connection with Property Use		
Unidentified Substance Containers		
Electrical or Mechanical Equipment Likely to Contain Fluids	✔	✔
Interior Stains or Corrosion		
Strong, Pungent, or Noxious Odors		
Pools of Liquid		
Drains, Sumps, and Clarifiers	✔	
Pits, Ponds, and Lagoons		
Stained Soil or Pavement		
Stressed Vegetation		
Solid Waste Disposal or Evidence of Fill Materials		
Waste Water Discharges		
Wells		
Septic Systems or Cesspools		
Biomedical Wastes		
Other	✔	

7.1 Subject Property Reconnaissance Findings

During the site reconnaissance, AEI observed the items listed in the above Reconnaissance Findings Summary table, which are further discussed below.

7.1.1 Electrical or Mechanical Equipment Likely to Contain Fluids

Toxic PCBs were commonly used historically in electrical equipment such as transformers, fluorescent lamp ballasts, and capacitors. According to United States EPA regulation 40 CFR Part 761, there are three categories for classifying such equipment: <50 ppm of PCBs is considered "Non-PCB"; between 50 and 500 ppm is considered "PCB-Contaminated"; and >500

ppm is considered "PCB-Containing." Pursuant to 15 U.S.C. 2605(e)(2)(A), the manufacture, process, or distribution in commerce or use of any polychlorinated biphenyl in any manner other than in a totally enclosed manner was prohibited after January 1, 1977.

Transformers

Type	Quantity	Owner	Presumed Date of Installation	Spills or Stains Observed (Yes/ No)	Non-PCB Label (Yes/ No)
Pad-Mounted	1	American Electric Power	~2007	No	Yes
Pole-Mounted	1	American Electric Power	~2007	No	No

The management of potential PCB-containing transformers is the responsibility of the local utility or the transformer owner. Actual material samples need to be collected to determine if transformers are PCB-containing.

Transformers installed prior to 1977 may be PCB containing while transformers installed after 1977 are unlikely to be PCB containing. Federal Regulations (40 CFR 761 Subpart G) require any release of material containing >50 ppm PCB and occurring after May 4, 1987, be cleaned up by the transformer owner following the United States EPA's PCB spill cleanup policy.

AEI did not observe evidence of spills, staining, or leaks on or around the transformers. Based on the good condition of the equipment, the transformers are not expected to represent a significant environmental concern.

Air Compressor

One air compressor was located in the southern portion of the subject property building. The air compressor contains small amounts of hydraulic oil. No spills, staining or leaks were observed on or around the compressor. Based on the good condition of the equipment, the compressor is not expected to represent a significant environmental concern.

7.1.2 Drains, Sumps, and Clarifiers

Several floor drains were observed throughout the interior of the subject property building. No significant stains were observed in the area of the drains, and no evidence of the improper discharge of hazardous substances or petroleum products was apparent. No storage of hazardous substances or petroleum products appeared present near the drains. Based on these observations, the presence of the drains is not expected to represent a significant environmental concern.

7.1.3 Other

AEI observed a vacuum system in the workshop area of the subject property building. According to Ms. Linda Orsack, this is just a collection system for toner on the property. The toner is collected into buckets and disposed of with general wastes. AEI also observed large amounts of toner throughout the building. However, since toner is a non-hazardous substance, this is not expected to represent a significant environmental concern.

7.2 Adjoining Property Reconnaissance Findings

During the site reconnaissance, AEI observed the items listed in the above Reconnaissance Findings Summary table, which are further discussed below.

7.2.1 Electrical or Mechanical Equipment Likely to Contain Fluids

One pole-mounted transformer was observed on an adjoining site during the site reconnaissance. No spills, staining, or leaks were observed on or around the transformer. Based on the good condition of the equipment, the transformer is not expected to represent a significant environmental concern.

8.0 NON-ASTM SERVICES

8.1 ASBESTOS-CONTAINING BUILDING MATERIALS

Asbestos is the name for a group of naturally occurring silicate minerals that can be separated into fibers. The fibers are strong, durable, and resistant to heat and fire. They are also long, thin and flexible, so they can even be woven into cloth. Because of these qualities, asbestos has been used in thousands of consumer, industrial, maritime, automotive, scientific and building products. During the 20th century, some 30 million tons of asbestos have been used in industrial sites, homes, schools, shipyards and commercial buildings in the United States. Commercial use of ACM began in the early 1900s and peaked in the period between 1940 and into the 1970s. Common ACMs include pipe-covering, insulating cement, insulating block, refractory and boiler insulation materials, transite board, fireproofing spray, joint compound, vinyl floor tile, ceiling tile, mastics, roofing products, and duct insulation for HVAC applications. Inhalation of asbestos fibers can result in deleterious health effects.

The potential for ACM was evaluated based the United States EPA Guidance Document: Managing Asbestos in Place - A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials (the Green Book). In 1973 the NESHAPS banned the use of most spray-applied surfacing ACM, specifically asbestos containing spray-on fireproofing and insulation. Subsequent revisions to this regulation in 1975 and 1978 effectively eliminated the use of friable pre-molded pipe, boiler, turbine, and duct insulation; and the spray application of friable asbestos-containing materials for all uses in buildings. In 1989 the EPA issued regulations to ban some asbestos-containing products and phase out most others over a multi-year period. The "Ban and Phase-Down" rule was challenged in court and the regulation remanded to the agency. As a result, any asbestos-containing products then "in commerce" would not be banned. Those not in commerce would be banned. Those materials "banned" could not be sold. It did not affect such materials already installed, or in use. Most US firms voluntarily ceased production of asbestos containing building materials not covered by the aforementioned Federal bans by the mid-1980s. In 1994, the OSHA determined that employers and building owners are required to treat installed thermal system installation and sprayed on and troweled-on surfacing materials, as well as vinyl or asphalt flooring material, as ACM in buildings constructed no later than 1980 until tested by laboratory analysis to prove otherwise.

The information below is for general informational purposes only and does not constitute an asbestos survey. In addition, the information is not intended to comply with federal, state or local regulations in regards to ACM.

Although the cutoff date of 1981 referenced in the OSHA regulations is generally accepted for estimating the likelihood that certain building materials may contain asbestos, building materials manufactured after 1981, while not expected to, may still contain asbestos. Typical materials that are known to still be manufactured with asbestos include but are not limited to: asphalt roofing products and building caulking materials and adhesives. A limited list of typical suspect ACMs is included in the following table:

Material Type	Location
Plaster (acoustical and smooth)	Walls and ceilings
Ceiling tile	Ceiling systems
Thermal systems insulations, packings, and gaskets	Heating systems, cooling systems, domestic and heating and cooling piping, ductwork, and other equipment
Floor tile and associate mastics, flooring felts, and papers (under hardwood/other)	Floors
Vinyl sheet flooring and adhesives	Floors
Cove base and associated mastics	Walls
Ceramic tile adhesives and grouts	Walls, floors, and ceilings
All adhesives	Mirrors, wall coverings, construction, etc.
Grout and caulking	Windows and doors
Gypsum board, tape, and joint compound	Wall and ceiling systems
Insulation materials	Walls, ceilings, and attic spaces
Roofing materials (felts, rolled, shingle, flashings, adhesives, tar, and insulations)	Roof and parapet wall systems
Brick and block, mortars	Walls

The observed suspect ACMs were in good condition and are not expected to pose a health and safety concern to the occupants of the subject property at this time. In the event that building renovation or demolition activities are planned, a thorough asbestos survey is required in accordance with the EPA NESHAP 40 CFR Part 61 prior to demolition or renovation activities that may disturb ACMs.

8.2 Lead-Based Paint

Lead-based paint (LBP) is defined as any paint, varnish, stain, or other applied coating that has ≥1 mg/cm² (5,000 µg/g or 5,000 ppm) or more of lead by federal guidelines; state and local definitions may differ from the federal definitions in amounts ranging from 0.5 mg/cm² to 2.0 mg/cm². Section 1017 of the Housing and Urban Development (HUD) Guidelines, Residential Lead-Based Paint Hazard Reduction Act of 1992, otherwise known as "Title X," defines a LBP hazard as "any condition that causes exposure to lead that would result in adverse human health effects" resulting from lead-contaminated dust, bare, lead-contaminated soil, and/or lead-contaminated paint that is deteriorated or present on accessible, friction, or impact surfaces. Therefore, under Title X, intact LBP on most walls and ceilings would not be considered a "hazard," although the paint should be maintained and its condition monitored to ensure that it does not deteriorate and become a hazard. Additionally, Section 1018 of this law directed HUD and EPA to require the disclosure of known information on LBP and LBP hazards before the sale or lease of most housing built before 1978. Most private housing, public housing, or federally owned or subsidized housing is affected by this rule.

Under OSHA, lead-containing paint (LCP) is defined as any paint with any detectable amount of lead present in it. Therefore, all LBP is considered LCP. Conversely, LCP may not meet the criteria to be considered LBP in accordance with HUD guidelines or some states' definition of LBP.

It is important to note that LCP may create a lead hazard when being removed. The condition of these materials must be monitored when they are being disturbed. In the event LCP is subject to abrading, sanding, torching, and/or cutting during demolition or renovation activities, there may be regulatory issues that must be addressed.

The information below is for general informational purposes only and does not constitute a lead hazard evaluation. In addition, the information is not intended to comply with federal, state, or local regulations in regards to LBP.

In buildings constructed after 1978, it is unlikely that LBP is present; however, some paints utilized after 1978 will be LCP under OSHA. Structures built prior to 1978 and especially prior to the 1960s should be expected to contain LBP.

Due to the age of the subject property building, it is unlikely that LBP is present; however, LCP may be present. No significant areas of damaged paint were observed. Based on the generally good condition of the observed painted surfaces, potential LCP is not considered a significant environmental concern at this time.

8.3 Naturally-Occurring Radon

Radon is a naturally-occurring, odorless, and invisible gas. Natural radon levels vary and are closely related to geologic formations. Radon may enter buildings through basement sumps or other openings.

The United States EPA has prepared a map to assist National, State, and local organizations to target their resources and to implement radon-resistant building codes. The map divides the country into three radon zones, with Zone 1 being those areas with the average predicted indoor radon concentration in residential dwellings exceeding the EPA Action Limit of 4.0 pCi/L. It is important to note that the EPA has found homes with elevated levels of radon in all three zones, and the EPA recommends site specific testing to determine radon levels at a specific location. However, the map does give a valuable indication of the propensity of radon gas accumulation in structures.

Radon sampling was not requested as part of this assessment. According to the US EPA, the radon zone level for the area is Zone 3, which has a predicted average indoor screening level less than 2.0 pCi/L, below the action level of 4.0 pCi/L set forth by the US EPA.

8.4 Suspect Mold or Microbial Growth Conditions

Molds are simple microscopic organisms which can often be seen in the form of discoloration, frequently green, gray, white, brown, or black. When excessive moisture or water accumulates indoors, mold growth may occur, particularly if the moisture problem remains undiscovered or unaddressed. As such, interior areas of buildings characterized by poor ventilation and high humidity are the most common locations of mold growth. Building materials, including drywall, wallpaper, baseboards, wood framing, insulation, and carpeting, often play host to such growth. Mold spores primarily cause health problems through the inhalation of spores or the toxins they emit when they are present in large numbers. This can occur when there is active mold growth within places where people live or work.

Mold, if present, may or may not visually manifest itself. Neither the individual completing this inspection, nor AEI has any liability for the identification of mold-related concerns except as defined in applicable industry standards. In short, this Phase I ESA should not be construed as a mold survey or inspection.

This activity was not designed to discover all areas which may be affected by mold growth on the subject property. Rather, it is intended to give the client an indication if significant (based on observed areas) mold growth is present at the subject property. Potential areas of mold growth, such as in pipe chases, HVAC systems, and behind enclosed walls and ceilings, were not observed as part of this limited assessment.

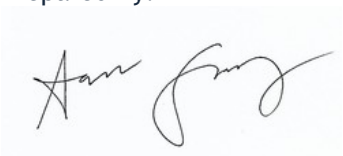
AEI observed interior areas of the subject property building in order to identify the presence of mold. AEI did not note obvious visual or olfactory indications of the presence of mold. However, several water stained ceiling tiles were observed in the office area of the subject property building. Based upon our observations, AEI recommends replacing stained ceiling tiles and confirming that the source of water intrusion has been addressed.

9.0 SIGNATURE OF ENVIRONMENTAL PROFESSIONALS

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in § 312.10 of 40 CFR Part 312.

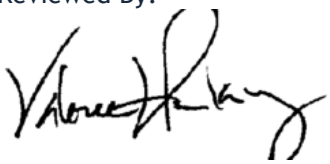
I have the specific qualifications based on education, training, and experience to assess a property of the nature, history and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Prepared By:



Alicia Sanchez
Project Manager

Reviewed By:



Valoree Harkey
National Client Manager

10.0 REFERENCES

Item	Date(s)	Source
Soils Information	Accessed February 2023	USDA Web Soil Survey http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Topographic Map	2013	USGS, Mercedes, TX
Depth to Groundwater Information	Accessed February 2023	Texas Water Development Board
Aerial Photographs	1939-2020, non-inclusive	EDR
Sanborn Map Report/Search	February 7, 2023	EDR
City Directories	1959-2017, non-inclusive	EDR
Historical Topographic Maps	1959-2019, non-inclusive	NETR Online (www.historicaerials.com)
Environmental Health Department	February 7, 2023	City of Mercedes Environmental Services Department
State Environmental Agency	Feburary 7, 2023	Texas Commission on Environmental Quality
Fire Department	February 7, 2023	City of Mercedes Fire Department
Building Department	February 7, 2023	City of Mercedes Public Works Department
Planning Department	February 7, 2023	City of Mercedes Planning Department
Assessor's Information and Parcel Map	February 7, 2023	Hidalgo County Appraisal District
Oil and Gas Wells	February 22, 2023	Railroad Commission of Texas
Oil and Gas Pipelines	February 22, 2023	NPMS Public Map Viewer https://www.npms.phmsa.dot.gov/PublicViewer/composite.jsf
Regulatory Database Report	February 7, 2023	EDR
Interview with Owner	February 22, 2023	Mr. Cruz Lopez, Owner
Interview with Key Site Manager	February 17, 2023	Ms. Linda Orsack, Office Administrator, Laser Lux
Radon Zone Information	1993	US EPA Map of Radon Zones https://www.epa.gov/radon

APPENDIX A

FIGURES

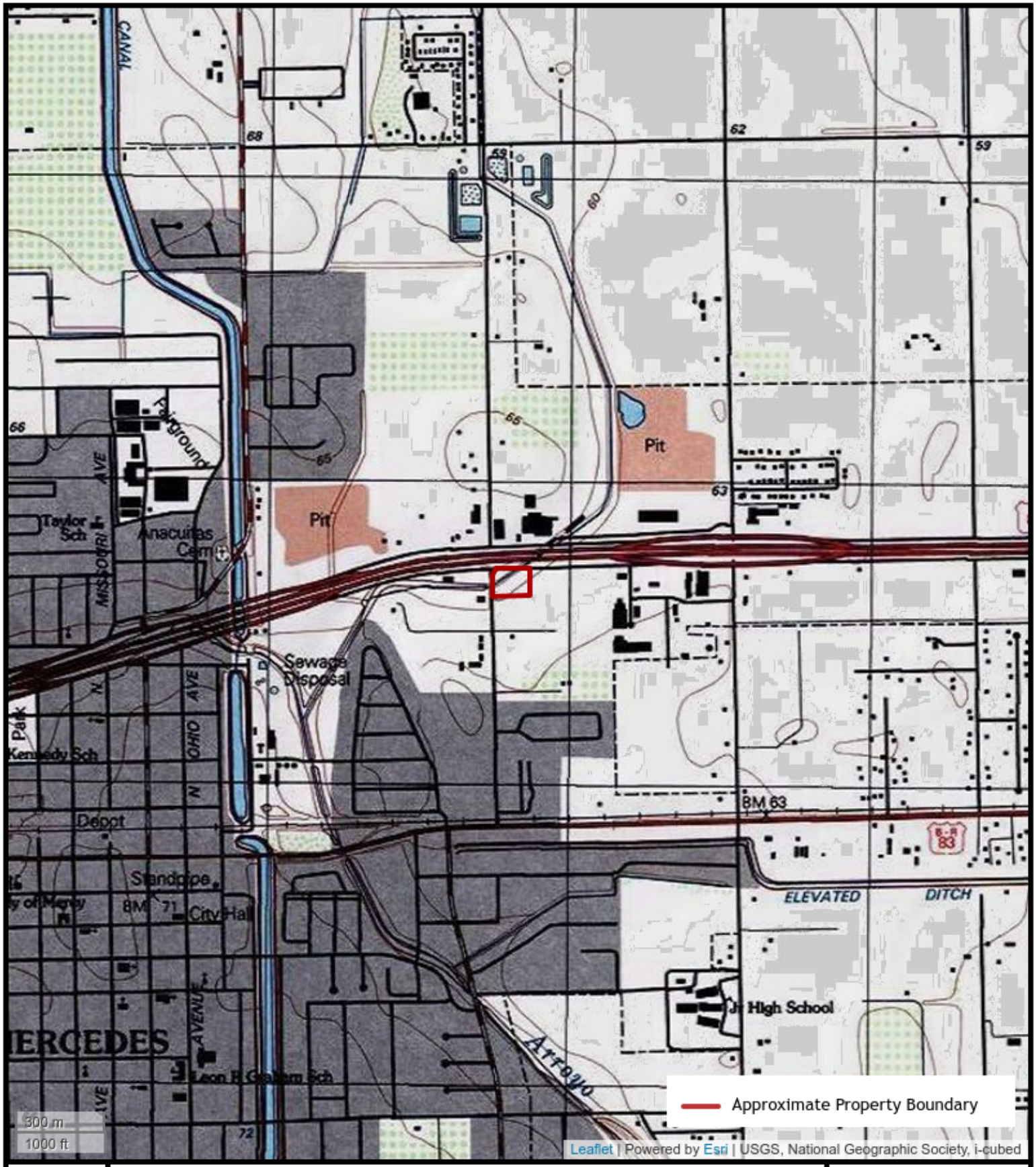


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FIGURE 1: TOPOGRAPHIC MAP

2000 East Express 83, Mercedes, Texas 78570

AEI Project Number: 474878

AEI

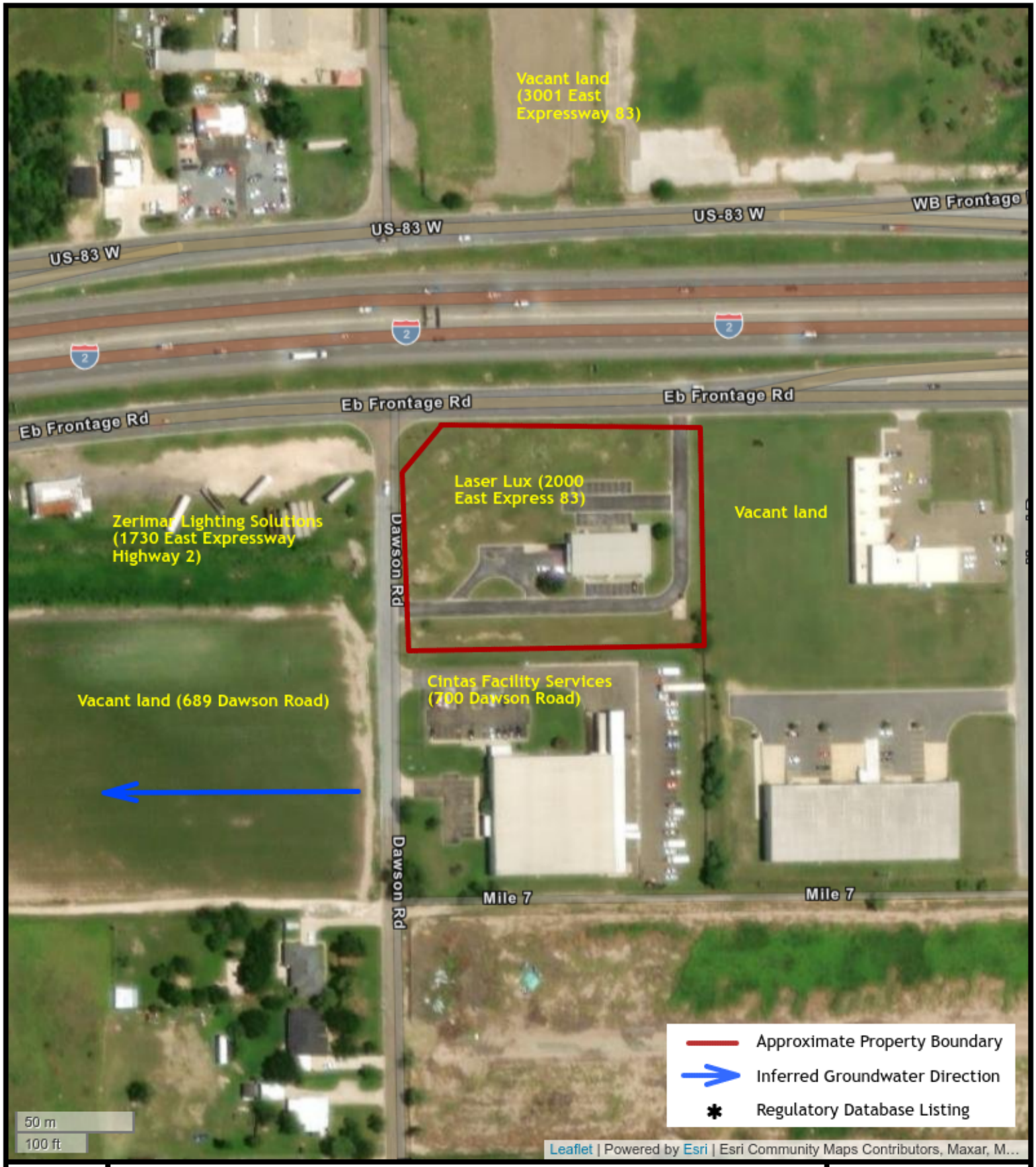

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FIGURE 2: SITE MAP

2000 East Express 83, Mercedes, Texas 78570

AEI Project Number: 474878

AEI

APPENDIX B

PROPERTY PHOTOGRAPHS

1. Northern View of the Subject Property Building

2. Northern View of the Subject Property Building

3. Northeastern View of the Subject Property Building

4. Eastern View of the Subject Property Building

5. Southern View of the Subject Property Building

6. Southwestern View of the Subject Property

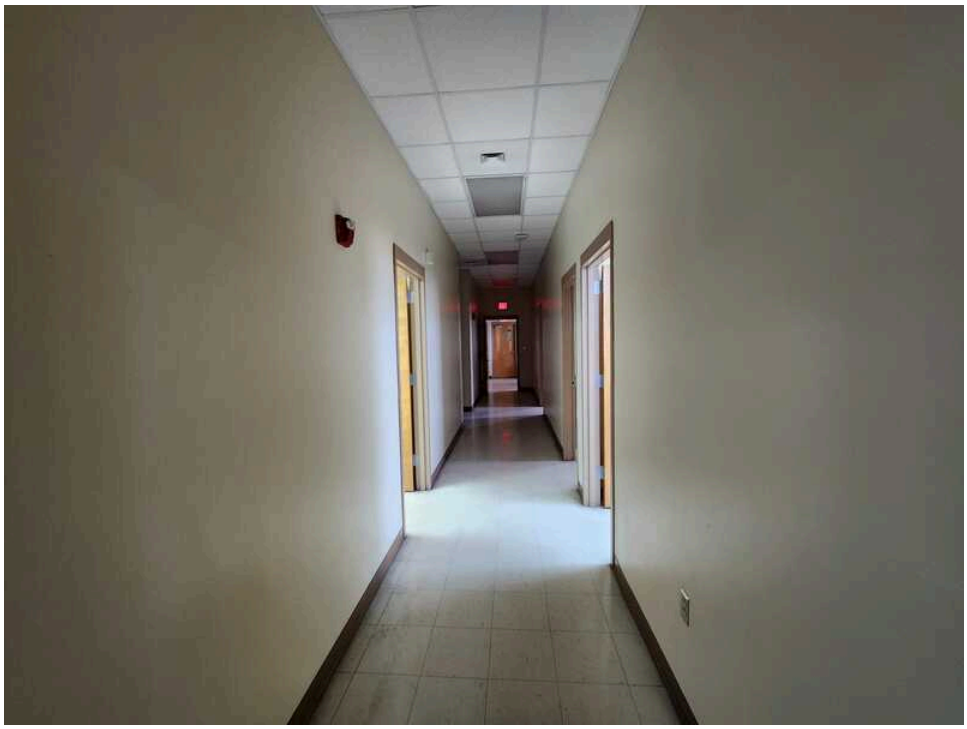
7. Western View of the Subject Property Building

8. Pad-Mounted Transformer

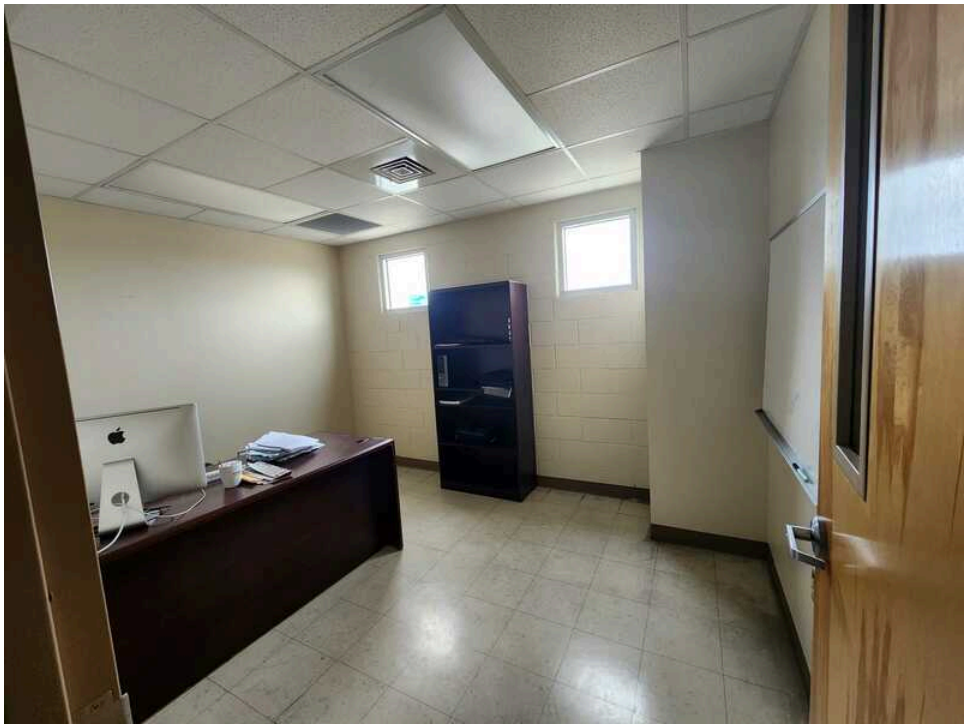
9. Pole-Mounted Transformer

10. Entry Room

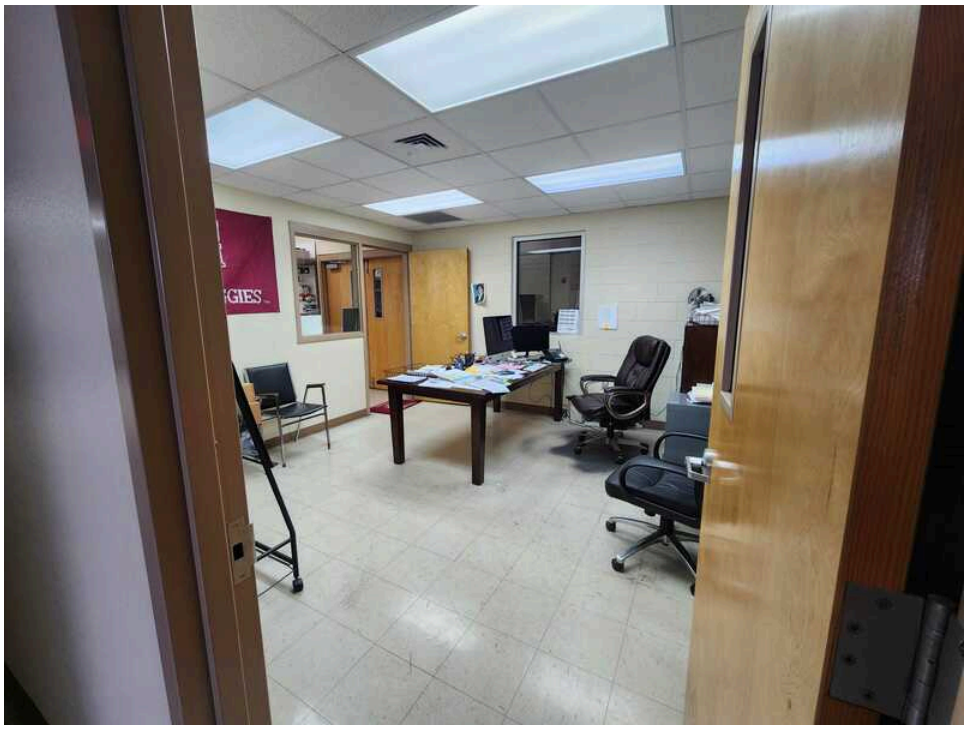
11. Reception Area



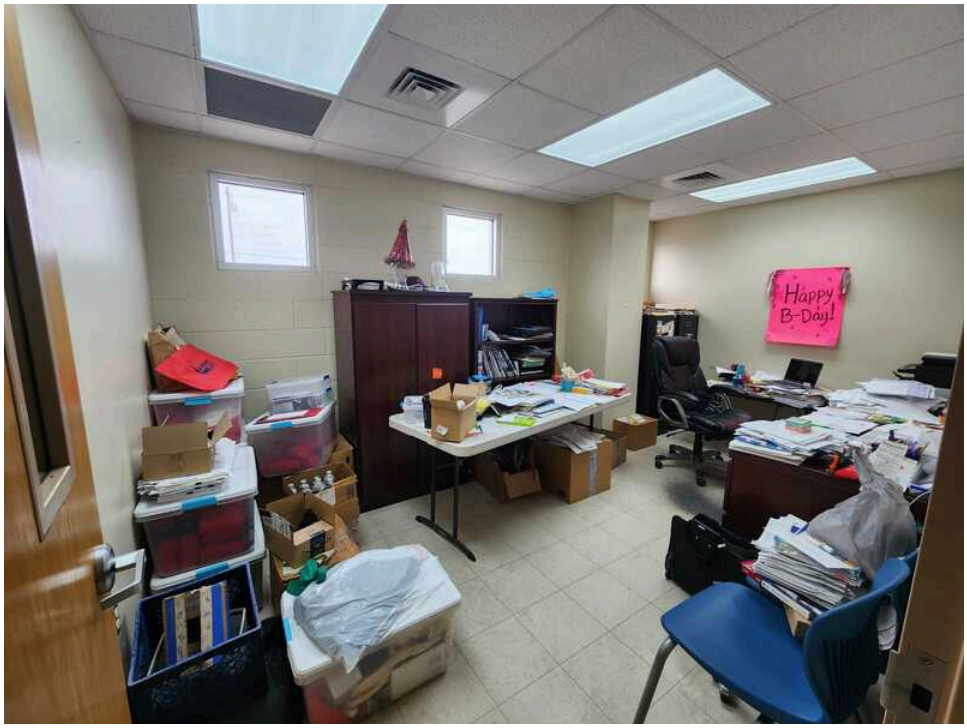
12. Office Hallway



13. Office



14. Office



15. Office

16. Restroom

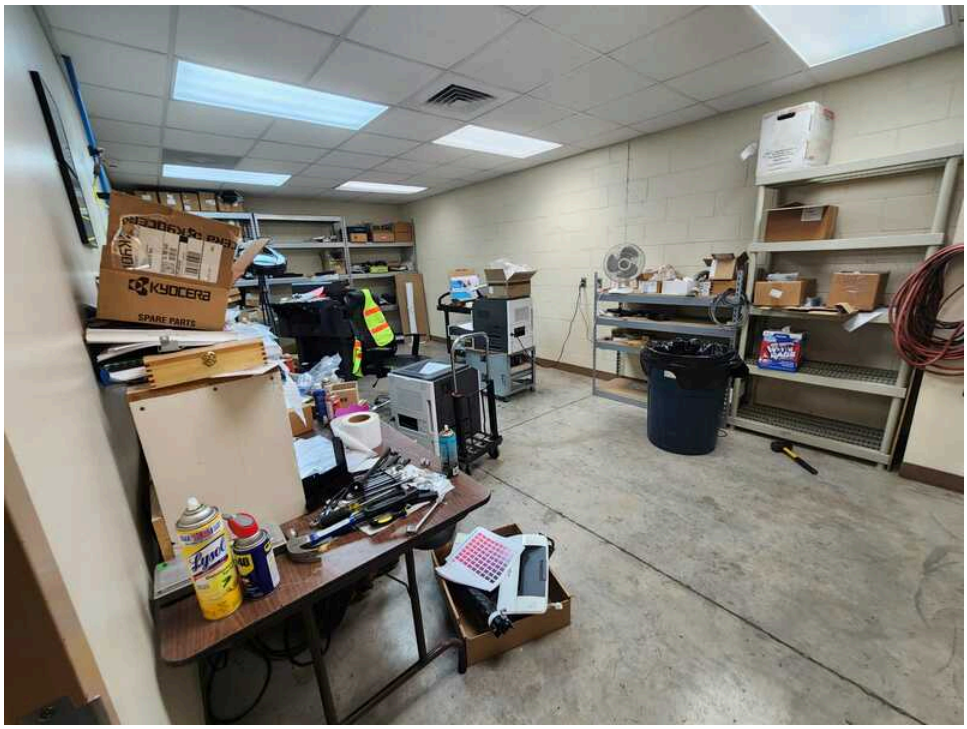
17. Floor Drain

18. Break Room

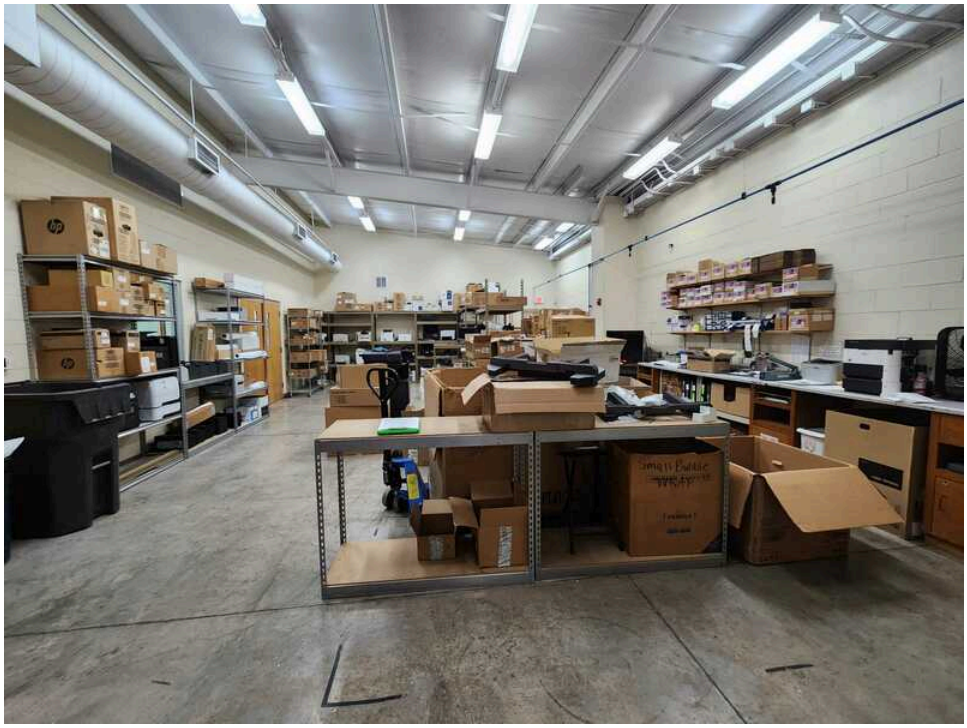
19. Break Room

20. Stained Ceiling Tile

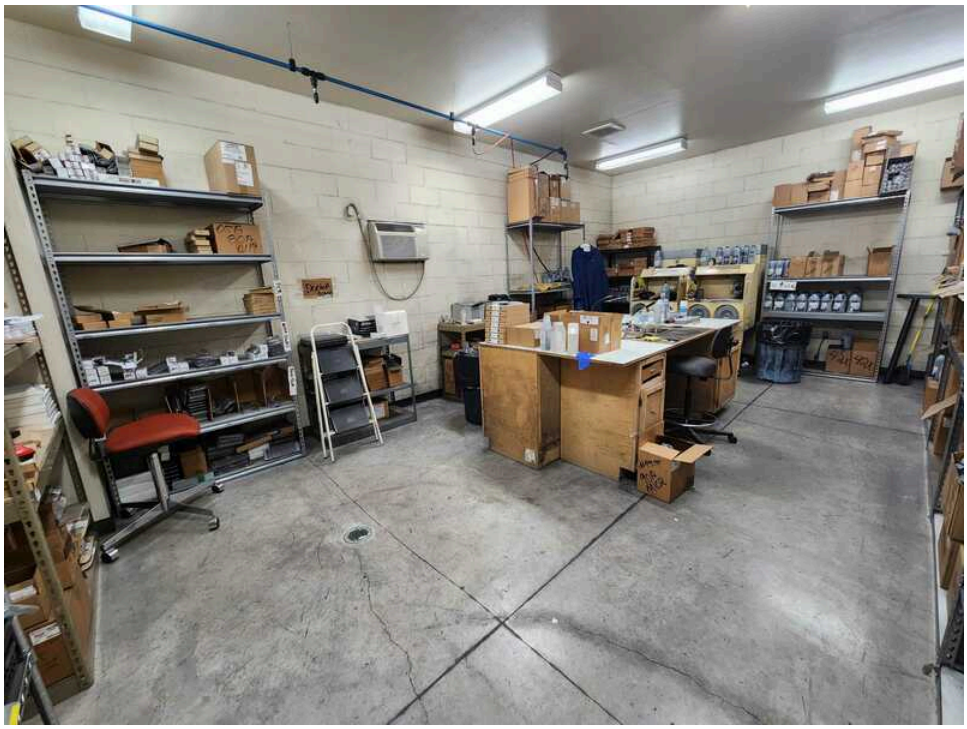
21. Stained Ceiling Tile



22. Workshop Area



23. Workshop Area

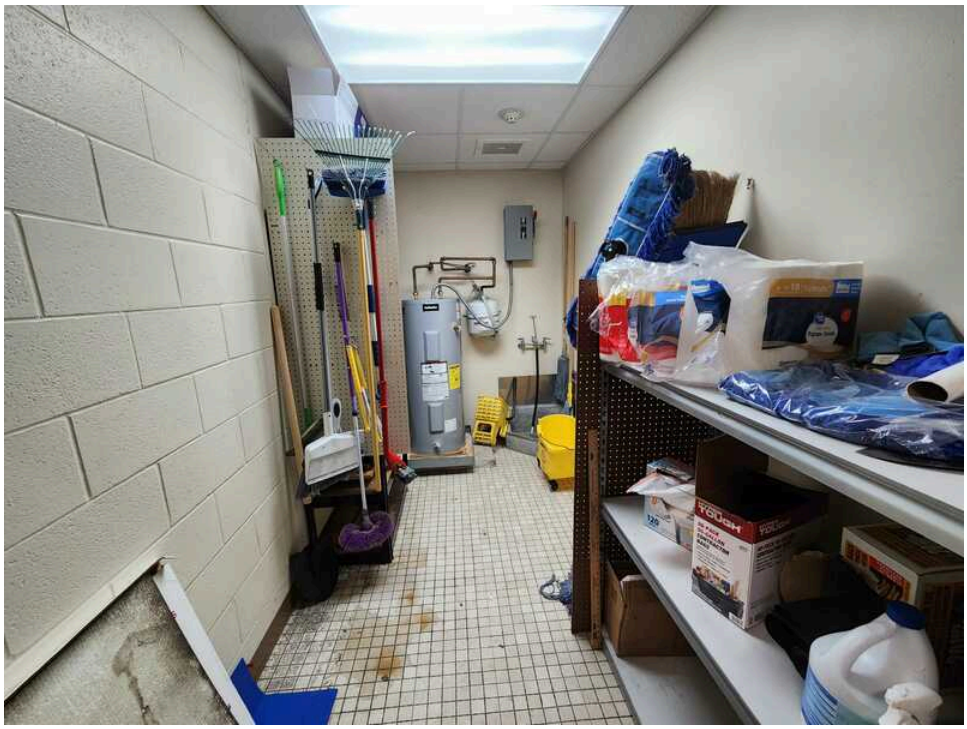


24. Workshop Area

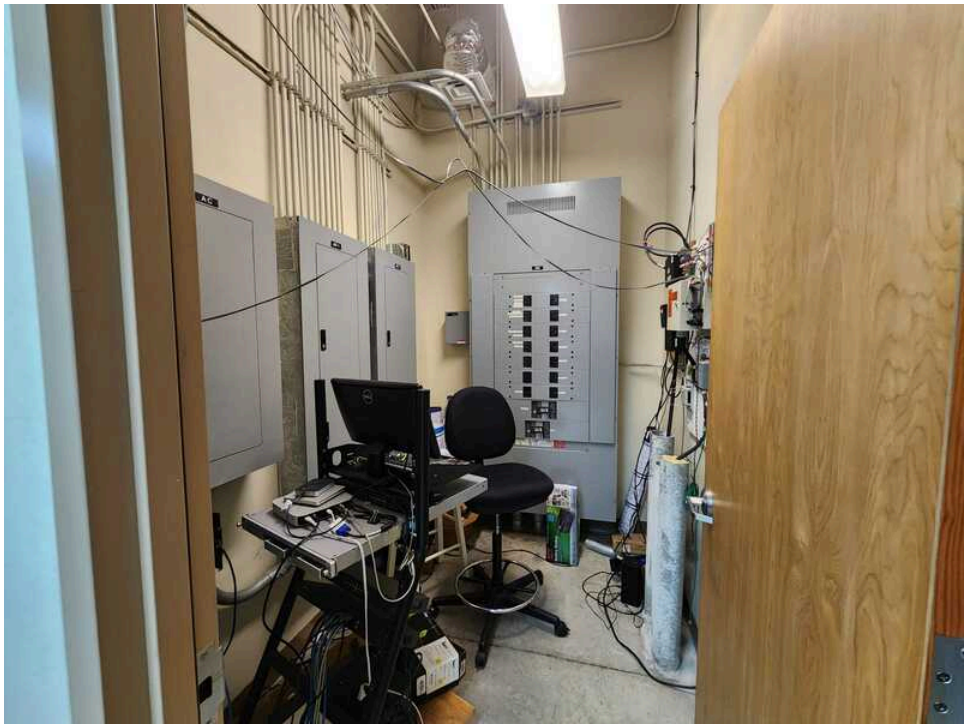
25. Floor Drain

26. Vacuum Collection System

27. Air Compressor



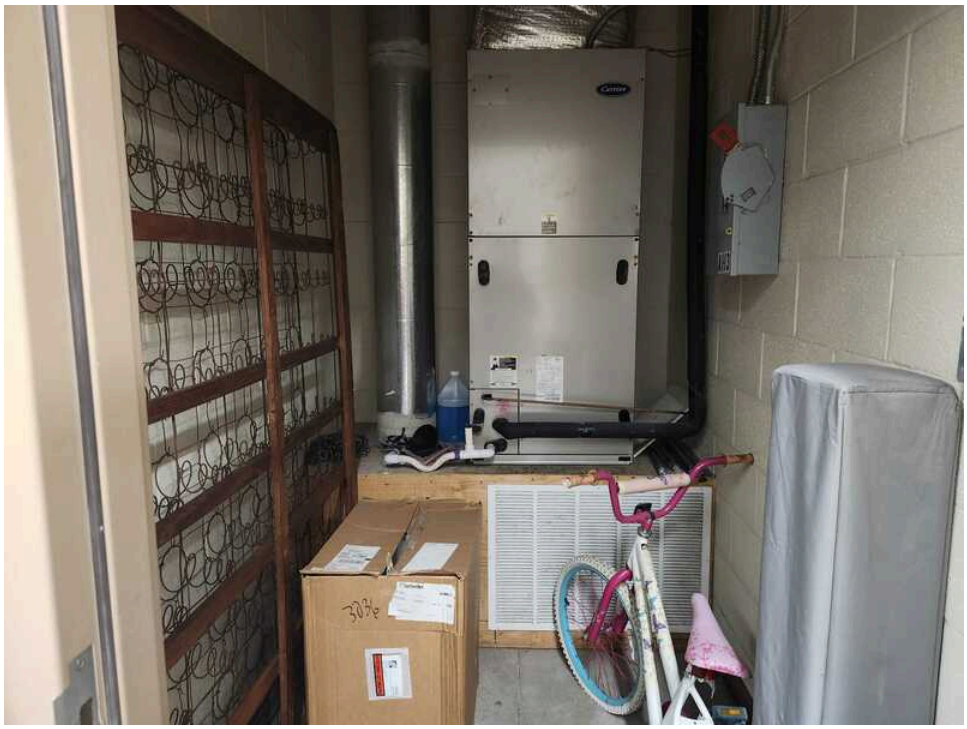
28. Janitorial Closet



29. Electrical Room

30. Warehouse Area

31. Restroom



32. Storage Closet

33. Warehouse Area

34. Toner Storage

35. Adjoining Property to the East

36. Adjoining Property to the South

37. Adjoining Property to the West

APPENDIX C

REGULATORY DATABASE

474878
2000 East Express 83
Mercedes, TX 78570

Inquiry Number: 7245729.2s
February 07, 2023

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E1527-21), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

2000 EAST EXPRESS 83
MERCEDES, TX 78570

COORDINATES

Latitude (North):	26.1580560 - 26ˆ 9' 29.00''
Longitude (West):	97.9012680 - 97ˆ 54' 4.56''
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	609817.1
UTM Y (Meters):	2893488.5
Elevation:	59 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5935869 MERCEDES, TX
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140515
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
2000 EAST EXPRESS 83
MERCEDES, TX 78570

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	BORDEN'S	303 INDUSTRIAL DR	RDR	Higher	1290, 0.244, East
A2	NEW DAIRY TEXAS	303 INDUSTRIAL PARK	UST	Higher	1290, 0.244, East
A3	NEW DAIRY TEXAS	303 INDUSTRIAL PARK	AST	Higher	1290, 0.244, East

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Lists of Federal NPL (Superfund) sites

NPL ..... National Priority List
Proposed NPL ..... Proposed National Priority List Sites
NPL LIENS ..... Federal Superfund Liens

Lists of Federal Delisted NPL sites

Delisted NPL ..... National Priority List Deletions

Lists of Federal sites subject to CERCLA removals and CERCLA orders

FEDERAL FACILITY ..... Federal Facility Site Information listing
SEMS ..... Superfund Enterprise Management System

Lists of Federal CERCLA sites with NFRAP

SEMS-ARCHIVE ..... Superfund Enterprise Management System Archive

Lists of Federal RCRA facilities undergoing Corrective Action

CORRACTS ..... Corrective Action Report

Lists of Federal RCRA TSD facilities

RCRA-TSDF ..... RCRA - Treatment, Storage and Disposal

Lists of Federal RCRA generators

RCRA-LQG ..... RCRA - Large Quantity Generators
RCRA-SQG ..... RCRA - Small Quantity Generators
RCRA-VSQG ..... RCRA - Very Small Quantity Generators (Formerly Conditionally Exempt Small Quantity Generators)

Federal institutional controls / engineering controls registries

LUCIS ..... Land Use Control Information System

EXECUTIVE SUMMARY

US ENG CONTROLS..... Engineering Controls Sites List
US INST CONTROLS..... Institutional Controls Sites List

Federal ERNS list

ERNS..... Emergency Response Notification System

Lists of state- and tribal (Superfund) equivalent sites

SHWS..... State Superfund Registry

Lists of state and tribal landfills and solid waste disposal facilities

SWF/LF..... Permitted Solid Waste Facilities
CLI..... Closed Landfill Inventory
DEBRIS..... DEBRIS
WASTE MGMT..... Commercial Hazardous & Solid Waste Management Facilities

Lists of state and tribal leaking storage tanks

INDIAN LUST..... Leaking Underground Storage Tanks on Indian Land
LPST..... Leaking Petroleum Storage Tank Listing

Lists of state and tribal registered storage tanks

FEMA UST..... Underground Storage Tank Listing
INDIAN UST..... Underground Storage Tanks on Indian Land
TANKS..... Petroleum Storage Tanks Listing

State and tribal institutional control / engineering control registries

AUL..... Sites with Controls

Lists of state and tribal voluntary cleanup sites

VCP..... Voluntary Cleanup Program Database
INDIAN VCP..... Voluntary Cleanup Priority Listing

Lists of state and tribal brownfield sites

BROWNFIELDS..... Brownfields Site Assessments

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS..... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

SWRCY..... Recycling Facility Listing
INDIAN ODI..... Report on the Status of Open Dumps on Indian Lands
DEBRIS REGION 9..... Torres Martinez Reservation Illegal Dump Site Locations
ODI..... Open Dump Inventory

EXECUTIVE SUMMARY

IHS OPEN DUMPS ..... Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL ..... Delisted National Clandestine Laboratory Register
CDL ..... CDL
PRIORITYCLEANERS ..... Dry Cleaner Remediation Program Prioritization List
DEL SHWS ..... Deleted Superfund Registry Sites
US CDL ..... National Clandestine Laboratory Register
CENTRAL REGISTRY ..... CENTRAL REGISTRY

Local Lists of Registered Storage Tanks

NON REGIST PST ..... Petroleum Storage Tank Non Registered

Local Land Records

HIST LIENS ..... Environmental Liens Listing
LIENS ..... Environmental Liens Listing
LIENS 2 ..... CERCLA Lien Information

Records of Emergency Release Reports

HMIRS ..... Hazardous Materials Information Reporting System
SPILLS ..... Spills Database
SPILLS 90 ..... SPILLS 90 data from FirstSearch
SPILLS 80 ..... SPILLS 80 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR ..... RCRA - Non Generators / No Longer Regulated
FUDS ..... Formerly Used Defense Sites
DOD ..... Department of Defense Sites
SCRD DRYCLEANERS ..... State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR ..... Financial Assurance Information
EPA WATCH LIST ..... EPA WATCH LIST
2020 COR ACTION ..... 2020 Corrective Action Program List
TSCA ..... Toxic Substances Control Act
TRIS ..... Toxic Chemical Release Inventory System
SSTS ..... Section 7 Tracking Systems
ROD ..... Records Of Decision
RMP ..... Risk Management Plans
RAATS ..... RCRA Administrative Action Tracking System
PRP ..... Potentially Responsible Parties
PADS ..... PCB Activity Database System
ICIS ..... Integrated Compliance Information System
FTTS ..... FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS ..... Material Licensing Tracking System
COAL ASH DOE ..... Steam-Electric Plant Operation Data
COAL ASH EPA ..... Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER ..... PCB Transformer Registration Database
RADINFO ..... Radiation Information Database
HIST FTTS ..... FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS ..... Incident and Accident Data

EXECUTIVE SUMMARY

CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
FINDS	Facility Index System/Facility Registry System
DOCKET HWC	Hazardous Waste Compliance Docket Listing
ECHO	Enforcement & Compliance History Information
UXO	Unexploded Ordnance Sites
FUELS PROGRAM	EPA Fuels Program Registered Listing
PFAS NPL	Superfund Sites with PFAS Detections Information
PFAS FEDERAL SITES	Federal Sites PFAS Information
PFAS TSCA	PFAS Manufacture and Imports Information
PFAS RCRA MANIFEST	PFAS Transfers Identified In the RCRA Database Listing
PFAS ATSDR	PFAS Contamination Site Location Listing
PFAS WQP	Ambient Environmental Sampling for PFAS
PFAS NPDES	Clean Water Act Discharge Monitoring Information
PFAS ECHO	Facilities in Industries that May Be Handling PFAS Listing
PFAS ECHO FIRE TRAINING	Facilities in Industries that May Be Handling PFAS Listing
PFAS PART 139 AIRPORT	All Certified Part 139 Airports PFAS Information Listing
AQUEOUS FOAM NRC	Aqueous Foam Related Incidents Listing
PFAS	PFAS Contamination Site Location Listing
AIRS	Current Emission Inventory Data
APAR	Affected Property Assessment Report Site Listing
ASBESTOS	ASBESTOS
COAL ASH	Coal Ash Disposal Sites
DRYCLEANERS	Drycleaner Registration Database Listing
ED AQUIF	Edwards Aquifer Permits
ENF	Notice of Violations Listing
Financial Assurance	Financial Assurance Information Listing
GCC	Groundwater Contamination Cases
IOP	Innocent Owner/Operator Program
LEAD	LEAD
Ind. Haz Waste	Industrial & Hazardous Waste Database
MSD	Municipal Settings Designations Database
NPDES	NPDES Facility List
RWS	Radioactive Waste Sites
TIER 2	Tier 2 Chemical Inventory Reports
UIC	Underground Injection Wells Database Listing
IHW CORR ACTION	IHW CORR ACTION
PST STAGE 2	PST Stage 2
COMP HIST	Compliance History Listing
MINES MRDS	Mineral Resources Data System

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto	EDR Exclusive Historical Auto Stations
EDR Hist Cleaner	EDR Exclusive Historical Cleaners

EXECUTIVE SUMMARY

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS..... Recovered Government Archive State Hazardous Waste Facilities List
RGA LF..... Recovered Government Archive Solid Waste Facilities List

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Lists of state and tribal leaking storage tanks

RDR: An owner-operator permanently removing an underground storage tank system from service must determine whether a release of a stored regulated substance has occurred. Assemble and submit documentation of tank removal and release determination?including the details of all excavation, removal, and sampling activities?to the TCEQ using the PST Program?s Release Determination Report form (TCEQ-00621).

A review of the RDR list, as provided by EDR, and dated 09/13/2022 has revealed that there is 1 RDR site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
BORDEN'S	303 INDUSTRIAL DR	E 1/8 - 1/4 (0.244 mi.)	A1	8

Lists of state and tribal registered storage tanks

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Texas Commission on Environmental Quality's Petroleum Storage Tank Database.

A review of the UST list, as provided by EDR, and dated 09/19/2022 has revealed that there is 1 UST site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
NEW DAIRY TEXAS Facility Status: ACTIVE	303 INDUSTRIAL PARK	E 1/8 - 1/4 (0.244 mi.)	A2	8

EXECUTIVE SUMMARY

Facility Id: 68396
Facility Num: 103408
AI Number: 604598062003041

AST: The Aboveground Storage Tank database contains registered ASTs. The data come from the Texas Commission on Environmental Quality's Petroleum Storage Tank Database.

A review of the AST list, as provided by EDR, and dated 09/19/2022 has revealed that there is 1 AST site within approximately 0.25 miles of the target property.

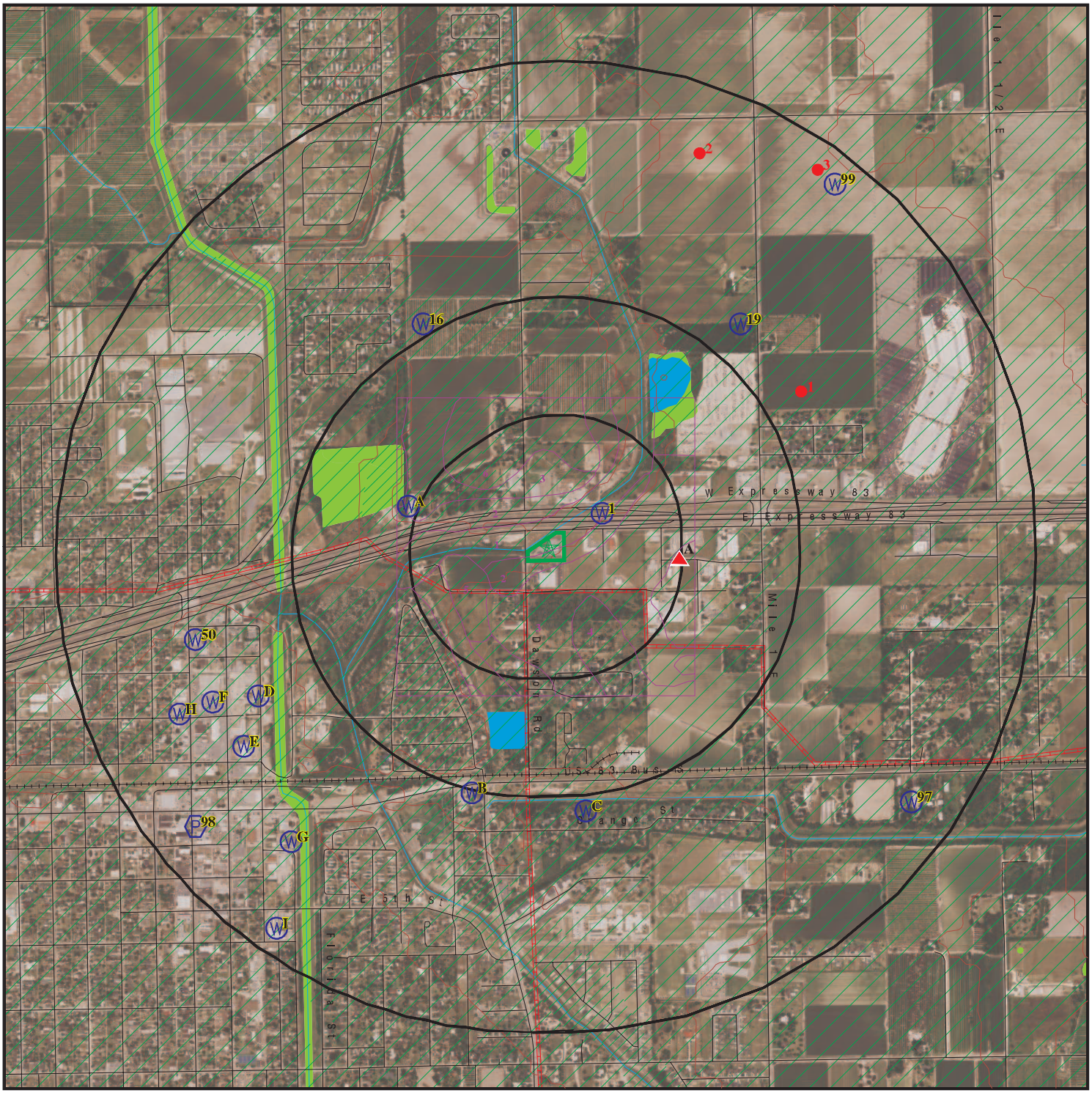
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
NEW DAIRY TEXAS Facility Id: 103408 Facility Id: 604598062003041 Facility Id: 68396 Facility Status: ACTIVE	303 INDUSTRIAL PARK	E 1/8 - 1/4 (0.244 mi.)	A3	12

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 2 records.

Site Name	Database(s)
CITY OF MERCEDES TRANSFER STATION	SWF/LF
CITY OF MERCEDES TRANSFER STATION	SWF/LF

OVERVIEW MAP - 7245729.2S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

National Priority List Sites

Dept. Defense Sites

0 1/4 1/2 1 Miles

Indian Reservations BIA

Pipelines

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: 474878	CLIENT: AEI Consultants
ADDRESS: 2000 East Express 83 Mercedes TX 78570	CONTACT: Cynthia
LAT/LONG: 26.158056 / 97.901268	INQUIRY #: 7245729.2s
	DATE: February 07, 2023 12:14 pm

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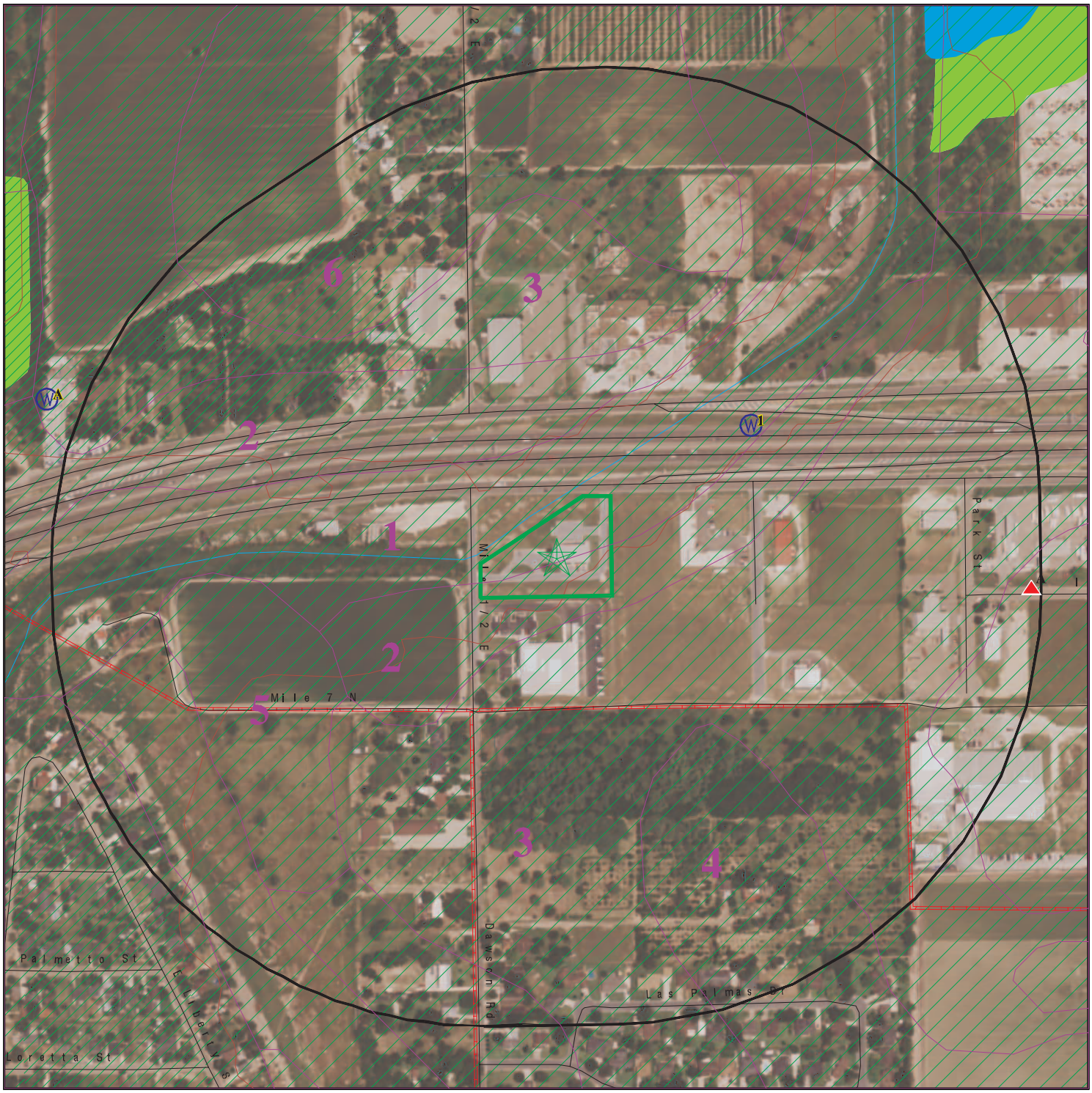
DETAIL MAP - 7245729.2S



0 1/16 1/8 1/4 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: 474878 ADDRESS: 2000 East Express 83 Mercedes TX 78570 LAT/LONG: 26.158056 / 97.901268	CLIENT: AEI Consultants CONTACT: Cynthia INQUIRY #: 7245729.2s DATE: February 07, 2023 12:19 pm

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Lists of Federal NPL (Superfund) sites								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Lists of Federal Delisted NPL sites								
Delisted NPL	1.000		0	0	0	0	NR	0
Lists of Federal sites subject to CERCLA removals and CERCLA orders								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Lists of Federal CERCLA sites with NFRAP								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Lists of Federal RCRA facilities undergoing Corrective Action								
CORRACTS	1.000		0	0	0	0	NR	0
Lists of Federal RCRA TSD facilities								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Lists of Federal RCRA generators								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-VSQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROLS	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
Lists of state- and tribal (Superfund) equivalent sites								
SHWS	1.000		0	0	0	0	NR	0
Lists of state and tribal landfills and solid waste disposal facilities								
SWF/LF	0.500		0	0	0	NR	NR	0
CLI	0.500		0	0	0	NR	NR	0
DEBRIS	0.500		0	0	0	NR	NR	0
WASTE MGMT	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
Lists of state and tribal leaking storage tanks								
INDIAN LUST	0.500		0	0	0	NR	NR	0
LPST	0.500		0	0	0	NR	NR	0
RDR	0.500		0	1	0	NR	NR	1
Lists of state and tribal registered storage tanks								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	1	NR	NR	NR	1
AST	0.250		0	1	NR	NR	NR	1
INDIAN UST	0.250		0	0	NR	NR	NR	0
TANKS	0.500		0	0	0	NR	NR	0
State and tribal institutional control / engineering control registries								
AUL	0.500		0	0	0	NR	NR	0
Lists of state and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
Lists of state and tribal brownfield sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
PRIORITYCLEANERS	0.500		0	0	0	NR	NR	0
DEL SHWS	1.000		0	0	0	0	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
CENTRAL REGISTRY	TP		NR	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
NON REGIST PST	0.250		0	0	NR	NR	NR	0
Local Land Records								
HIST LIENS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LIENS	TP		NR	NR	NR	NR	NR	0
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
SPILLS 80	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
PFAS NPL	0.250		0	0	NR	NR	NR	0
PFAS FEDERAL SITES	0.250		0	0	NR	NR	NR	0
PFAS TSCA	0.250		0	0	NR	NR	NR	0
PFAS RCRA MANIFEST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
PFAS ATSDR	0.250		0	0	NR	NR	NR	0
PFAS WQP	0.250		0	0	NR	NR	NR	0
PFAS NPDES	0.250		0	0	NR	NR	NR	0
PFAS ECHO	0.250		0	0	NR	NR	NR	0
PFAS ECHO FIRE TRAINING	0.250		0	0	NR	NR	NR	0
PFAS PART 139 AIRPORT	0.250		0	0	NR	NR	NR	0
AQUEOUS FOAM NRC	0.250		0	0	NR	NR	NR	0
PFAS	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
APAR	TP		NR	NR	NR	NR	NR	0
ASBESTOS	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
ED AQUIF	TP		NR	NR	NR	NR	NR	0
ENF	TP		NR	NR	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
GCC	TP		NR	NR	NR	NR	NR	0
IOP	TP		NR	NR	NR	NR	NR	0
LEAD	TP		NR	NR	NR	NR	NR	0
Ind. Haz Waste	0.250		0	0	NR	NR	NR	0
MSD	0.500		0	0	0	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
RWS	TP		NR	NR	NR	NR	NR	0
TIER 2	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
IHW CORR ACTION	0.250		0	0	NR	NR	NR	0
PST STAGE 2	0.250		0	0	NR	NR	NR	0
COMP HIST	TP		NR	NR	NR	NR	NR	0
MINES MRDS	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
- Totals --		0	0	3	0	0	0	3

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1 East 1/8-1/4 0.244 mi. 1290 ft. | **BORDEN'S 303 INDUSTRIAL DR MERCEDES, TX** | **RDR** | **S127537904 N/A**

Site 1 of 3 in cluster A

Relative: Higher
Actual: 64 ft.

RDR:

RDR ID:	9121
Facility ID:	68396
RN:	Not reported
CN:	Not reported
Name:	BORDEN'S
Address:	303 INDUSTRIAL DR
City,State,Zip:	MERCEDES, TX
Date Report Received:	9/7/1999
Due Date:	11/6/1999
Tank Owner:	BORDEN MILK PRODUCTS
Contact Person:	KERMIT STRACKBEIN
Report:	RDR
Latest TCEQ Letter:	No Leaker
Date of Latest TCEQ Letter:	10/12/1999
Project Manager:	Beth Fraser
Team:	#N/A
New LPST Number:	Not reported
Pre-Existing LPST Number:	Not reported
Comments:	APPROVED
Review Coordinator:	EBF
Date Release Reported:	Not reported
Suspected:	Not reported
Confirmed:	Not reported
NOLPST Letter Date:	10/12/1999
Date Report Returned:	Not reported
Region:	Not reported
DKC RDR (misfiled):	Not reported

A2 East 1/8-1/4 0.244 mi. 1290 ft. | **NEW DAIRY TEXAS 303 INDUSTRIAL PARK MERCEDES, TX 78570** | **UST** | **U003842552 N/A**

Site 2 of 3 in cluster A

Relative: Higher
Actual: 64 ft.

UST:

Name:	NEW DAIRY TEXAS
Address:	303 INDUSTRIAL PARK
City,State,Zip:	MERCEDES, TX 785704300
AI Number:	68396
Facility Type:	FLEET REFUELING
Facility Begin Date:	08/31/1987
Facility Status:	ACTIVE
Additional ID:	604598062003041
Facility Exempt Status:	N
Records Off-Site:	No
UST Financial Assurance Required:	No
Number Of Active UST:	0
Site Location Description:	Not reported
Site Location (Nearest City Name):	Not reported
Site Location (County Name):	HIDALGO
Site Location (Tceq Region):	15
Site Location (Location Zip):	78570
Contact Name/Title:	GUADALUPE LOPEZ,SUPERVISOR

NEW DAIRY TEXAS (Continued) **U003842552**

Contact Organization Name:	NEW DAIRY TEXAS
Contact Mailing Address1:	Not reported
Contact Mailing Address2:	Not reported
Contact Mailing City/State/Zip:	Not reported
Contact Telephone:	9569903014
Facility Contact Address Deliverable:	Not reported
Contact Fax Number:	Not reported
Contact Email Address:	LUPE.LOPEZ@BORDENDAIRY.COM
Signature Date On Earliest Reg Form:	11/30/2020
Signature Name/Title On Earliest Reg Form:	JOSEPH PENALOZA,GM
Application Received Date On Earliest Reg Form:	01/21/2021
Signature Role On Earliest Reg Form:	LEGAL AUTH REP OWNER
Signature Company On Earliest Reg Form:	Not reported
Enforcement Action:	No
Facility Not Inspectable:	No

Operator:

Princ ID:	271339832020240
Additional ID:	604598062003041
Ai Number:	68396
Operator CN:	CN605807924
Operator Name:	NEW DAIRY TEXAS LLC
Operator Effective Begin Date:	07/20/2020
Operator Type:	CO
Operator Role:	OWNOPRCON
Contact Name:	JOSEPH PENALOZA/GENERAL MGR
Contact Organization Name:	NEW DAIRY TEXAS LLC
Contact Mailing Address (Delivery):	71 STRANDTMAN CV
Contact Mailing Address (Internal Delivery):	Not reported
Contact Mailing City/State/Zip:	AUSTIN TX 78702-5100
Contact Phone Country Code:	1
Contact Phone Area Code:	210
Contact Phone Number:	6611138
Contact Phone Extension:	0
Contact Fax Country Code:	Not reported
Contact Fax Area Code:	Not reported
Contact Fax Number:	Not reported
Contact Fax Extension:	Not reported
Contact Email Address:	JOSEPH.PENALOZA@BORDENDAIRY.COM
Contact Address Deliverable:	Not reported

Owner:

Owner CN:	CN605807924
Owner Last Name:	NEW DAIRY TEXAS LLC
Owner First Name:	Not reported
Owner Middle Name:	Not reported
Owner Type:	CO
Contact Mailing Address (Delivery):	71 STRANDTMAN CV
Contact Mailing Address (Internal Delivery):	Not reported
Contact Mailing City:	AUSTIN
Contact Mailing State:	TX
Contact Mailing Zip:	78702
Contact Mailing Zip5:	5100
Contact Phone Number/Ext:	1 210 6611138/0
Contact Fax Country Code:	Not reported
Contact Fax Number/Ext:	/
Contact Email Address:	JOSEPH.PENALOZA@BORDENDAIRY.COM

NEW DAIRY TEXAS (Continued) **U003842552**

Contact Address Deliverable:	Not reported
Princ ID:	271339832020240
Additional ID:	604598062003041
AI Number:	68396
Owner Effective Begin Date:	07/20/2020
State Tax ID:	18518345170
Contact Role:	OWNOPRCON
Contact Name/Title:	JOSEPH PENALOZA/GENERAL MGR
Contact Organization Name:	NEW DAIRY TEXAS LLC

Tank:

Install Date:	01/01/1988
Tank Registration Date:	03/27/1996
Number of Compartments:	1
Tank Capacity:	500
Tank Singlewall:	Y
Tank Doublewall:	N
Pipe Type:	Not reported
UST ID:	179748
Facility ID:	103408
Ai Number:	68396
Tank Id:	1
Tank Status (Current):	REMOVED FROM GROUND
Tank Status Date:	07/28/1999
Empty:	N
Tank Regulatory Status:	FULLY REGULATED
Tank Int Prot (Internal Tank Lining Date):	Not reported
Piping Design (Single Wall):	N
Piping Design (Double Wall):	N
Tank Ext Cont(Fac-Built Nonmetallic Jacket):	N
Tank Ext Cont(Syn Tank-Pit/Piping-Trench Liner):	N
Tank Ext Cont(Tank Vault/Rigid Trench Liner):	N
Piping Ext Cont(Fac-Built Nonmetallic Jacket):	N
Piping Ext Cont(Syn Tank-Pit/Piping-Trench Liner):	N
Piping Ext Cont(Tank Vault/Rigid Trench Liner):	N
Tank Material (Steel):	Y
Tank Material(Frp(Fiberglass-Reinforced Plastic):	N
Tank Mat(Composite (Steel W/Ext Frp Cladding)):	N
Tank Mat(Concrete):	N
Tank Mat(Jacketed (Steel W/Ext Nonmetallic Jck)):	N
Tank Mat(Coated(Steel W/ExtPolyurethane Cladding)):	N
Piping Material (Steel):	Y
Piping Mat(Frp(Fiberglass Reinforced Plastic):	N
Piping Mat(Concrete):	N
Piping Mat(Jacketed(Steel W/Ext Nonmetallic Jacket)):	N
Piping Mat(Nonmetallic Flex Piping):	N
PipingConnect/Valves(Shear/Impact Valves(Under Disp)):	N
Piping Connect/Valves(Steel Swing-Joints(End Of Piping)):	N
Piping Connect/Valves (Flex Connectors(Ends Of Piping)):	N
Tank Corr Prot Meth(TCPM)(Cathodic-Field Installation):	N
TCPM (ExtDielectricCoat/Laminate/Tape/Wrap):	Y
TCPM(Cathodic Prot-FacInstallation):	N
TCPM(Composite Tank(Steel W/Frp Ext Laminate):	N
TCPMeth(Coated Tank(Steel W/ExtPolyurethaneLaminate):	N
TCPM(FRP Tank Or Piping(Noncorrodible)):	N
TCPM(Ext Nonmetallic Jacket):	N
TCPMeth(Unnecessary Per Corrosion Prot Spec):	N

NEW DAIRY TEXAS (Continued) **U003842552**

Piping Corr Prot Meth(Dielectric Coat/Laminate/Tape/Wrap):	N
Piping Corr Prot Method(PCPM) (Cathodic Factory Install):	N
PCPM(Cathodic Prot-Field Install):	N
PCPMethod (FRP Tank Or Piping(Noncorrodible):	N
PCPM(Nonmetallic FlexPiping (Noncorrodible)):	N
PCPMeth(Isolated Open Area/2nd Containment):	N
PCPM (Dual Protected):	N
PCPM(Unnec Per Corrosion Prot Specialist):	N
Tank Corr Prot Compliance Flag:	N
Piping Corr Prot Compliance Flag:	N
Tank Corrosion Prot Variance:	N
Piping Corrosion Prot Variance:	N
Temp Out Of Service Compliance:	N
Technical Compliance Flag:	N
Tank Tested Flag:	N
Installation Signature Date:	Not reported

Compartment Records:

Tank ID:	1
Tank Capacity:	500
UST Comprt ID:	166980
UST ID:	179748
AI Number:	68396
Compartment ID:	A
Substance Stored1:	USED OIL
Substance Stored2:	Not reported
Substance Stored3:	Not reported
CompartmentReleaseDetectionMethod(Vapor):	N
CRDM(GW Monitoring):	N
CRDM(Monitoring Of Secondary Cont Barrier):	N
CRDM(Auto Tank Gauge Test/Inv Control):	N
CRDM(Interstitial Monitoring SecWall/Jacket):	N
CRDM(Wkly Manual Gauging(Tanks<=1000 G):	N
CRDM(Mthly Tank Gauging(Emer Gen Tanks):	N
CRDM(Sir (Stat Inv Reconciliation)/Inv Control):	N
PipingReleaseDetectionMethod(PRDM)(Vapor):	N
PRDM(Groundwater Monitoring):	N
PRDM(Monitoring Sec Containment Barrier):	N
PRDM(InterstitialMonitoring w/in SecWall/Jacket):	N
PRDM(Mthly Piping Tightness Test)@.2Gph:	N
PRDM(AnnualPipingTightTest/ElecMon@.1Gph:	N
PRDM(TriennialTightTest(Suction/GravityPiping):	N
PRDM AutoLineLeakDet(3.0 Gph PressPiping):	N
PRDM(Sir(StatInv Recon)/Inv Control)):	N
PRDM(Exempt System Suction:	N
Spill Overfill Prevention Equip(SOPE):	Y
SOPE(Spill Cont/Bucket/Sump):	N
SOPE(DelShut-Off Valve)):	N
SOPE(FlowRestrictorValue:	N
SOPE(Alarm (Set@<=90%) W/3a Or 3b:	N
SOPE(N/A Deliveries To Tank<=25G):	N
Compartment Release Det Compliance Flag:	N
Piping Release Detection Compliance Flag):	N
Spill/OverfillPreventionCompliance Flag:	N
Compartment Release Detection Variance:	N
Piping Release Detection Variance:	N
Spill And Overfill Prevention Variance:	N
Stage I Vapor Recovery:	Not reported

NEW DAIRY TEXAS (Continued) **U003842552**

Stage 1 Installation Date: Not reported

Facility Billing Contacts:

Contact Organization Name:	NEW DAIRY TEXAS LLC
Contact Mailing Address (Delivery):	71 STRANDTMAN CV
Contact Mailing Address (Internal Delivery):	Not reported
Contact Mailing City/State/Zip:	AUSTIN, TX 78702 5100
Phone Number/Ext:	210 6611138/0
Contact Fax Number/Ext:	/
Contact Email Address:	JOSEPH.PENALOZA@BORDENDAIRY.COM
Contact Address Deliverable:	Y
Facility ID:	103408
Additional ID:	604598062003041
Princ ID:	271339832020240
AI Number:	68396
Facility Name:	NEW DAIRY TEXAS
AR Number:	82296
AR UST Number Suffix:	A
AR AST Number Suffix:	U
Contact Name/Title:	JOSEPH PENALOZA/GENERAL MGR

A3 **NEW DAIRY TEXAS** **AST** **A100182651**
East **303 INDUSTRIAL PARK** **N/A**
1/8-1/4 **MERCEDES, TX 78570**
0.244 mi.
1290 ft. **Site 3 of 3 in cluster A**

Relative:
Higher

Actual:
64 ft.

AST:

Name:	NEW DAIRY TEXAS
Address:	303 INDUSTRIAL PARK
City,State,Zip:	MERCEDES, TX 785704300
Facility ID:	103408
Additional ID:	604598062003041
AI Number:	68396
Facility Type:	FLEET REFUELING
Facility Begin Date:	08/31/1987
Facility Status:	ACTIVE
Facility Exempt Status:	N
Records Off-Site:	N
UST Financial Assurance Required:	N
Number of Active ASTs:	1
Site Location Description:	Not reported
Site Location (nearest city name):	Not reported
Site Location (county name):	HIDALGO
Site Location (TCEQ region):	15
Site Location (location zip):	78570
Contact Name/Title:	GUADALUPE LOPEZ/SUPERVISOR
Contact Organization Name:	NEW DAIRY TEXAS
Contact Mailing Address1:	Not reported
Contact Mailing Address2:	Not reported
Contact CityStateZip:	Not reported
Contact Telephone:	9569903014
Contact Address Deliverable:	Not reported
Contact Fax Number:	Not reported
Contact Email Address:	LUPE.LOPEZ@BORDENDAIRY.COM

NEW DAIRY TEXAS (Continued) **A100182651**

Signature Date on Earliest Reg Form:	11/30/2020
Signature First Name on Earliest Reg Form:	JOSEPH
Application Received Date on Earliest Reg Form:	01/21/2021
Signature Middle Name on Earliest Reg Form:	Not reported
Signature Last Name on Earliest Reg Form:	PENALOZA
Signature Title on Earliest Reg Form:	GM
Signature Role on Earliest Reg Form:	LEGAL AUTH REP OWNER
Signature Company on Earliest Reg Form:	Not reported
Enforcement Action:	N
Facility Not Inspectable:	N
Facility Not Inspectable Reason A:	Not reported
Facility Not Inspectable Reason B:	Not reported
Enforcement Action Date:	Not reported

Facility:

Facility ID:	103408
Tank ID:	1
AST ID:	179749
AI Number:	68396
Install Date:	05/17/1989
Tank Registration Date:	03/27/1996
Mult Comp:	N
Tank Status:	OUT OF USE
Tank Status Date:	03/27/1996
Tank Reg Status:	FULLY REGULATED
Tank Capacity:	6000
Substance:	GASOLINE
Other Substance B:	Not reported
Other Substance C:	Not reported
Steel:	Y
Fiber:	N
Aluminum:	N
Metal:	N
Concrete:	N
Dike:	N
Liner:	N
Contains CO:	Y
Contains NO:	N
Vapor Rec:	Not reported
Inst Stage Date:	Not reported

Facility ID:	103408
Tank ID:	2
AST ID:	179750
AI Number:	68396
Install Date:	05/17/1989
Tank Registration Date:	03/27/1996
Mult Comp:	N
Tank Status:	IN USE
Tank Status Date:	05/17/1989
Tank Reg Status:	FULLY REGULATED
Tank Capacity:	10000
Substance:	DIESEL
Other Substance B:	Not reported
Other Substance C:	Not reported
Steel:	Y
Fiber:	N
Aluminum:	N

NEW DAIRY TEXAS (Continued) **A100182651**

Metal:	N
Concrete:	N
Dike:	N
Liner:	N
Contains CO:	Y
Contains NO:	N
Vapor Rec:	Not reported
Inst Stage Date:	Not reported

Count: 2 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
MERCEDES	S126999118	CITY OF MERCEDES TRANSFER STATION	.3 MILE SE OF INTERSECTION OF		SWF/LF
MERCEDES	S126999341	CITY OF MERCEDES TRANSFER STATION	.3 MILE SE OF INTERSECTION OF		SWF/LF

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Lists of Federal NPL (Superfund) sites

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 02/03/2023
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Lists of Federal Delisted NPL sites

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Quarterly

Lists of Federal sites subject to CERCLA removals and CERCLA orders

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 08/25/2022
Date Data Arrived at EDR: 09/06/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 90

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Quarterly

Lists of Federal CERCLA sites with NFRAP

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Quarterly

Lists of Federal RCRA facilities undergoing Corrective Action

CORRACTS: Corrective Action Report
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 11/21/2022
Date Data Arrived at EDR: 11/21/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 14

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

Lists of Federal RCRA TSD facilities

RCRA-TSDF: RCRA - Treatment, Storage and Disposal
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 11/21/2022
Date Data Arrived at EDR: 11/21/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 214-665-6444
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

Lists of Federal RCRA generators

RCRA-LQG: RCRA - Large Quantity Generators
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 11/21/2022
Date Data Arrived at EDR: 11/21/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 214-665-6444
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 11/21/2022
Date Data Arrived at EDR: 11/21/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 214-665-6444
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

RCRA-VSQG: RCRA - Very Small Quantity Generators (Formerly Conditionally Exempt Small Quantity Generators)

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Very small quantity generators (VSQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 11/21/2022
Date Data Arrived at EDR: 11/21/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 214-665-6444
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 11/02/2022
Date Data Arrived at EDR: 11/08/2022
Date Made Active in Reports: 01/10/2023
Number of Days to Update: 63

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 02/03/2023
Next Scheduled EDR Contact: 05/22/2023
Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 08/15/2022
Date Data Arrived at EDR: 08/17/2022
Date Made Active in Reports: 10/24/2022
Number of Days to Update: 68

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/16/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

US INST CONTROLS: Institutional Controls Sites List

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 08/15/2022
Date Data Arrived at EDR: 08/17/2022
Date Made Active in Reports: 10/24/2022
Number of Days to Update: 68

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/16/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/12/2022
Date Data Arrived at EDR: 12/14/2022
Date Made Active in Reports: 12/19/2022
Number of Days to Update: 5

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 12/14/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

Lists of state- and tribal (Superfund) equivalent sites

SHWS: State Superfund Registry

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 03/31/2021
Date Data Arrived at EDR: 06/22/2021
Date Made Active in Reports: 09/16/2021
Number of Days to Update: 86

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5680
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Semi-Annually

Lists of state and tribal landfills and solid waste disposal facilities

SWF/LF: Permitted Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 10/21/2022
Date Data Arrived at EDR: 10/21/2022
Date Made Active in Reports: 01/18/2023
Number of Days to Update: 89

Source: Texas Commission on Environmental Quality
Telephone: 512-239-6706
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Quarterly

DEBRIS: DEBRIS

A listing of temporary debris management sites and MSW landfills for debris resulting from Hurricane Harvey.

Date of Government Version: 03/27/2018
Date Data Arrived at EDR: 04/04/2018
Date Made Active in Reports: 06/08/2018
Number of Days to Update: 65

Source: Texas Commission on Environmental Quality
Telephone: 512-239-6840
Last EDR Contact: 12/01/2022
Next Scheduled EDR Contact: 03/20/2023
Data Release Frequency: Varies

H-GAC CLI: Houston-Galveston Closed Landfill Inventory

Closed Landfill Inventory for the Houston-Galveston Area Council Region. In 1993, the Texas Legislature passed House Bill (HB) 2537, which required Councils of Governments (COGs) to develop an inventory of closed municipal solid waste landfills for their regional solid waste management plans.

Date of Government Version: 09/26/2022
Date Data Arrived at EDR: 09/27/2022
Date Made Active in Reports: 12/12/2022
Number of Days to Update: 76

Source: Houston-Galveston Area Council
Telephone: 832-681-2518
Last EDR Contact: 12/22/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

CLI: Closed Landfill Inventory
Closed and abandoned landfills (permitted as well as unauthorized) across the state of Texas. For current information regarding any of the sites included in this database, contact the appropriate Council of Governments agency.

Date of Government Version: 08/30/1999
Date Data Arrived at EDR: 09/28/2000
Date Made Active in Reports: 10/30/2000
Number of Days to Update: 32
Source: Texas Commission on Environmental Quality
Telephone: N/A
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

WASTE MGMT: Commercial Hazardous & Solid Waste Management Facilities
This list contains commercial recycling facilities and facilities permitted or authorized (interim status) by the Texas Natural Resource Conservation Commission.

Date of Government Version: 10/16/2019
Date Data Arrived at EDR: 01/10/2020
Date Made Active in Reports: 03/18/2020
Number of Days to Update: 68
Source: Texas Commission on Environmental Quality
Telephone: 512-239-2920
Last EDR Contact: 12/29/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

Lists of state and tribal leaking storage tanks

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 04/11/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64
Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 04/20/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64
Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 04/08/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64
Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 04/20/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64
Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 04/14/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 06/02/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/31/2022
Number of Days to Update: 79

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 04/28/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/28/2021
Date Data Arrived at EDR: 06/11/2021
Date Made Active in Reports: 09/07/2021
Number of Days to Update: 88

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

LPST: Leaking Petroleum Storage Tank Database
An inventory of reported leaking petroleum storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 09/23/2022
Date Data Arrived at EDR: 09/29/2022
Date Made Active in Reports: 12/14/2022
Number of Days to Update: 76

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2200
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

RDR: Release Determination Report Listing
An owner-operator permanently removing an underground storage tank system from service must determine whether a release of a stored regulated substance has occurred. Assemble and submit documentation of tank removal and release determination?including the details of all excavation, removal, and sampling activities?to the TCEQ using the PST Program?s Release Determination Report form (TCEQ-00621).

Date of Government Version: 09/13/2022
Date Data Arrived at EDR: 09/26/2022
Date Made Active in Reports: 12/13/2022
Number of Days to Update: 78

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2081
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Varies

Lists of state and tribal registered storage tanks

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 10/14/2021
Date Data Arrived at EDR: 11/05/2021
Date Made Active in Reports: 02/01/2022
Number of Days to Update: 88

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 12/28/2022
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

UST: Petroleum Storage Tank Database

Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 09/19/2022
Date Data Arrived at EDR: 09/22/2022
Date Made Active in Reports: 09/23/2022
Number of Days to Update: 1

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Last EDR Contact: 12/19/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

AST: Petroleum Storage Tank Database

Registered Aboveground Storage Tanks.

Date of Government Version: 09/19/2022
Date Data Arrived at EDR: 09/22/2022
Date Made Active in Reports: 09/23/2022
Number of Days to Update: 1

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Last EDR Contact: 12/19/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 04/08/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 04/28/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 04/11/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/07/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 04/20/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 04/14/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 04/20/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/16/2022
Number of Days to Update: 64

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 06/02/2022
Date Data Arrived at EDR: 06/13/2022
Date Made Active in Reports: 08/31/2022
Number of Days to Update: 79

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

TANKS: Petroleum Storage Tanks Listing

A list of facilities included on the Petroleum Storage Tank database that have no association as either underground or aboveground tanks.

Date of Government Version: 09/19/2022
Date Data Arrived at EDR: 09/22/2022
Date Made Active in Reports: 10/27/2022
Number of Days to Update: 35

Source: Texas Commission on Environmental Quality
Telephone: 512-239-0985
Last EDR Contact: 12/19/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

State and tribal institutional control / engineering control registries

AUL: Sites with Controls
Activity and use limitations include both engineering controls and institutional controls.

Date of Government Version: 06/27/2022
Date Data Arrived at EDR: 06/30/2022
Date Made Active in Reports: 07/07/2022
Number of Days to Update: 7

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5891
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

Lists of state and tribal voluntary cleanup sites

VCP TCEQ: Voluntary Cleanup Program Database
The Texas Voluntary Cleanup Program was established to provide administrative, technical, and legal incentives to encourage the cleanup of contaminated sites in Texas.

Date of Government Version: 09/23/2022
Date Data Arrived at EDR: 09/30/2022
Date Made Active in Reports: 12/15/2022
Number of Days to Update: 76

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5891
Last EDR Contact: 12/22/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Quarterly

VCP RRC: Voluntary Cleanup Program Sites
The Voluntary Cleanup Program (RRC-VCP) provides an incentive to remediate Oil & Gas related pollution by participants as long as they did not cause or contribute to the contamination. Applicants to the program receive a release of liability to the state in exchange for a successful cleanup.

Date of Government Version: 09/26/2022
Date Data Arrived at EDR: 09/27/2022
Date Made Active in Reports: 12/13/2022
Number of Days to Update: 77

Source: Railroad Commission of Texas
Telephone: 512-463-6969
Last EDR Contact: 12/22/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 07/08/2021
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

Lists of state and tribal brownfield sites

BROWNFIELDS: Brownfields Site Assessments
Brownfield site assessments that are being cleaned under EPA grant monies.

Date of Government Version: 09/23/2022
Date Data Arrived at EDR: 10/04/2022
Date Made Active in Reports: 12/20/2022
Number of Days to Update: 77

Source: TCEQ
Telephone: 512-239-5872
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Semi-Annually

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 02/23/2022
Date Data Arrived at EDR: 03/10/2022
Date Made Active in Reports: 03/10/2022
Number of Days to Update: 0

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/07/2022
Next Scheduled EDR Contact: 03/27/2023
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

NCTCOG LI: North Central Landfill Inventory

North Central Texas Council of Governments landfill database.

Date of Government Version: 09/26/2022
Date Data Arrived at EDR: 09/27/2022
Date Made Active in Reports: 12/12/2022
Number of Days to Update: 76

Source: North Central Texas Council of Governments
Telephone: 817-695-9223
Last EDR Contact: 12/22/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

CAPCOG LI: Capitol Area Landfill Inventory

Permitted and unpermitted landfills for the CAPCOG region. Serving Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Llano, Travis, and Williamson Counties.

Date of Government Version: 01/06/2017
Date Data Arrived at EDR: 01/10/2017
Date Made Active in Reports: 03/15/2017
Number of Days to Update: 64

Source: Capital Area Council of Governments
Telephone: 512-916-6000
Last EDR Contact: 12/22/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

SWRCY: Recycling Facility Listing

A listing of recycling facilities in the state.

Date of Government Version: 11/07/2022
Date Data Arrived at EDR: 11/07/2022
Date Made Active in Reports: 01/27/2023
Number of Days to Update: 81

Source: TCEQ
Telephone: 512-239-6700
Last EDR Contact: 02/06/2023
Next Scheduled EDR Contact: 05/22/2023
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 01/20/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 01/13/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land
A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 01/27/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 07/29/2022
Date Data Arrived at EDR: 08/18/2022
Date Made Active in Reports: 10/24/2022
Number of Days to Update: 67

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: No Update Planned

CDL: Clandestine Drug Site Locations Listing
A listing of former clandestine drug site locations

Date of Government Version: 09/07/2021
Date Data Arrived at EDR: 12/09/2021
Date Made Active in Reports: 03/01/2022
Number of Days to Update: 82

Source: Department of Public Safety
Telephone: 512-424-2144
Last EDR Contact: 02/06/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Varies

PRIORITY CLEANERS: Dry Cleaner Remediation Program Prioritization List
A listing of dry cleaner related contaminated sites.

Date of Government Version: 03/01/2022
Date Data Arrived at EDR: 05/31/2022
Date Made Active in Reports: 08/19/2022
Number of Days to Update: 80

Source: Texas Commisision on Environmenatl Quality
Telephone: 512-239-5658
Last EDR Contact: 11/30/2022
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Varies

DEL SHWS: Deleted Superfund Registry Sites
Sites have been deleted from the state Superfund registry in accordance with the Act, 361.189

Date of Government Version: 03/31/2021
Date Data Arrived at EDR: 06/22/2021
Date Made Active in Reports: 09/16/2021
Number of Days to Update: 86

Source: Texas Commission on Environmental Quality
Telephone: 512-239-0666
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/29/2022
Date Data Arrived at EDR: 08/18/2022
Date Made Active in Reports: 10/24/2022
Number of Days to Update: 67

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Quarterly

CENTRAL REGISTRY: The Central Registry

The Central Registry, a common record area of the TCEQ, maintains information about TCEQ customers and regulated activities, such as company names, addresses, and telephone numbers. This information is commonly referred to as "core data". The Central Registry provides the regulated community with a central access point within the agency to check core data and make changes when necessary.

Date of Government Version: 09/30/2022
Date Data Arrived at EDR: 10/04/2022
Date Made Active in Reports: 12/27/2022
Number of Days to Update: 84

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5175
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

Local Lists of Registered Storage Tanks

NON REGIST PST: Petroleum Storage Tank Non Registered

A listing of non-registered petroleum storage tank site locations.

Date of Government Version: 07/29/2022
Date Data Arrived at EDR: 07/29/2022
Date Made Active in Reports: 10/17/2022
Number of Days to Update: 80

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2081
Last EDR Contact: 01/30/2023
Next Scheduled EDR Contact: 05/15/2023
Data Release Frequency: Quarterly

Local Land Records

HIST LIENS: Environmental Liens Listing

This listing contains information fields that are no longer tracked in the LIENS database.

Date of Government Version: 03/23/2007
Date Data Arrived at EDR: 03/23/2007
Date Made Active in Reports: 05/02/2007
Number of Days to Update: 40

Source: Texas Commission on Environmental Qualilty
Telephone: 512-239-2209
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

LIENS: Environmental Liens Listing

The listing covers TCEQ liens placed against either State Superfund sites or Federal Superfund sites to recover cost incurred by TCEQ.

Date of Government Version: 09/27/2022
Date Data Arrived at EDR: 10/04/2022
Date Made Active in Reports: 12/21/2022
Number of Days to Update: 78

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2209
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 09/19/2022
Date Data Arrived at EDR: 09/19/2022
Date Made Active in Reports: 09/30/2022
Number of Days to Update: 11

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 12/14/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

SPILLS: Spills Database
Spills reported to the Emergency Response Division.

Date of Government Version: 10/04/2022
Date Data Arrived at EDR: 10/10/2022
Date Made Active in Reports: 12/21/2022
Number of Days to Update: 72

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5100
Last EDR Contact: 01/11/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Quarterly

SPILLS 90: SPILLS90 data from FirstSearch
Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 10/23/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/07/2013
Number of Days to Update: 63

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SPILLS 80: SPILLS80 data from FirstSearch
Spills 80 includes those spill and release records available from FirstSearch databases prior to 1990. Typically, they may include chemical, oil and/or hazardous substance spills recorded before 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 80.

Date of Government Version: 05/15/2005
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/07/2013
Number of Days to Update: 63

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 11/21/2022
Date Data Arrived at EDR: 11/21/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 214-665-6444
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 08/11/2022
Date Data Arrived at EDR: 08/11/2022
Date Made Active in Reports: 09/30/2022
Number of Days to Update: 50

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 11/10/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 06/07/2021
Date Data Arrived at EDR: 07/13/2021
Date Made Active in Reports: 03/09/2022
Number of Days to Update: 239

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 01/13/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 04/02/2018
Date Data Arrived at EDR: 04/11/2018
Date Made Active in Reports: 11/06/2019
Number of Days to Update: 574

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 01/03/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017
Date Data Arrived at EDR: 02/03/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 05/22/2023
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 09/19/2022
Date Data Arrived at EDR: 09/20/2022
Date Made Active in Reports: 12/22/2022
Number of Days to Update: 93

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 12/14/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 01/30/2023
Next Scheduled EDR Contact: 05/15/2023
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017
Date Data Arrived at EDR: 05/08/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 02/03/2023
Next Scheduled EDR Contact: 05/15/2023
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 06/17/2020
Date Made Active in Reports: 09/10/2020
Number of Days to Update: 85

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/12/2022
Next Scheduled EDR Contact: 03/27/2023
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 08/14/2020
Date Made Active in Reports: 11/04/2020
Number of Days to Update: 82

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 11/01/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 10/17/2022
Date Data Arrived at EDR: 10/18/2022
Date Made Active in Reports: 01/10/2023
Number of Days to Update: 84

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 01/18/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 04/27/2022
Date Data Arrived at EDR: 05/04/2022
Date Made Active in Reports: 05/10/2022
Number of Days to Update: 6

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 05/15/2023
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 01/20/2022
Date Data Arrived at EDR: 01/20/2022
Date Made Active in Reports: 03/25/2022
Number of Days to Update: 64

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 01/04/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016
Date Data Arrived at EDR: 11/23/2016
Date Made Active in Reports: 02/10/2017
Number of Days to Update: 79

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/28/2022
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 10/26/2022
Date Data Arrived at EDR: 11/22/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 13

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 01/17/2023
Next Scheduled EDR Contact: 05/01/2023
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2020
Date Data Arrived at EDR: 11/30/2021
Date Made Active in Reports: 02/22/2022
Number of Days to Update: 84

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 11/29/2022
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 01/12/2017
Date Data Arrived at EDR: 03/05/2019
Date Made Active in Reports: 11/11/2019
Number of Days to Update: 251

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 11/23/2022
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 09/13/2019
Date Data Arrived at EDR: 11/06/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 96

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 02/03/2023
Next Scheduled EDR Contact: 05/15/2023
Data Release Frequency: Varies

RADINFO: Radiation Information Database
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/01/2019
Date Data Arrived at EDR: 07/01/2019
Date Made Active in Reports: 09/23/2019
Number of Days to Update: 84

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 01/02/2020
Date Data Arrived at EDR: 01/28/2020
Date Made Active in Reports: 04/17/2020
Number of Days to Update: 80

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 01/24/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Quarterly

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 09/30/2022
Date Data Arrived at EDR: 10/21/2022
Date Made Active in Reports: 01/10/2023
Number of Days to Update: 81

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 01/03/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2019
Date Data Arrived at EDR: 03/02/2022
Date Made Active in Reports: 03/25/2022
Number of Days to Update: 23

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 12/21/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/14/2015
Date Made Active in Reports: 01/10/2017
Number of Days to Update: 546

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 01/06/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 07/26/2021
Date Data Arrived at EDR: 07/27/2021
Date Made Active in Reports: 10/22/2021
Number of Days to Update: 87

Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 01/30/2023
Next Scheduled EDR Contact: 05/15/2023
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 08/30/2019
Date Data Arrived at EDR: 11/15/2019
Date Made Active in Reports: 01/28/2020
Number of Days to Update: 74

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/09/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 10/27/2022
Date Data Arrived at EDR: 11/01/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data
A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File
Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/03/2022
Date Data Arrived at EDR: 08/17/2022
Date Made Active in Reports: 08/31/2022
Number of Days to Update: 14

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 11/17/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Semi-Annually

MINES VIOLATIONS: MSHA Violation Assessment Data
Mines violation and assessment information. Department of Labor, Mine Safety & Health Administration.

Date of Government Version: 11/29/2022
Date Data Arrived at EDR: 11/30/2022
Date Made Active in Reports: 12/22/2022
Number of Days to Update: 22

Source: DOL, Mine Safety & Health Admi
Telephone: 202-693-9424
Last EDR Contact: 01/03/2023
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Quarterly

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing
This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 05/06/2020
Date Data Arrived at EDR: 05/27/2020
Date Made Active in Reports: 08/13/2020
Number of Days to Update: 78

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 11/21/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing
Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 11/21/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

ABANDONED MINES: Abandoned Mines
An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 09/13/2022
Date Data Arrived at EDR: 09/14/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 82

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 03/20/2023
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 08/03/2022
Date Data Arrived at EDR: 08/25/2022
Date Made Active in Reports: 10/24/2022
Number of Days to Update: 60

Source: EPA
Telephone: (214) 665-2200
Last EDR Contact: 11/29/2022
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 11/09/2021
Date Data Arrived at EDR: 10/20/2022
Date Made Active in Reports: 01/10/2023
Number of Days to Update: 82

Source: Department of Defense
Telephone: 703-704-1564
Last EDR Contact: 01/09/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Varies

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 09/25/2022
Date Data Arrived at EDR: 09/30/2022
Date Made Active in Reports: 12/22/2022
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-564-2280
Last EDR Contact: 01/04/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/06/2021
Date Data Arrived at EDR: 05/21/2021
Date Made Active in Reports: 08/11/2021
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 11/15/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 08/11/2022
Date Data Arrived at EDR: 08/11/2022
Date Made Active in Reports: 09/30/2022
Number of Days to Update: 50

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 11/10/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Quarterly

PFAS NPL: Superfund Sites with PFAS Detections Information

EPA's Office of Land and Emergency Management and EPA Regional Offices maintain data describing what is known about site investigations, contamination, and remedial actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) where PFAS is present in the environment.

Date of Government Version: 02/23/2022
Date Data Arrived at EDR: 07/08/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 123

Source: Environmental Protection Agency
Telephone: 703-603-8895
Last EDR Contact: 01/10/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS FEDERAL SITES: Federal Sites PFAS Information

Several federal entities, such as the federal Superfund program, Department of Defense, National Aeronautics and Space Administration, Department of Transportation, and Department of Energy provided information for sites with known or suspected detections at federal facilities.

Date of Government Version: 02/23/2022
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS TSCA: PFAS Manufacture and Imports Information

EPA issued the Chemical Data Reporting (CDR) Rule under the Toxic Substances Control Act (TSCA) and requires chemical manufacturers and facilities that manufacture or import chemical substances to report data to EPA. EPA publishes non-confidential business information (non-CBI) and includes descriptive information about each site, corporate parent, production volume, other manufacturing information, and processing and use information.

Date of Government Version: 01/03/2022
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS RCRA MANIFEST: PFAS Transfers Identified In the RCRA Database Listing

To work around the lack of PFAS waste codes in the RCRA database, EPA developed the PFAS Transfers dataset by mining e-Manifest records containing at least one of these common PFAS keywords: PFAS, PFOA, PFOS, PERFL, AFFF, GENX, GEN-X (plus the VT waste codes). These keywords were searched for in the following text fields: Manifest handling instructions (MANIFEST_HANDLING_INSTR), Non-hazardous waste description (NON_HAZ_WASTE_DESCRIPTION), DOT printed information (DOT_PRINTED_INFORMATION), Waste line handling instructions (WASTE_LINE_HANDLING_INSTR), Waste residue comments (WASTE_RESIDUE_COMMENTS).

Date of Government Version: 01/03/2022
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS ATSDR: PFAS Contamination Site Location Listing

PFAS contamination site locations from the Department of Health & Human Services, Center for Disease Control & Prevention. ATSDR is involved at a number of PFAS-related sites, either directly or through assisting state and federal partners. As of now, most sites are related to drinking water contamination connected with PFAS production facilities or fire training areas where aqueous film-forming firefighting foam (AFFF) was regularly used.

Date of Government Version: 06/24/2020
Date Data Arrived at EDR: 03/17/2021
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 601

Source: Department of Health & Human Services
Telephone: 202-741-5770
Last EDR Contact: 01/23/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Varies

PFAS WQP: Ambient Environmental Sampling for PFAS

The Water Quality Portal (WQP) is a part of a modernized repository storing ambient sampling data for all environmental media and tissue samples. A wide range of federal, state, tribal and local governments, academic and non-governmental organizations and individuals submit project details and sampling results to this public repository. The information is commonly used for research and assessments of environmental quality.

Date of Government Version: 01/03/2022
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS NPDES: Clean Water Act Discharge Monitoring Information

Any discharger of pollutants to waters of the United States from a point source must have a National Pollutant Discharge Elimination System (NPDES) permit. The process for obtaining limits involves the regulated entity (permittee) disclosing releases in a NPDES permit application and the permitting authority (typically the state but sometimes EPA) deciding whether to require monitoring or monitoring with limits.

Date of Government Version: 01/03/2022
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS ECHO: Facilities in Industries that May Be Handling PFAS Listing

Regulators and the public have expressed interest in knowing which regulated entities may be using PFAS. EPA has developed a dataset from various sources that show which industries may be handling PFAS. Approximately 120,000 facilities subject to federal environmental programs have operated or currently operate in industry sectors with processes that may involve handling and/or release of PFAS.

Date of Government Version: 01/03/2022
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS ECHO FIRE TRAINING: Facilities in Industries that May Be Handling PFAS Listing

A list of fire training sites was added to the Industry Sectors dataset using a keyword search on the permitted facilitys name to identify sites where fire-fighting foam may have been used in training exercises. Additionally, you may view an example spreadsheet of the subset of fire training facility data, as well as the keywords used in selecting or deselecting a facility for the subset. as well as the keywords used in selecting or deselecting a facility for the subset. These keywords were tested to maximize accuracy in selecting facilities that may use fire-fighting foam in training exercises, however, due to the lack of a required reporting field in the data systems for designating fire training sites, this methodology may not identify all fire training sites or may potentially misidentify them.

Date of Government Version: 08/22/2018
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS PART 139 AIRPORT: All Certified Part 139 Airports PFAS Information Listing

Since July 1, 2006, all certified part 139 airports are required to have fire-fighting foam onsite that meet military specifications (MIL-F-24385) (14 CFR 139.317). To date, these military specification fire-fighting foams are fluorinated and have been historically used for training and extinguishing. The 2018 FAA Reauthorization Act has a provision stating that no later than October 2021, FAA shall not require the use of fluorinated AFFF. This provision does not prohibit the use of fluorinated AFFF at Part 139 civilian airports; it only prohibits FAA from mandating its use. The Federal Aviation Administration?s document AC 150/5210-6D - Aircraft Fire Extinguishing Agents provides guidance on Aircraft Fire Extinguishing Agents, which includes Aqueous Film Forming Foam (AFFF).

Date of Government Version: 08/22/2018
Date Data Arrived at EDR: 10/26/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 13

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

AQUEOUS FOAM NRC: Aqueous Foam Related Incidents Listing

The National Response Center (NRC) serves as an emergency call center that fields initial reports for pollution and railroad incidents and forwards that information to appropriate federal/state agencies for response. The spreadsheets posted to the NRC website contain initial incident data that has not been validated or investigated by a federal/state response agency. Response center calls from 1990 to the most recent complete calendar year where there was indication of Aqueous Film Forming Foam (AFFF) usage are included in this dataset. NRC calls may reference AFFF usage in the ?Material Involved? or ?Incident Description? fields.

Date of Government Version: 02/23/2022
Date Data Arrived at EDR: 03/31/2022
Date Made Active in Reports: 11/08/2022
Number of Days to Update: 222

Source: Environmental Protection Agency
Telephone: 202-272-0167
Last EDR Contact: 01/05/2023
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PFAS: PFAS Contamination Site Location Listing

PFOS and PFOA stand for perfluorooctane sulfonate and perfluorooctanoic acid, respectively. Both are fluorinated organic chemicals, part of a larger family of compounds referred to as perfluoroalkyl substances (PFASs).

Date of Government Version: 08/25/2022
Date Data Arrived at EDR: 09/01/2022
Date Made Active in Reports: 11/21/2022
Number of Days to Update: 81

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2341
Last EDR Contact: 11/28/2022
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Varies

AIRS: Current Emission Inventory Data

The database lists by company, along with their actual emissions, the TNRCC air accounts that emit EPA criteria pollutants.

Date of Government Version: 09/09/2022
Date Data Arrived at EDR: 09/13/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 83

Source: Texas Commission on Environmental Quality
Telephone: N/A
Last EDR Contact: 12/01/2022
Next Scheduled EDR Contact: 03/20/2023
Data Release Frequency: Semi-Annually

APAR: Affected Property Assessment Report Site Listing

Listing of Sites That Have Received an APAR (Affected Property Assessment Report)

Date of Government Version: 10/06/2022
Date Data Arrived at EDR: 10/07/2022
Date Made Active in Reports: 12/20/2022
Number of Days to Update: 74

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5872
Last EDR Contact: 12/29/2022
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

ASBESTOS: Asbestos Notification Listing

A listing of asbestos notification site locations.

Date of Government Version: 08/24/2022
Date Data Arrived at EDR: 08/25/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 82

Source: Department of State Health Services
Telephone: 512-834-6787
Last EDR Contact: 12/01/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Sites

A listing of facilities that use surface impoundments or landfills to dispose of coal ash.

Date of Government Version: 10/25/2022
Date Data Arrived at EDR: 10/28/2022
Date Made Active in Reports: 01/18/2023
Number of Days to Update: 82

Source: Texas Commission on Environmental Quality
Telephone: 512-239-6624
Last EDR Contact: 01/23/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Varies

DRYCLEANERS: Drycleaner Registration Database Listing
A listing of drycleaning facilities.

Date of Government Version: 08/04/2022
Date Data Arrived at EDR: 08/23/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 84

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Last EDR Contact: 11/17/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

ED AQUIF: Edwards Aquifer Permits
A listing of permits in the Edwards Aquifer Protection Program database. The information provided is for the counties located in the Austin Region (Hays, Travis, and Williamson counties).

Date of Government Version: 09/28/2022
Date Data Arrived at EDR: 10/05/2022
Date Made Active in Reports: 12/20/2022
Number of Days to Update: 76

Source: Texas Commission on Environmental Quality, Austin Region
Telephone: 512-339-2929
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Varies

ENFORCEMENT: Notice of Violations Listing
A listing of permit violations.

Date of Government Version: 01/09/2023
Date Data Arrived at EDR: 01/12/2023
Date Made Active in Reports: 02/01/2023
Number of Days to Update: 20

Source: Texas Commission on Environmental Quality
Telephone: 512-239-6012
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Semi-Annually

Financial Assurance 1: Financial Assurance Information Listing
Financial assurance information.

Date of Government Version: 09/16/2022
Date Data Arrived at EDR: 09/26/2022
Date Made Active in Reports: 12/12/2022
Number of Days to Update: 77

Source: Texas Commission on Environmental Quality
Telephone: 512-239-6239
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Varies

Financial Assurance 2: Financial Assurance Information Listing
Financial Assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay

Date of Government Version: 09/19/2022
Date Data Arrived at EDR: 09/22/2022
Date Made Active in Reports: 12/05/2022
Number of Days to Update: 74

Source: Texas Commission on Environmental Quality
Telephone: 512-239-0986
Last EDR Contact: 12/19/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Quarterly

GCC: Groundwater Contamination Cases
Texas Water Code, Section 26.406 requires the annual report to describe the current status of groundwater monitoring activities conducted or required by each agency at regulated facilities or associated with regulated activities. The report is required to contain a description of each case of groundwater contamination documented during the previous calendar year. Also to be included, is a description of each case of contamination documented during previous periods for which voluntary clean up action was incomplete at the time the preceding report was issued. The report is also required to indicate the status of enforcement action for each listed case.

Date of Government Version: 12/31/2021
Date Data Arrived at EDR: 08/29/2022
Date Made Active in Reports: 11/16/2022
Number of Days to Update: 79

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5690
Last EDR Contact: 11/17/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Annually

IOP: Innocent Owner/Operator Program
Contains information on all sites that are in the IOP. An IOP is an innocent owner or operator whose property is contaminated as a result of a release or migration of contaminants from a source or sources not located on the property, and they did not cause or contribute to the source or sources of contamination.

Date of Government Version: 09/23/2022
Date Data Arrived at EDR: 09/30/2022
Date Made Active in Reports: 12/14/2022
Number of Days to Update: 75

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5894
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Quarterly

LEAD: Lead Inspection Listing
Lead inspection sites

Date of Government Version: 08/24/2022
Date Data Arrived at EDR: 08/25/2022
Date Made Active in Reports: 11/15/2022
Number of Days to Update: 82

Source: Department of State Health Services
Telephone: 512-834-6600
Last EDR Contact: 11/28/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Varies

Ind. Haz Waste: Industrial & Hazardous Waste Database
Summary reports reported by waste handlers, generators and shippers in Texas.

Date of Government Version: 08/04/2022
Date Data Arrived at EDR: 10/10/2022
Date Made Active in Reports: 12/20/2022
Number of Days to Update: 71

Source: Texas Commission on Environmental Quality
Telephone: 512-239-0985
Last EDR Contact: 01/11/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Annually

MSD: Municipal Settings Designations Database
An MSD is an official state designation given to property within a municipality or its extraterritorial jurisdiction that certifies that designated groundwater at the property is not use as potable water, and is prohibited from future use as potatable water because that groundwater is contaminated in excess of the applicable potable-water protective concentration level.

Date of Government Version: 10/24/2022
Date Data Arrived at EDR: 11/02/2022
Date Made Active in Reports: 01/23/2023
Number of Days to Update: 82

Source: Texas Commission on Environmental Quality
Telephone: 512-239-4982
Last EDR Contact: 01/23/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Varies

NPDES: NPDES Facility List
Permitted wastewater outfalls.

Date of Government Version: 01/27/2023
Date Data Arrived at EDR: 01/27/2023
Date Made Active in Reports: 01/30/2023
Number of Days to Update: 3

Source: Texas Commission on Environmental Quality
Telephone: 512-239-4591
Last EDR Contact: 01/27/2023
Next Scheduled EDR Contact: 05/22/2023
Data Release Frequency: Varies

RWS: Radioactive Waste Sites
Sites in the State of Texas that have been designated as Radioactive Waste sites.

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 12/14/2006
Date Made Active in Reports: 01/23/2007
Number of Days to Update: 40

Source: Texas Commission on Environmental Quality
Telephone: 512-239-0859
Last EDR Contact: 02/02/2023
Next Scheduled EDR Contact: 05/22/2023
Data Release Frequency: Semi-Annually

TIER 2: Tier 2 Chemical Inventory Reports
A listing of facilities which store or manufacture hazardous materials and submit a chemical inventory report.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 06/07/2013
Date Made Active in Reports: 07/22/2013
Number of Days to Update: 45

Source: Department of State Health Services
Telephone: 512-834-6603
Last EDR Contact: 11/09/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Annually

UIC: Underground Injection Wells Database Listing
Class V injection wells regulated by the TCEQ. Class V wells are used to inject non-hazardous fluids underground. Most Class V wells are used to dispose of wastes into or above underground sources of drinking water and can pose a threat to ground water quality, if not managed properly.

Date of Government Version: 08/09/2022
Date Data Arrived at EDR: 08/10/2022
Date Made Active in Reports: 11/01/2022
Number of Days to Update: 83

Source: Texas Commission on Environmental Quality
Telephone: 512-239-6627
Last EDR Contact: 01/09/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Varies

IHW CORR ACTION: IHW CORR ACTION
Industrial hazardous waste facilities with corrective actions.

Date of Government Version: 09/23/2022
Date Data Arrived at EDR: 09/30/2022
Date Made Active in Reports: 12/14/2022
Number of Days to Update: 75

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5872
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 04/10/2023
Data Release Frequency: Varies

PST STAGE 2: PST Stage 2
State II Vapor Recovery. Decommissioning of Stage II Rule - Gasoline dispensing facilities (GDFs) may begin the process of removing Stage II equipment on May 16, 2014 providing that all other requirements for decommissioning have been met, including appropriate notification.

Date of Government Version: 07/17/2019
Date Data Arrived at EDR: 07/18/2019
Date Made Active in Reports: 09/24/2019
Number of Days to Update: 68

Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Last EDR Contact: 12/13/2022
Next Scheduled EDR Contact: 04/03/2023
Data Release Frequency: Varies

COMP HIST: Compliance History Listing
A listing of compliance histories of regulated entities

Date of Government Version: 12/13/2021
Date Data Arrived at EDR: 02/24/2022
Date Made Active in Reports: 05/24/2022
Number of Days to Update: 89

Source: Txas Commission on Environmental Quality
Telephone: 512-239-3282
Last EDR Contact: 11/22/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

PCS ENF: Enforcement data
No description is available for this data

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 02/05/2015
Date Made Active in Reports: 03/06/2015
Number of Days to Update: 29

Source: EPA
Telephone: 202-564-2497
Last EDR Contact: 12/28/2022
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Varies

PCS INACTIVE: Listing of Inactive PCS Permits
An inactive permit is a facility that has shut down or is no longer discharging.

Date of Government Version: 11/05/2014
Date Data Arrived at EDR: 01/06/2015
Date Made Active in Reports: 05/06/2015
Number of Days to Update: 120

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 12/28/2022
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Semi-Annually

PCS: Permit Compliance System

PCS is a computerized management information system that contains data on National Pollutant Discharge Elimination System (NPDES) permit holding facilities. PCS tracks the permit, compliance, and enforcement status of NPDES facilities.

Date of Government Version: 07/14/2011
Date Data Arrived at EDR: 08/05/2011
Date Made Active in Reports: 09/29/2011
Number of Days to Update: 55

Source: EPA, Office of Water
Telephone: 202-564-2496
Last EDR Contact: 12/28/2022
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Semi-Annually

MINES MRDS: Mineral Resources Data System

Mineral Resources Data System

Date of Government Version: 04/06/2018
Date Data Arrived at EDR: 10/21/2019
Date Made Active in Reports: 10/24/2019
Number of Days to Update: 3

Source: USGS
Telephone: 703-648-6533
Last EDR Contact: 11/22/2022
Next Scheduled EDR Contact: 03/06/2023
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Texas Commission of Environmental Quality in Texas formerly known as Texas Natural Resources Conservation Commission which changed in 2002.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/26/2013
Number of Days to Update: 178

Source: Texas Commission on Environmental Quality
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Texas Commission of Environmental Quality in Texas formerly known as Texas Natural Resources Conservation Commission which changed in 2002.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/13/2014
Number of Days to Update: 196

Source: Texas Commission on Environmental Quality
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

COUNTY RECORDS

TRAVIS COUNTY:

HIST UST AUSTIN: Historic Tank Records

A listing of historic records from the City of Austin.

Date of Government Version: 08/28/2022
Date Data Arrived at EDR: 08/29/2022
Date Made Active in Reports: 09/02/2022
Number of Days to Update: 4

Source: Department of Planning & Development Review
Telephone: 512-974-2715
Last EDR Contact: 11/30/2022
Next Scheduled EDR Contact: 03/13/2023
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 11/16/2022
Date Data Arrived at EDR: 11/16/2022
Date Made Active in Reports: 02/06/2023
Number of Days to Update: 82

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 11/16/2022
Next Scheduled EDR Contact: 02/20/2023
Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/16/2019
Number of Days to Update: 36

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 12/28/2022
Next Scheduled EDR Contact: 04/17/2023
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 01/01/2019
Date Data Arrived at EDR: 10/29/2021
Date Made Active in Reports: 01/19/2022
Number of Days to Update: 82

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 01/27/2023
Next Scheduled EDR Contact: 05/08/2023
Data Release Frequency: Quarterly

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 06/30/2018
Date Data Arrived at EDR: 07/19/2019
Date Made Active in Reports: 09/10/2019
Number of Days to Update: 53

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 01/06/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2020
Date Data Arrived at EDR: 11/30/2021
Date Made Active in Reports: 02/18/2022
Number of Days to Update: 80

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 12/20/2022
Next Scheduled EDR Contact: 02/27/2023
Data Release Frequency: Annually

VT MANIFEST: Hazardous Waste Manifest Data
Hazardous waste manifest information.

Date of Government Version: 10/28/2019
Date Data Arrived at EDR: 10/29/2019
Date Made Active in Reports: 01/09/2020
Number of Days to Update: 72

Source: Department of Environmental Conservation
Telephone: 802-241-3443
Last EDR Contact: 01/06/2023
Next Scheduled EDR Contact: 04/24/2023
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 06/19/2019
Date Made Active in Reports: 09/03/2019
Number of Days to Update: 76

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 12/01/2022
Next Scheduled EDR Contact: 03/20/2023
Data Release Frequency: Annually

Oil/Gas Pipelines
Source: Endeavor Business Media
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by Endeavor Business Media. This information is provided on a best effort basis and Endeavor Business Media does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of Endeavor Business Media.

Electric Power Transmission Line Data
Source: Endeavor Business Media
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Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Facility List
Source: Department of Protective & Regulatory Services
Telephone: 512-438-3269

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005, 2010 and 2015 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory
Source: Texas General Land Office
Telephone: 512-463-0745

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

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GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

474878
2000 EAST EXPRESS 83
MERCEDES, TX 78570

TARGET PROPERTY COORDINATES

Latitude (North):	26.158056 - 26ˆ 9’ 29.00’’
Longitude (West):	97.901268 - 97ˆ 54’ 4.56’’
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	609817.1
UTM Y (Meters):	2893488.5
Elevation:	59 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5935869 MERCEDES, TX
Version Date:	2013

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

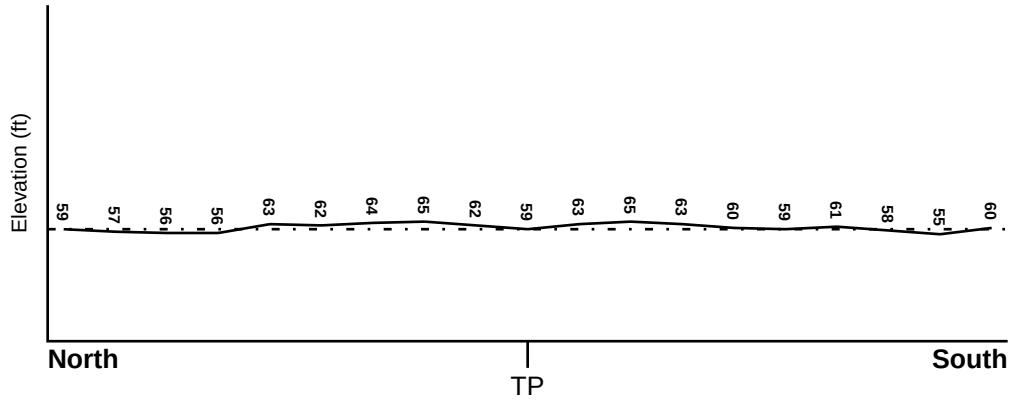
TOPOGRAPHIC INFORMATION

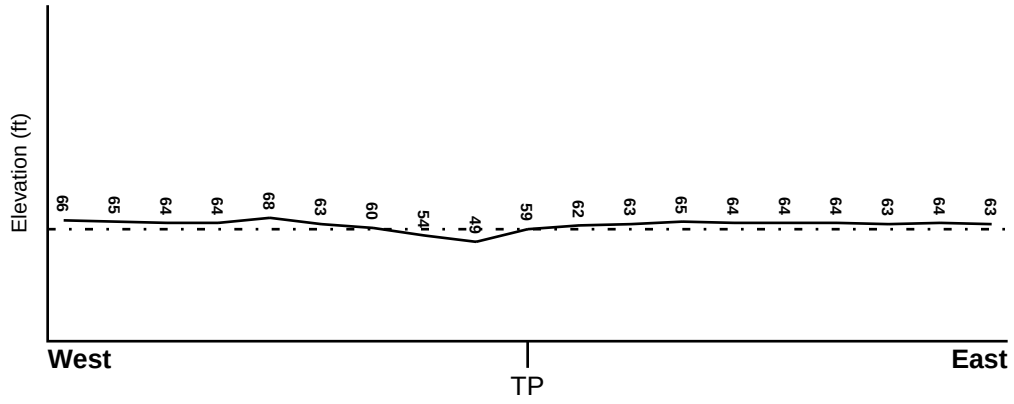
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General West

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 59 ft.

0 1/2 1 Miles

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
4803440001B	FEMA Q3 Flood data

Additional Panels in search area:	FEMA Source Type
4803340450B	FEMA Q3 Flood data
4803340525B	FEMA Q3 Flood data
4803440003B	FEMA Q3 Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
MERCEDES	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius:	1.25 miles
Status:	Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

* ©1996 Site−specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

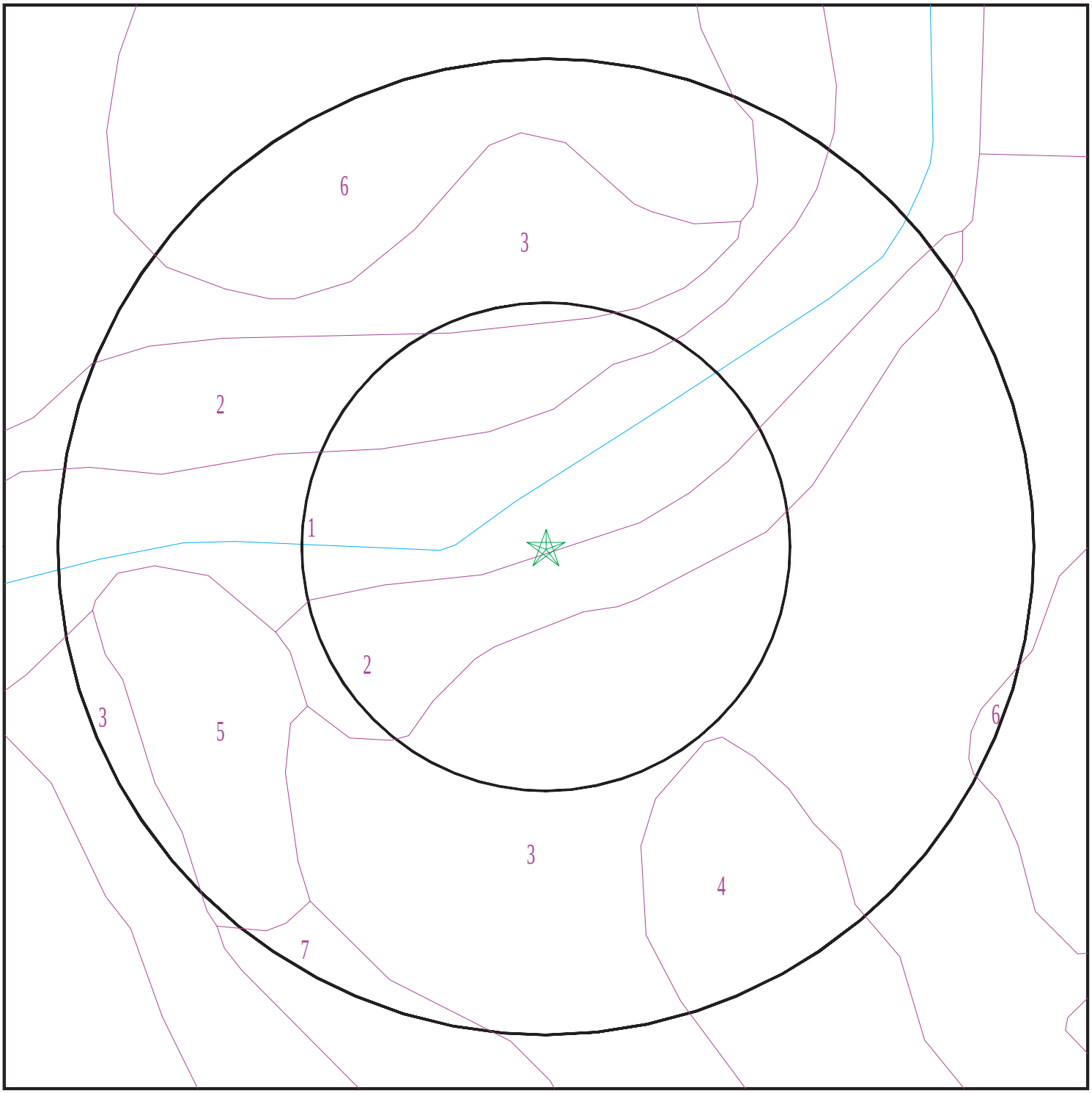
Era:	Cenozoic
System:	Quaternary
Series:	Holocene
Code:	Qh *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 7245729.2s



Target Property
SSURGO Soil
Water

0 1/16 1/8 1/4 Miles

N

SITE NAME: 474878 ADDRESS: 2000 East Express 83 Mercedes TX 78570 LAT/LONG: 26.158056 / 97.901268	CLIENT: AEI Consultants CONTACT: Cynthia INQUIRY #: 7245729.2s DATE: February 07, 2023 12:21 pm

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GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Mercedes

Soil Surface Texture: clay

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Moderately well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	18 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 7.9
2	18 inches	57 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 7.9
3	57 inches	64 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 7.9

Soil Map ID: 2

Soil Component Name: Raymondville

Soil Surface Texture: clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Moderately well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.9
2	14 inches	42 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.9
3	42 inches	64 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.9

Soil Map ID: 3

Soil Component Name: Hidalgo

Soil Surface Texture: sandy clay loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9
2	16 inches	27 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9
3	27 inches	79 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9

Soil Map ID: 4

Soil Component Name: Hidalgo

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9
2	16 inches	27 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9
3	27 inches	79 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9

Soil Map ID: 5

Soil Component Name: Willacy

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 6.6
2	14 inches	72 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 6.6

Soil Map ID: 6

Soil Component Name: Hidalgo

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	16 inches	27 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9
3	27 inches	79 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 7.9

Soil Map ID: 7

Soil Component Name: Willacy

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 6.6

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	14 inches	72 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 8.4 Min: 6.6

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
98	TX1080007	1/2 - 1 Mile SW

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	TXPLU6000088783	1/8 - 1/4 Mile NE

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	TXMON6000440968	1/4 - 1/2 Mile WNW
A3	TXMON6000440970	1/4 - 1/2 Mile WNW
A4	TXMON6000440969	1/4 - 1/2 Mile WNW
A5	TXPLU6000165778	1/4 - 1/2 Mile WNW
A6	TXPLU6000165779	1/4 - 1/2 Mile WNW
A7	TXPLU6000165780	1/4 - 1/2 Mile WNW
B8	TXPLU6000162518	1/2 - 1 Mile SSW
B9	TXPLU6000162517	1/2 - 1 Mile SSW
B10	TXPLU6000162519	1/2 - 1 Mile SSW
B11	TXPLU6000162520	1/2 - 1 Mile SSW
B12	TXMON6000396898	1/2 - 1 Mile SSW
B13	TXMON6000384591	1/2 - 1 Mile SSW
B14	TXMON6000396899	1/2 - 1 Mile SSW
B15	TXMON6000426575	1/2 - 1 Mile SSW
16	TXWDB8000120907	1/2 - 1 Mile NNW
C17	TXPLU6000102011	1/2 - 1 Mile South
C18	TXPLU6000102010	1/2 - 1 Mile South
19	TXWDB8000115500	1/2 - 1 Mile NE
D20	TXPLU6000131171	1/2 - 1 Mile WSW
D21	TXMON6000265980	1/2 - 1 Mile WSW
D22	TXPLU6000131166	1/2 - 1 Mile WSW
D23	TXMON6000265974	1/2 - 1 Mile WSW
D24	TXPLU6000131169	1/2 - 1 Mile WSW
D25	TXPLU6000131168	1/2 - 1 Mile WSW
D26	TXMON6000265977	1/2 - 1 Mile WSW
D27	TXMON6000265978	1/2 - 1 Mile WSW
E28	TXPLU6000075888	1/2 - 1 Mile WSW
F29	TXMON6000265979	1/2 - 1 Mile WSW
F30	TXPLU6000131170	1/2 - 1 Mile WSW
E31	TXPLU6000131167	1/2 - 1 Mile WSW
E32	TXMON6000265976	1/2 - 1 Mile WSW
E33	TXPLU6000073549	1/2 - 1 Mile WSW
E34	TXPLU6000073540	1/2 - 1 Mile WSW
E35	TXPLU6000073542	1/2 - 1 Mile WSW
E36	TXPLU6000073541	1/2 - 1 Mile WSW
E37	TXPLU6000084557	1/2 - 1 Mile WSW
E38	TXPLU6000084556	1/2 - 1 Mile WSW
E39	TXPLU6000084563	1/2 - 1 Mile WSW
E40	TXPLU6000084562	1/2 - 1 Mile WSW
E41	TXPLU6000084565	1/2 - 1 Mile WSW
E42	TXPLU6000084566	1/2 - 1 Mile WSW
E43	TXPLU6000084564	1/2 - 1 Mile WSW
E44	TXPLU6000084555	1/2 - 1 Mile WSW
E45	TXPLU6000084567	1/2 - 1 Mile WSW
E46	TXPLU6000073554	1/2 - 1 Mile WSW
E47	TXPLU6000073553	1/2 - 1 Mile WSW
E48	TXPLU6000073556	1/2 - 1 Mile WSW
E49	TXPLU6000073555	1/2 - 1 Mile WSW
50	TXMON6000307864	1/2 - 1 Mile WSW
F51	TXPLU6000070096	1/2 - 1 Mile WSW
F52	TXPLU6000070095	1/2 - 1 Mile WSW
F53	TXPLU6000070097	1/2 - 1 Mile WSW

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
F54	TXPLU6000070099	1/2 - 1 Mile WSW
F55	TXPLU6000070098	1/2 - 1 Mile WSW
F56	TXPLU6000016113	1/2 - 1 Mile WSW
F57	TXPLU6000016109	1/2 - 1 Mile WSW
F58	TXPLU6000016108	1/2 - 1 Mile WSW
F59	TXPLU6000016110	1/2 - 1 Mile WSW
F60	TXPLU6000016112	1/2 - 1 Mile WSW
F61	TXPLU6000016111	1/2 - 1 Mile WSW
F62	TXPLU6000070110	1/2 - 1 Mile WSW
F63	TXPLU6000070109	1/2 - 1 Mile WSW
F64	TXPLU6000070108	1/2 - 1 Mile WSW
F65	TXPLU6000070113	1/2 - 1 Mile WSW
F66	TXPLU6000070112	1/2 - 1 Mile WSW
F67	TXPLU6000070111	1/2 - 1 Mile WSW
F68	TXPLU6000070107	1/2 - 1 Mile WSW
F69	TXPLU6000070102	1/2 - 1 Mile WSW
F70	TXPLU6000070101	1/2 - 1 Mile WSW
F71	TXPLU6000070100	1/2 - 1 Mile WSW
F72	TXPLU6000070105	1/2 - 1 Mile WSW
F73	TXPLU6000070104	1/2 - 1 Mile WSW
F74	TXPLU6000070103	1/2 - 1 Mile WSW
E75	TXMON6000188426	1/2 - 1 Mile SW
E76	TXMON6000188433	1/2 - 1 Mile SW
E77	TXMON6000188435	1/2 - 1 Mile SW
G78	TXEQ70000013087	1/2 - 1 Mile SW
G79	TXEQ70000013085	1/2 - 1 Mile SW
G80	TXWDB8000111779	1/2 - 1 Mile SW
G81	TXBR40000042622	1/2 - 1 Mile SW
G82	TXEQ70000013086	1/2 - 1 Mile SW
H83	TXPLU6000075884	1/2 - 1 Mile WSW
H84	TXPLU6000075881	1/2 - 1 Mile WSW
G85	TXWDB8000111778	1/2 - 1 Mile SW
G86	TXBR40000042019	1/2 - 1 Mile SW
H87	TXPLU6000075883	1/2 - 1 Mile WSW
H88	TXPLU6000075874	1/2 - 1 Mile WSW
H89	TXPLU6000075880	1/2 - 1 Mile WSW
H90	TXPLU6000075886	1/2 - 1 Mile WSW
H91	TXPLU6000075887	1/2 - 1 Mile WSW
H92	TXPLU6000075885	1/2 - 1 Mile WSW
H93	TXPLU6000071993	1/2 - 1 Mile WSW
H94	TXPLU6000075882	1/2 - 1 Mile WSW
H95	TXPLU6000071992	1/2 - 1 Mile WSW
H96	TXPLU6000071994	1/2 - 1 Mile WSW
97	TXMON6000367185	1/2 - 1 Mile SE
99	TXBR40000042033	1/2 - 1 Mile NE
I100	TXMON6000275449	1/2 - 1 Mile SW
I101	TXPLU6000132684	1/2 - 1 Mile SW

OTHER STATE DATABASE INFORMATION

STATE OIL/GAS WELL INFORMATION

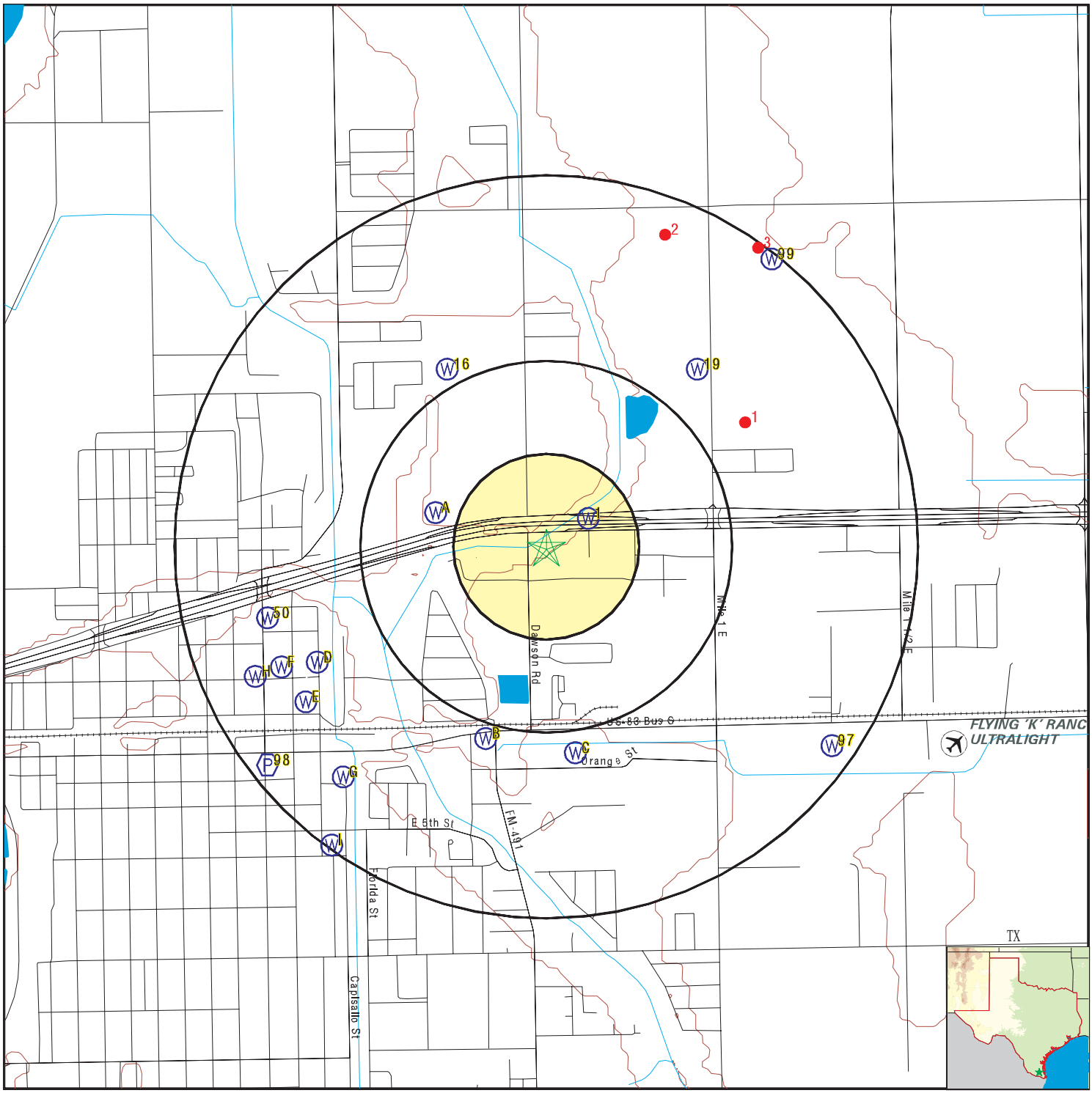
MAP ID	WELL ID	LOCATION FROM TP
1	TXOG90001212903	1/2 - 1 Mile ENE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE OIL/GAS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
2	TXOG90001212900	1/2 - 1 Mile NNE
3	TXOG90001212901	1/2 - 1 Mile NE

PHYSICAL SETTING SOURCE MAP - 7245729.2s



0 1/4 1/2 1 Miles

N

County Boundary
Major Roads
Contour Lines
Airports
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
Indeterminate Groundwater Flow at Location
Groundwater Flow Varies at Location
Closest Hydrogeological Data
Oil or gas wells

SITE NAME: 474878 ADDRESS: 2000 East Express 83 Mercedes TX 78570 LAT/LONG: 26.158056 / 97.901268	CLIENT: AEI Consultants CONTACT: Cynthia INQUIRY #: 7245729.2s DATE: February 07, 2023 12:21 pm

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Map ID Direction Distance Elevation	Database	EDR ID Number
1 **NE** **1/8 - 1/4 Mile** **Higher**	**TX WELLS**	**TXPLU6000088783**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	4638
Well Type:	Withdrawal of Water	Borehole Depth (ft):	0

A2 **WNW** **1/4 - 1/2 Mile** **Higher**	**TX WELLS**	**TXMON6000440968**

Database:	Submitted Drillers Reports Database		
Well Report #:	452120	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	20
Injurious Water Quality:	no	Plugging Rpt #:	168931

A3 **WNW** **1/4 - 1/2 Mile** **Higher**	**TX WELLS**	**TXMON6000440970**

Database:	Submitted Drillers Reports Database		
Well Report #:	452122	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	8
Injurious Water Quality:	no	Plugging Rpt #:	168933

A4 **WNW** **1/4 - 1/2 Mile** **Higher**	**TX WELLS**	**TXMON6000440969**

Database:	Submitted Drillers Reports Database		
Well Report #:	452121	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	8
Injurious Water Quality:	no	Plugging Rpt #:	168932

A5 **WNW** **1/4 - 1/2 Mile** **Higher**	**TX WELLS**	**TXPLU6000165778**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	452120	Plugging Rpt #:	168931
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	20

Map ID Direction Distance Elevation	Database	EDR ID Number
A6 **WNW** **1/4 - 1/2 Mile** **Higher**	**TX WELLS**	**TXPLU6000165779**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	452121	Plugging Rpt #:	168932
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	8

A7 **WNW** **1/4 - 1/2 Mile** **Higher**	**TX WELLS**	**TXPLU6000165780**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	452122	Plugging Rpt #:	168933
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	8

B8 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000162518**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	403500	Plugging Rpt #:	165714
Well Type:	Monitor	Borehole Depth (ft):	25

B9 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000162517**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	390659	Plugging Rpt #:	165712
Well Type:	Monitor	Borehole Depth (ft):	25

B10 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000162519**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	403501	Plugging Rpt #:	165715
Well Type:	Monitor	Borehole Depth (ft):	25

Map ID Direction Distance Elevation	Database	EDR ID Number
B11 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000162520**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	436509	Plugging Rpt #:	165716
Well Type:	Monitor	Borehole Depth (ft):	25

B12 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000396898**	

Database:	Submitted Drillers Reports Database		
Well Report #:	403500	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	25
Injurious Water Quality:	no	Plugging Rpt #:	165714

B13 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000384591**	

Database:	Submitted Drillers Reports Database		
Well Report #:	390659	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	25
Injurious Water Quality:	yes	Plugging Rpt #:	165712

B14 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000396899**	

Database:	Submitted Drillers Reports Database		
Well Report #:	403501	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	25
Injurious Water Quality:	no	Plugging Rpt #:	165715

B15 **SSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000426575**	

Database:	Submitted Drillers Reports Database		
Well Report #:	436509	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	25
Injurious Water Quality:	no	Plugging Rpt #:	165716

Map ID Direction Distance Elevation	Database	EDR ID Number
16 **NNW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXWDB8000120907**

Database:	Groundwater Database	Well #:	8849904
Primary Water Use:	Domestic	Elevation (ft):	64
Well Depth (ft):	45	Observation Type:	Miscellaneous Measurements
Water Quality Review:	Yes	Aquifer:	112GLFC - Gulf Coast Aquifer
Well Type:	Withdrawal of Water		

C17 **South** **1/2 - 1 Mile** **Lower**	**TX WELLS**	**TXPLU6000102011**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	5559
Well Type:	Monitor	Borehole Depth (ft):	20

C18 **South** **1/2 - 1 Mile** **Lower**	**TX WELLS**	**TXPLU6000102010**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	5558
Well Type:	Monitor	Borehole Depth (ft):	20

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19 **NE** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXWDB8000115500**

Database:	Groundwater Database	Well #:	8849905
Primary Water Use:	Domestic	Elevation (ft):	61
Well Depth (ft):	40	Observation Type:	Miscellaneous Measurements
Water Quality Review:	Yes	Aquifer:	112GLFC - Gulf Coast Aquifer
Well Type:	Withdrawal of Water		

D20 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000131171**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	270087	Plugging Rpt #:	133226
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	20

Map ID Direction Distance Elevation	Database	EDR ID Number
D21 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000265980**

Database:	Submitted Drillers Reports Database		
Well Report #:	270087	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	20
Injurious Water Quality:	Not Reported	Plugging Rpt #:	133226

D22 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000131166**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	270081	Plugging Rpt #:	133221
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	24

D23 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000265974**

Database:	Submitted Drillers Reports Database		
Well Report #:	270081	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	24
Injurious Water Quality:	Not Reported	Plugging Rpt #:	133221

D24 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000131169**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	270085	Plugging Rpt #:	133224
Well Type:	Monitor	Borehole Depth (ft):	24

D25 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000131168**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	270084	Plugging Rpt #:	133223
Well Type:	Monitor	Borehole Depth (ft):	24

Map ID Direction Distance Elevation	Database	EDR ID Number
D26 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000265977**

Database:	Submitted Drillers Reports Database		
Well Report #:	270084	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	24
Injurious Water Quality:	Not Reported	Plugging Rpt #:	133223

D27 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000265978**

Database:	Submitted Drillers Reports Database		
Well Report #:	270085	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	24
Injurious Water Quality:	Not Reported	Plugging Rpt #:	133224

E28 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075888**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44203
Well Type:	Monitor	Borehole Depth (ft):	25

F29 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000265979**

Database:	Submitted Drillers Reports Database		
Well Report #:	270086	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	24
Injurious Water Quality:	Not Reported	Plugging Rpt #:	133225

F30 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000131170**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	270086	Plugging Rpt #:	133225
Well Type:	Monitor	Borehole Depth (ft):	24

Map ID Direction Distance Elevation	Database	EDR ID Number
E31 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000131167**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	270083	Plugging Rpt #:	133222
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	20

E32 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000265976**

Database:	Submitted Drillers Reports Database		
Well Report #:	270083	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	20
Injurious Water Quality:	Not Reported	Plugging Rpt #:	133222

E33 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073549**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72781
Well Type:	Monitor	Borehole Depth (ft):	30

E34 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073540**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72776
Well Type:	Monitor	Borehole Depth (ft):	30

E35 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073542**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72778
Well Type:	Monitor	Borehole Depth (ft):	30

Map ID Direction Distance Elevation	Database	EDR ID Number
E36 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073541**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72777
Well Type:	Monitor	Borehole Depth (ft):	30

E37 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084557**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72792
Well Type:	Monitor	Borehole Depth (ft):	30

E38 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084556**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72789
Well Type:	Monitor	Borehole Depth (ft):	30

E39 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084563**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72785
Well Type:	Monitor	Borehole Depth (ft):	30

E40 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084562**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72780
Well Type:	Monitor	Borehole Depth (ft):	30

Map ID Direction Distance Elevation	Database	EDR ID Number
E41 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084565**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72787
Well Type:	Monitor	Borehole Depth (ft):	30

E42 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084566**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72788
Well Type:	Monitor	Borehole Depth (ft):	30

E43 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084564**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72786
Well Type:	Monitor	Borehole Depth (ft):	30

E44 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084555**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72779
Well Type:	Monitor	Borehole Depth (ft):	30

E45 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000084567**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72790
Well Type:	Monitor	Borehole Depth (ft):	30

Map ID Direction Distance Elevation	Database	EDR ID Number
E46 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073554**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72783
Well Type:	Monitor	Borehole Depth (ft):	30

E47 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073553**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72782
Well Type:	Monitor	Borehole Depth (ft):	30

E48 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073556**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72791
Well Type:	Monitor	Borehole Depth (ft):	30

E49 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000073555**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	72784
Well Type:	Monitor	Borehole Depth (ft):	30

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50 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000307864**

Database:	Submitted Drillers Reports Database		
Well Report #:	312528	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	25
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
F51 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070096**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53525
Well Type:	Monitor	Borehole Depth (ft):	24

F52 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070095**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53521
Well Type:	Monitor	Borehole Depth (ft):	24

F53 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070097**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53526
Well Type:	Monitor	Borehole Depth (ft):	30

F54 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070099**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53528
Well Type:	Monitor	Borehole Depth (ft):	30

F55 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070098**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53527
Well Type:	Monitor	Borehole Depth (ft):	30

Map ID Direction Distance Elevation	Database	EDR ID Number
F56 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000016113**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53537
Well Type:	Monitor	Borehole Depth (ft):	28

F57 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000016109**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53523
Well Type:	Monitor	Borehole Depth (ft):	24

F58 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000016108**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53522
Well Type:	Monitor	Borehole Depth (ft):	23

F59 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000016110**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53524
Well Type:	Monitor	Borehole Depth (ft):	24

F60 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000016112**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53536
Well Type:	Monitor	Borehole Depth (ft):	35

Map ID Direction Distance Elevation	Database	EDR ID Number
F61 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000016111**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53529
Well Type:	Monitor	Borehole Depth (ft):	12.5

F62 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070110**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53541
Well Type:	Monitor	Borehole Depth (ft):	30

F63 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070109**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53540
Well Type:	Monitor	Borehole Depth (ft):	30

F64 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070108**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53539
Well Type:	Monitor	Borehole Depth (ft):	25

F65 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070113**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53544
Well Type:	Monitor	Borehole Depth (ft):	30

Map ID Direction Distance Elevation	Database	EDR ID Number
F66 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070112**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53543
Well Type:	Monitor	Borehole Depth (ft):	30

F67 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070111**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53542
Well Type:	Monitor	Borehole Depth (ft):	30

F68 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070107**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53538
Well Type:	Monitor	Borehole Depth (ft):	25

F69 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070102**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53532
Well Type:	Monitor	Borehole Depth (ft):	24

F70 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070101**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53531
Well Type:	Monitor	Borehole Depth (ft):	35

Map ID Direction Distance Elevation	Database	EDR ID Number
F71 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070100**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53530
Well Type:	Monitor	Borehole Depth (ft):	26.5

F72 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070105**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53535
Well Type:	Monitor	Borehole Depth (ft):	20.5

F73 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070104**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53534
Well Type:	Monitor	Borehole Depth (ft):	20.5

F74 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000070103**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	53533
Well Type:	Monitor	Borehole Depth (ft):	20

E75 **SW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000188426**

Database:	Submitted Drillers Reports Database		
Well Report #:	191485	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	30
Injurious Water Quality:	no	Plugging Rpt #:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
E76 **SW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000188433**

Database:	Submitted Drillers Reports Database		
Well Report #:	191492	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	30
Injurious Water Quality:	no	Plugging Rpt #:	Not Reported

E77 **SW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000188435**

Database:	Submitted Drillers Reports Database		
Well Report #:	191494	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	30
Injurious Water Quality:	no	Plugging Rpt #:	Not Reported

G78 **SW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXEQ70000013087**

Database:	Public Water Supply Sources Databases		
PWS ID:	1080007	Water Source:	S1080007A
Locating Agency:	TCEQ	Elevation:	62

G79 **SW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXEQ70000013085**

Database:	Public Water Supply Sources Databases		
PWS ID:	1080007	Water Source:	G1080007A
Locating Agency:	TNRCC	Elevation:	0

Construction Information:

Record #:	2	Well Interval:	CASING
Top Depth (ft):	0	Bottom Depth (ft):	230
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	3	Well Interval:	WELL OPENINGS
Top Depth (ft):	230	Bottom Depth (ft):	250
Casing Above Surface:	Not Reported	Diameter (in):	16

Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	20
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	4	Well Interval:	CASING
Top Depth (ft):	250	Bottom Depth (ft):	278
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	5	Well Interval:	WELL OPENINGS
Top Depth (ft):	278	Bottom Depth (ft):	338
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	60
Opening Method:	Not Reported	Packer Material:	Not Reported

Water Level Information:

Date Water Level Measure:	19380501	Feet below Ground Surface:	-38.0
Collecting Agency:	TNRCC	Collection Method:	REPORTED - METHOD NOT KNOWN
Remarks:	Not Reported		

G80
SW
1/2 - 1 Mile
Higher

TX WELLS **TXWDB8000111779**

Database:	Groundwater Database	Well #:	8849902
Primary Water Use:	Public Supply	Elevation (ft):	65
Well Depth (ft):	400	Observation Type:	Miscellaneous Measurements
Water Quality Review:	Yes		
Aquifer:	112BMLG - Beaumont Clay, Lissie Formation and Goliad Sand		
Well Type:	Withdrawal of Water		

G81
SW
1/2 - 1 Mile
Higher

TX WELLS **TXBR40000042622**

Database:	Brackish Resources Aquifer Characterization System Database		
Well ID:	43525	Well Type:	Withdrawal of Water
Well Use:	Public supply	Data Source:	TWDB Groundwater Database
Well Depth (ft):	400	Well Bottom Elevation (ft):	-99999
Total Hole Depth (ft):	400	Bottom Hole Elevation (ft):	-99999
Drill Date:	05/30/1996	Kelly Bushing Height (ft):	5
Remarks:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
G82 **SW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXEQ70000013086**

Database:	Public Water Supply Sources Databases		
PWS ID:	1080007	Water Source:	G1080007B
Locating Agency:	TCEQ	Elevation:	65

Construction Information:

Record #:	1	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	180
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	2	Well Interval:	CASING
Top Depth (ft):	0	Bottom Depth (ft):	48
Casing Above Surface:	Not Reported	Diameter (in):	36
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	3	Well Interval:	CASING
Top Depth (ft):	0	Bottom Depth (ft):	215
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	4	Well Interval:	WELL OPENINGS
Top Depth (ft):	215	Bottom Depth (ft):	255
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	SCREEN - TYPE NOT KNOWN		
Casing Material:	Not Reported	Opening Material:	STAINLESS STEEL
Opening Length (ft):	40	Opening Method:	Not Reported
Packer Material:	Not Reported		

Construction Information:

Record #:	5	Well Interval:	CASING
Top Depth (ft):	255	Bottom Depth (ft):	273
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	6	Well Interval:	WELL OPENINGS
Top Depth (ft):	273	Bottom Depth (ft):	335
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	SCREEN - TYPE NOT KNOWN		
Casing Material:	Not Reported	Opening Material:	STAINLESS STEEL
Opening Length (ft):	62	Opening Method:	Not Reported
Packer Material:	Not Reported		

Construction Information:

Record #:	7	Well Interval:	CASING
Top Depth (ft):	335	Bottom Depth (ft):	365
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	8	Well Interval:	WELL OPENINGS
Top Depth (ft):	365	Bottom Depth (ft):	395
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	SCREEN - TYPE NOT KNOWN		
Casing Material:	Not Reported	Opening Material:	STAINLESS STEEL
Opening Length (ft):	30	Opening Method:	Not Reported
Packer Material:	Not Reported		

Construction Information:

Record #:	9	Well Interval:	CASING
Top Depth (ft):	395	Bottom Depth (ft):	400
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Geologic Information:

Record #:	1	Top Geo Unit Below Surface (ft):	0
Bottom Geo Unit Below Surface (ft):	10	Geo Unit Thickness (ft):	10
Geo Unit Description:	SURFACE SOIL		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	2	Top Geo Unit Below Surface (ft):	10
Bottom Geo Unit Below Surface (ft):	35	Geo Unit Thickness (ft):	25
Geo Unit Description:	HARD BROWN SAND W SMALL GRAVEL		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	3	Top Geo Unit Below Surface (ft):	35
Bottom Geo Unit Below Surface (ft):	50	Geo Unit Thickness (ft):	15
Geo Unit Description:	RED SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	4	Top Geo Unit Below Surface (ft):	50
Bottom Geo Unit Below Surface (ft):	175	Geo Unit Thickness (ft):	125
Geo Unit Description:	BROWN SAND FINE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	5	Top Geo Unit Below Surface (ft):	175
Bottom Geo Unit Below Surface (ft):	215	Geo Unit Thickness (ft):	40
Geo Unit Description:	RED SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	6	Top Geo Unit Below Surface (ft):	215
Bottom Geo Unit Below Surface (ft):	255	Geo Unit Thickness (ft):	40
Geo Unit Description:	IUM COARSE RED SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	7	Top Geo Unit Below Surface (ft):	255
Bottom Geo Unit Below Surface (ft):	273	Geo Unit Thickness (ft):	18
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	8	Top Geo Unit Below Surface (ft):	273
Bottom Geo Unit Below Surface (ft):	335	Geo Unit Thickness (ft):	62
Geo Unit Description:	COARSE RED SAND GRAVEL		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	9	Top Geo Unit Below Surface (ft):	335
Bottom Geo Unit Below Surface (ft):	365	Geo Unit Thickness (ft):	30
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	10	Top Geo Unit Below Surface (ft):	365
Bottom Geo Unit Below Surface (ft):	395	Geo Unit Thickness (ft):	30
Geo Unit Description:	IUM COARSE RED SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	11	Top Geo Unit Below Surface (ft):	395
Bottom Geo Unit Below Surface (ft):	400	Geo Unit Thickness (ft):	5
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960530	Feet below Ground Surface:	-32
Collecting Agency:	DRILL		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	Not Reported		

H83
WSW **TX WELLS** **TXPLU6000075884**
1/2 - 1 Mile
Higher

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	84257	Plugging Rpt #:	44199
Well Type:	Monitor	Borehole Depth (ft):	25

H84
WSW **TX WELLS** **TXPLU6000075881**
1/2 - 1 Mile
Higher

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44198
Well Type:	Monitor	Borehole Depth (ft):	26

G85
SW **TX WELLS** **TXWDB8000111778**
1/2 - 1 Mile
Higher

Database:	Groundwater Database	Well #:	8849901
Primary Water Use:	Plugged or Destroyed	Elevation (ft):	70
Well Depth (ft):	338	Observation Type:	Miscellaneous Measurements
Water Quality Review:	Yes		
Aquifer:	112BMLG - Beaumont Clay, Lissie Formation and Goliad Sand		
Well Type:	Withdrawal of Water		

Map ID Direction Distance Elevation	Database	EDR ID Number
G86 **SW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXBR40000042019**

Database:	Brackish Resources Aquifer Characterization System Database		
Well ID:	42899	Well Type:	Withdrawal of Water
Well Use:	Plugged or destroyed		
Data Source:	RRC GAU Q Paper/Digital Geophysical Logs		
Well Depth (ft):	338	Well Bottom Elevation (ft):	-99999
Total Hole Depth (ft):	347	Bottom Hole Elevation (ft):	-99999
Drill Date:	05/14/1953	Kelly Bushing Height (ft):	2
Remarks:	Well construction and geochemistry information available in scanned documents. Screened interval also included in Table 4 remarks.		

H87 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075883**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	84260	Plugging Rpt #:	44195
Well Type:	Monitor	Borehole Depth (ft):	25

H88 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075874**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44196
Well Type:	Monitor	Borehole Depth (ft):	25

H89 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075880**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	84258	Plugging Rpt #:	44197
Well Type:	Monitor	Borehole Depth (ft):	25

H90 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075886**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44201
Well Type:	Monitor	Borehole Depth (ft):	25

Map ID Direction Distance Elevation	Database	EDR ID Number
H91 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075887**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44202
Well Type:	Monitor	Borehole Depth (ft):	25

H92 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075885**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44200
Well Type:	Monitor	Borehole Depth (ft):	25

H93 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000071993**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	84255	Plugging Rpt #:	44205
Well Type:	Monitor	Borehole Depth (ft):	25

H94 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000075882**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44194
Well Type:	Monitor	Borehole Depth (ft):	26

H95 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000071992**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	44204
Well Type:	Monitor	Borehole Depth (ft):	25

Map ID Direction Distance Elevation	Database	EDR ID Number
H96 **WSW** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXPLU6000071994**

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	84249	Plugging Rpt #:	44206
Well Type:	Monitor	Borehole Depth (ft):	25

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97 **SE** **1/2 - 1 Mile** **Higher**	**TX WELLS**	**TXMON6000367185**

Database:	Submitted Drillers Reports Database		
Well Report #:	372738	Well Type:	New Well
Proposed Use:	Domestic	Borehole Depth (ft):	47
Injurious Water Quality:	no	Plugging Rpt #:	Not Reported

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98 **SW** **1/2 - 1 Mile** **Higher**	**FRDS PWS**	**TX1080007**

Epa region:	06	State:	TX
Pwsid:	TX1080007	Pwsname:	CITY OF MERCEDES
Cityserved:	Not Reported	Stateserved:	TX
Zipserved:	Not Reported	Fipscounty:	48215
Status:	Active	Retpopsrvd:	15700
Pwssvcconn:	5909	Psource longname:	Surface_water
Pwstype:	CWS	Owner:	Local_Govt
Contact:	HINOJOSA, HENRY	Contactorgname:	HINOJOSA, HENRY
Contactphone:	956-565-3114	Contactaddress1:	PO BOX 837
Contactaddress2:	Not Reported	Contactcity:	MERCEDES
Contactstate:	TX	Contactzip:	78570-0837
Pwsactivitycode:	A		

Pwsid:	TX1080007	Facid:	65063
Facname:	WELL 2 INTO MIDDLE (0.18MG) CLEARWELL		
Factype:	Treatment_plant	Facactivitycode:	A
Trtobjective:	disinfection	Trtprocess:	gaseous chlorination, pre
Factypecode:	TP		

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	particulate removal
Trtprocess:	coagulation	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	particulate removal
Trtprocess:	rapid mix	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	particulate removal

Trtprocess:	sedimentation	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	disinfection
Trtprocess:	chloramines	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	disinfection
Trtprocess:	gaseous chlorination, pre	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	taste / odor control
Trtprocess:	chlorine dioxide	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	particulate removal
Trtprocess:	filtration, rapid sand	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	other
Trtprocess:	innovative	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	particulate removal
Trtprocess:	flocculation	Factypecode:	TP

Pwsid:	TX1080007	Facid:	8181
Facname:	PLANT 2 (SWTP)	Factype:	Treatment_plant
Facactivitycode:	A	Trtobjective:	taste / odor control
Trtprocess:	aeration, packed tower	Factypecode:	TP

PWS ID:	TX1080007	PWS name:	MERCEDES CITY OF
Address:	P O BOX 327	Care of:	C/O OSWALDO GARZA -PROJECT MGR O
City:	MERCEDES	State:	TX
Zip:	78570	Owner:	MERCEDES CITY OF
Source code:	Surface water	Population:	14672

PWS ID:	TX1080007	PWS type:	System Owner/Responsible Party
PWS name:	NORMA GARCIA	PWS address:	Not Reported
PWS city:	Not Reported	PWS state:	Not Reported
PWS zip:	Not Reported	PWS name:	CITY OF MERCEDES
PWS type code:	C	Retail population served:	14185
Contact:	QUINTANILLA, JOEL	Contact address:	PO BOX 837
Contact address:	MERCEDES	Contact city:	TX
Contact state:	78	Contact zip:	956-565-31
Contact telephone:	Not Reported		

County:	HIDALGO	Source:	Surface water
Treatment Objective:	DISINFECTION BY-PRODUCTS CONTROL		
Process:	CHLORAMINES	Population:	14672

County:	HIDALGO	Source:	Surface water
Treatment Objective:	DISINFECTION	Process:	CHLORAMINES
Population:	14672		

County:	HIDALGO	Source:	Surface water

Treatment Objective:	DISINFECTION	Process:	GASEOUS CHLORINATION, PRE
Population:	14672		
County:	HIDALGO	Source:	Surface water
Treatment Objective:	PARTICULATE REMOVAL	Process:	COAGULATION
Population:	14672		
County:	HIDALGO	Source:	Surface water
Treatment Objective:	PARTICULATE REMOVAL	Process:	FILTRATION, RAPID SAND
Population:	14672		
County:	HIDALGO	Source:	Surface water
Treatment Objective:	PARTICULATE REMOVAL	Process:	FLOCCULATION
Population:	14672		
County:	HIDALGO	Source:	Surface water
Treatment Objective:	PARTICULATE REMOVAL	Process:	RAPID MIX
Population:	14672		
County:	HIDALGO	Source:	Surface water
Treatment Objective:	PARTICULATE REMOVAL	Process:	SEDIMENTATION
Population:	14672		
PWS ID:	TX1080007	Activity status:	Active
Date system activated:	Not Reported	Date system deactivated:	Not Reported
Retail population:	00012539	System name:	MERCEDES CITY OF
System address:	ROGER BOTHOF OMI	System address:	P O BOX 837
System city:	MERCEDES	System state:	TX
System zip:	78570		
Population served:	10,001 - 50,000 Persons	Treatment:	Treated
Latitude:	260857	Longitude:	0975447
Violation id:	105	Orig code:	S
State:	TX	Violation Year:	2004
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	02	Violation name:	MCL, Average
Rule code:	210	Rule name:	St1 DBP
Violation measur:	0.088	Unit of measure:	MG/L
State mcl:	Not Reported	Cmp bdt:	07/01/2004
Cmp edt:	09/30/2004		
Violation id:	205	Orig code:	S
State:	TX	Violation Year:	2004
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	01	Violation name:	MCL, Single Sample
Rule code:	500	Rule name:	Not Regulated
Violation measur:	0.08	Unit of measure:	MG/L
State mcl:	Not Reported	Cmp bdt:	10/01/2004
Cmp edt:	12/31/2004		
Violation id:	307	Orig code:	S
State:	TX	Violation Year:	2007
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	22	Violation name:	MCL, Monthly (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	06/01/2007
Cmp edt:	06/30/2007		
Violation id:	407	Orig code:	S

State:	TX	Violation Year:	2007
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	08/30/2007
Cmp edt:	Not Reported		

Violation id:	509	Orig code:	S
State:	TX	Violation Year:	2008
Contamination code:	0300	Contamination Name:	IESWTR
Violation code:	38		
Violation name:	Monitoring, Turbidity (Enhanced SWTR)		
Rule code:	122	Rule name:	LT1 ESWTR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	11/01/2008
Cmp edt:	11/30/2008		

Violation id:	514	Orig code:	S
State:	TX	Violation Year:	2010
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	25	Violation name:	Monitoring, Repeat Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	09/01/2010
Cmp edt:	09/30/2010		

Violation id:	515	Orig code:	S
State:	TX	Violation Year:	2010
Contamination code:	3014	Contamination Name:	E. COLI
Violation code:	34	Violation name:	Monitoring, Source Water (GWR)
Rule code:	140	Rule name:	GWR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	09/01/2010
Cmp edt:	Not Reported		

Violation id:	517	Orig code:	S
State:	TX	Violation Year:	2011
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/10/2011
Cmp edt:	Not Reported		

Violation id:	519	Orig code:	S
State:	TX	Violation Year:	2011
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	04/15/2011
Cmp edt:	Not Reported		

Violation id:	521	Orig code:	S
State:	TX	Violation Year:	2011
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	26	Violation name:	Monitoring, Repeat Minor (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	06/01/2011
Cmp edt:	06/30/2011		

Violation id:	526	Orig code:	S
State:	TX	Violation Year:	2011
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/10/2011
Cmp edt:	Not Reported		

Violation id:	536	Orig code:	S
State:	TX	Violation Year:	2012
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	22	Violation name:	MCL, Monthly (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2012
Cmp edt:	10/31/2012		

Violation id:	537	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2378	Contamination Name:	1,2,4-Trichlorobenzene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	538	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2380	Contamination Name:	cis-1,2-Dichloroethylene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	539	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2955	Contamination Name:	Xylenes, Total
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	540	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2964	Contamination Name:	DICHLOROMETHANE
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	541	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2968	Contamination Name:	o-Dichlorobenzene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	542	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2969	Contamination Name:	p-Dichlorobenzene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	543	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2976	Contamination Name:	Vinyl chloride
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	544	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2977	Contamination Name:	1,1-Dichloroethylene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	545	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2979	Contamination Name:	trans-1,2-Dichloroethylene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	546	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2980	Contamination Name:	1,2-Dichloroethane
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	547	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2981	Contamination Name:	1,1,1-Trichloroethane
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	548	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2982	Contamination Name:	Carbon tetrachloride
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	549	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2983	Contamination Name:	1,2-Dichloropropane
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	550	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2984	Contamination Name:	Trichloroethylene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	551	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2985	Contamination Name:	1,1,2-Trichloroethane
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	552	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2987	Contamination Name:	Tetrachloroethylene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	553	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2989	Contamination Name:	CHLOROBENZENE
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	554	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2990	Contamination Name:	Benzene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	555	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2991	Contamination Name:	Toluene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	556	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2992	Contamination Name:	Ethylbenzene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	557	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2996	Contamination Name:	Styrene
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	310	Rule name:	VOC
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	558	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	27	Violation name:	Monitoring and Reporting (DBP)
Rule code:	210	Rule name:	St1 DBP
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	559	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2456	Contamination Name:	Total Haloacetic Acids (HAA5)
Violation code:	27	Violation name:	Monitoring and Reporting (DBP)
Rule code:	210	Rule name:	St1 DBP
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2009
Cmp edt:	09/30/2009		

Violation id:	560	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	27	Violation name:	Monitoring and Reporting (DBP)
Rule code:	210	Rule name:	St1 DBP
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2009
Cmp edt:	12/31/2009		

Violation id:	561	Orig code:	S
State:	TX	Violation Year:	2009
Contamination code:	2456	Contamination Name:	Total Haloacetic Acids (HAA5)
Violation code:	27	Violation name:	Monitoring and Reporting (DBP)
Rule code:	210	Rule name:	St1 DBP
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2009
Cmp edt:	12/31/2009		

Violation id:	562	Orig code:	S
State:	TX	Violation Year:	2012
Contamination code:	0300	Contamination Name:	IESWTR
Violation code:	43		
Violation name:	Single Turbidity Exceed (Enhanced SWTR)		
Rule code:	122	Rule name:	LT1 ESWTR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	08/01/2012

Cmp edt:	08/31/2012		
Violation id:	565	Orig code:	S
State:	TX	Violation Year:	2006
Contamination code:	4000	Contamination Name:	Gross Alpha, Excl. Radon and U
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	340	Rule name:	Rads
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2006
Cmp edt:	12/31/2011		
Violation id:	566	Orig code:	S
State:	TX	Violation Year:	2006
Contamination code:	4006	Contamination Name:	Combined Uranium
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	340	Rule name:	Rads
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2006
Cmp edt:	12/31/2011		
Violation id:	567	Orig code:	S
State:	TX	Violation Year:	2006
Contamination code:	4010	Contamination Name:	Combined Radium (-226 and -228)
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	340	Rule name:	Rads
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2006
Cmp edt:	12/31/2011		
Violation id:	568	Orig code:	S
State:	TX	Violation Year:	2012
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2012
Cmp edt:	Not Reported		
Violation id:	571	Orig code:	S
State:	TX	Violation Year:	2012
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	27	Violation name:	Monitoring and Reporting (DBP)
Rule code:	210	Rule name:	St1 DBP
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2012
Cmp edt:	12/31/2012		
Violation id:	572	Orig code:	S
State:	TX	Violation Year:	2012
Contamination code:	2456	Contamination Name:	Total Haloacetic Acids (HAA5)
Violation code:	27	Violation name:	Monitoring and Reporting (DBP)
Rule code:	210	Rule name:	St1 DBP
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2012
Cmp edt:	12/31/2012		
Violation id:	578	Orig code:	S
State:	TX	Violation Year:	2012
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	02	Violation name:	MCL, Average
Rule code:	210	Rule name:	St1 DBP
Violation measur:	0.082	Unit of measure:	MG/L

State mcl:	0.08	Cmp bdt:	10/01/2012
Cmp edt:	12/31/2012		

Violation id:	581	Orig code:	S
State:	TX	Violation Year:	2013
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	02	Violation name:	MCL, Average
Rule code:	210	Rule name:	St1 DBP
Violation measur:	0.107	Unit of measure:	MG/L
State mcl:	0.08	Cmp bdt:	01/01/2013
Cmp edt:	03/31/2013		

Violation id:	585	Orig code:	S
State:	TX	Violation Year:	2013
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	02	Violation name:	MCL, Average
Rule code:	210	Rule name:	St1 DBP
Violation measur:	0.1	Unit of measure:	MG/L
State mcl:	0.08	Cmp bdt:	04/01/2013
Cmp edt:	06/30/2013		

Violation id:	588	Orig code:	S
State:	TX	Violation Year:	2013
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/13/2013
Cmp edt:	Not Reported		

Violation id:	590	Orig code:	S
State:	TX	Violation Year:	2013
Contamination code:	2950	Contamination Name:	TTHM
Violation code:	02	Violation name:	MCL, Average
Rule code:	210	Rule name:	St1 DBP
Violation measur:	0.086	Unit of measure:	MG/L
State mcl:	0.08	Cmp bdt:	07/01/2013
Cmp edt:	09/30/2013		

Violation id:	592	Orig code:	S
State:	TX	Violation Year:	2013
Contamination code:	5000	Contamination Name:	Lead and Copper Rule
Violation code:	52	Violation name:	Follow-up Or Routine LCR Tap M/R
Rule code:	350	Rule name:	LCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2013
Cmp edt:	Not Reported		

Violation ID:	105	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	11/22/2004
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal

Violation ID:	105	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	07/08/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving

Violation ID:	105	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	11/22/2004
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal

Violation ID:	105	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	12/15/2005

Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	205	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	12/15/2005
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	205	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	12/30/2004
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	205	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	07/08/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	307	Orig Code:	S
Enforcemnt FY:	2007	Enforcement Action:	07/02/2007
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	307	Orig Code:	S
Enforcemnt FY:	2008	Enforcement Action:	01/01/2008
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	307	Orig Code:	S
Enforcemnt FY:	2007	Enforcement Action:	07/02/2007
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	407	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Resolving
Violation ID:	407	Orig Code:	S
Enforcemnt FY:	2007	Enforcement Action:	08/01/2007
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	509	Orig Code:	S
Enforcemnt FY:	2009	Enforcement Action:	01/20/2009
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	509	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	08/09/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	509	Orig Code:	S
Enforcemnt FY:	2009	Enforcement Action:	01/20/2009
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	514	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	10/29/2010
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	514	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	04/01/2011
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	514	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	10/29/2010
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		

Violation ID:	515	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	11/17/2010
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	515	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	11/17/2010
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	515	Orig Code:	S
Enforcemnt FY:	2012	Enforcement Action:	04/04/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	517	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	12/12/2012
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	517	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/19/2013
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	517	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	07/13/2011
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	519	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/19/2013
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	519	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	07/13/2011
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	519	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	12/12/2012
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	521	Orig Code:	S
Enforcemnt FY:	2012	Enforcement Action:	03/01/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	521	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	07/25/2011
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	521	Orig Code:	S
Enforcemnt FY:	2011	Enforcement Action:	07/25/2011
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	526	Orig Code:	S
Enforcemnt FY:	2012	Enforcement Action:	10/25/2011
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	526	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	12/12/2012
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	526	Orig Code:	S

Enforcemnt FY:	2013	Enforcement Action:	07/19/2013
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	536	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	12/05/2012
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	536	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	10/29/2012
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	536	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/19/2013
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	536	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	12/12/2012
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	536	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	10/29/2012
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	536	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	12/01/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	537	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	538	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	539	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	540	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	541	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	542	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	543	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	544	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	545	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012

Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	546	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	547	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	548	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	549	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	550	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	551	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	552	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	553	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	554	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	555	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	556	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	557	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	558	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	559	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	560	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving

Violation ID:	561	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	11/12/2012
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	562	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	05/22/2013
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	568	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	02/12/2013
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	568	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	12/12/2012
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	568	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/19/2013
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	571	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	05/21/2013
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	572	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	05/21/2013
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	578	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	06/12/2013
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	578	Orig Code:	S
Enforcemnt FY:	2014	Enforcement Action:	01/25/2014
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	578	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/29/2013
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	578	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	06/12/2013
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	581	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	06/12/2013
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	581	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/24/2013
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	581	Orig Code:	S
Enforcemnt FY:	2014	Enforcement Action:	01/25/2014
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	585	Orig Code:	S
Enforcemnt FY:	2014	Enforcement Action:	01/25/2014
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	585	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/24/2013

Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	585	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	06/12/2013
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	588	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/23/2013
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	590	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	08/15/2013
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	590	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	08/15/2013
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
Violation ID:	590	Orig Code:	S
Enforcemnt FY:	2014	Enforcement Action:	01/25/2014
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	06/12/2013
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	06/12/2013
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/24/2013
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2014	Enforcement Action:	12/13/2013
Enforcement Detail:	St Public Notif received	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/24/2013
Enforcement Detail:	St Public Notif received	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/23/2013
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Not Reported		
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	07/24/2013
Enforcement Detail:	St Public Notif received	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2013	Enforcement Action:	08/15/2013
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S
Enforcemnt FY:	2012	Enforcement Action:	02/13/2012
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Not Reported
Violation ID:	Not Reported	Orig Code:	S

Enforcemnt FY:	2013	Enforcement Action:	06/12/2013
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Not Reported

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	105
Contaminant:	TTHM	Violation type:	2
Compliance start date:	7/1/2004 0:00:00	Compliance end date:	9/30/2004 0:00:00
Enforcement date:	11/22/2004 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	0.08		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	105
Contaminant:	TTHM	Violation type:	2
Compliance start date:	7/1/2004 0:00:00	Compliance end date:	9/30/2004 0:00:00
Enforcement date:	11/22/2004 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	0.08		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	105
Contaminant:	TTHM	Violation type:	2
Compliance start date:	7/1/2004 0:00:00	Compliance end date:	9/30/2004 0:00:00
Enforcement date:	12/15/2005 0:00:00	Enforcement action:	State AO (w/penalty) Issued
Violation measurement:	0.08		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	205
Contaminant:	TTHM	Violation type:	1
Compliance start date:	10/1/2004 0:00:00	Compliance end date:	12/31/2004 0:00:00
Enforcement date:	12/15/2005 0:00:00	Enforcement action:	State AO (w/penalty) Issued
Violation measurement:	0.08		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	205
Contaminant:	TTHM	Violation type:	1
Compliance start date:	10/1/2004 0:00:00	Compliance end date:	12/31/2004 0:00:00
Enforcement date:	12/30/2004 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	0.08		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	3059801
Contaminant:	SWTR	Violation type:	6
Compliance start date:	6/1/2001 0:00:00	Compliance end date:	6/30/2001 0:00:00
Enforcement date:	No Enf Action as of	Enforcement action:	7/8/2009 0:00:00
Violation measurement:	0		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	307
Contaminant:	COLIFORM (TCR)		
Violation type:	Max Contaminant Level, Monthly (TCR)		
Compliance start date:	6/1/2007 0:00:00	Compliance end date:	6/30/2007 0:00:00
Enforcement date:	7/2/2007 0:00:00	Enforcement action:	State Violation/Reminder Notice
Violation measurement:	Not Reported		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	307
Contaminant:	COLIFORM (TCR)		
Violation type:	Max Contaminant Level, Monthly (TCR)		
Compliance start date:	6/1/2007 0:00:00	Compliance end date:	6/30/2007 0:00:00
Enforcement date:	7/2/2007 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	Not Reported		

PWS name:	CITY OF MERCEDES	Population served:	14185

PWS type code:	C	Violation ID:	407
Contaminant:	7500	Violation type:	75
Compliance start date:	8/1/2007 0:00:00	Compliance end date:	12/31/2025 0:00:00
Enforcement date:	8/1/2007 0:00:00	Enforcement action:	State Violation/Reminder Notice
Violation measurement:	Not Reported		

PWS name:	CITY OF MERCEDES	Population served:	14185
PWS type code:	C	Violation ID:	509
Contaminant:	0300	Violation type:	38
Compliance start date:	11/1/2008 0:00:00	Compliance end date:	11/30/2008 0:00:00
Enforcement date:	No Enf Action as of	Enforcement action:	7/8/2009 0:00:00
Violation measurement:	Not Reported		

99
NE **TX WELLS** **TXBR40000042033**
1/2 - 1 Mile
Higher

Database:	Brackish Resources Aquifer Characterization System Database		
Well ID:	42913	Well Type:	Oil or Gas
Well Use:	Resource production		
Data Source:	RRC GAU Q Paper/Digital Geophysical Logs		
Well Depth (ft):	8897	Well Bottom Elevation (ft):	-99999
Total Hole Depth (ft):	8897	Bottom Hole Elevation (ft):	-99999
Drill Date:	06/05/1975	Kelly Bushing Height (ft):	11
Remarks:	N/A		

I100
SW **TX WELLS** **TXMON6000275449**
1/2 - 1 Mile
Higher

Database:	Submitted Drillers Reports Database		
Well Report #:	279659	Well Type:	New Well
Proposed Use:	Test Well	Borehole Depth (ft):	19
Injurious Water Quality:	Not Reported	Plugging Rpt #:	134742

I101
SW **TX WELLS** **TXPLU6000132684**
1/2 - 1 Mile
Higher

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	279659	Plugging Rpt #:	134742
Well Type:	Test Well	Borehole Depth (ft):	19

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance	Database	EDR ID Number

1
ENE
1/2 - 1 Mile

OIL_GAS **TXOG90001212903**

Surface ID:	564	Well Number:	Not Reported
Bottom ID:	564	API #:	42215
Current Wells #:	1	Well Type:	Dry Hole
Radioactive:	Not Reported	Side Track:	Not Reported

2
NNE
1/2 - 1 Mile

OIL_GAS **TXOG90001212900**

Surface ID:	561	Well Number:	31083
Bottom ID:	561	API #:	4221531083
Current Wells #:	1	Well Type:	Dry Hole
Radioactive:	Not Reported	Side Track:	Not Reported

3
NE
1/2 - 1 Mile

OIL_GAS **TXOG90001212901**

Surface ID:	563	Well Number:	Not Reported
Bottom ID:	563	API #:	42215
Current Wells #:	1	Well Type:	Dry Hole
Radioactive:	Not Reported	Side Track:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: TX Radon

Radon Test Results

County	Mean	Total Sites	%>4 pCi/L	%>20 pCi/L	Min pCi/L	Max pCi/L
HIDALGO	.5	22	.0	.0	<.5	1.9

Federal EPA Radon Zone for HIDALGO County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for HIDALGO COUNTY, TX

Number of sites tested: 18

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.500 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005, 2010 and 2015 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory
Source: Texas General Land Office
Telephone: 512-463-0745

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Public Water Supply Sources Databases
Source: Texas Commission on Environmental Quality
Telephone: 512-239-6199
Locations of public drinking water sources maintained by the TCEQ.

Groundwater Database
Source: Texas Water Development Board
Telephone: 512-936-0837

Well Report Database
Source: Department of Licensing and Regulation
Telephone: 512-936-0833

Water Well Database
Source: Harris-Galveston Coastal Subsidence District
Telephone: 281-486-1105

Brackish Resources Aquifer Characterization System Database
Source: Texas Water Development Board
WDB's Brackish Resources Aquifer Characterization System (BRACS) was designed to map and characterize the brackish aquifers of Texas in greater detail than previous studies. The information is contained in the BRACS Database and project data are summarized in a project report with companion geographic information system data files.

Submitted Driller's Reports Database
Source: Texas Water Development Board
Telephone: 512-936-0833
The Submitted Driller's Report Database is populated from the online Texas Well Report Submission and Retrieval System which is a cooperative Texas Department of Licensing and Regulation (TDLR) and Texas Water Development Board (TWDB) application that registered water-well drillers use to submit their required reports.

OTHER STATE DATABASE INFORMATION

PHYSICAL SETTING SOURCE RECORDS SEARCHED

Texas Oil and Gas Wells
Source: Texas Railroad Commission
Telephone: 512-463-6882
Oil and gas well locations.

RADON

State Database: TX Radon
Source: Department of Health
Telephone: 512-834-6688
Rinal Report of the Texas Indoor Radon Survey

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

STREET AND ADDRESS INFORMATION

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APPENDIX D

HISTORICAL SOURCES

474878

2000 East Express 83

Mercedes, TX 78570

Inquiry Number: 7245729.5

February 07, 2023

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

02/07/23

Site Name:

474878
2000 East Express 83
Mercedes, TX 78570
EDR Inquiry # 7245729.5

Client Name:

AEI Consultants
2500 Camino Diablo
Walnut Creek, CA 94597
Contact: Cynthia

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	*Scale*	*Details*	*Source*
2020	1"=500'	Flight Year: 2020	USDA/NAIP
2016	1"=500'	Flight Year: 2016	USDA/NAIP
2012	1"=500'	Flight Year: 2012	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
2002	1"=500'	Acquisition Date: January 01, 2002	USGS/DOQQ
1996	1"=500'	Acquisition Date: January 12, 1996	USGS/DOQQ
1983	1"=500'	Flight Date: February 28, 1983	NHAP
1977	1"=500'	Flight Date: July 21, 1977	USGS
1975	1"=500'	Flight Date: November 07, 1975	USDA
1967	1"=500'	Flight Date: January 01, 1967	USGS
1953	1"=500'	Flight Date: April 01, 1953	USGS
1950	1"=500'	Flight Date: November 04, 1950	USDA
1939	1"=500'	Flight Date: October 29, 1939	USDA

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Aerial Photograph

2020

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 2020

AEI

Aerial Photograph

2016

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 2016

Aerial Photograph

2012

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 2012

AEI

Aerial Photograph

2006

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 2006

AEI

Aerial Photograph

2002

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 2002

AEI

Aerial Photograph

1996

0 Feet 500 1000 2000

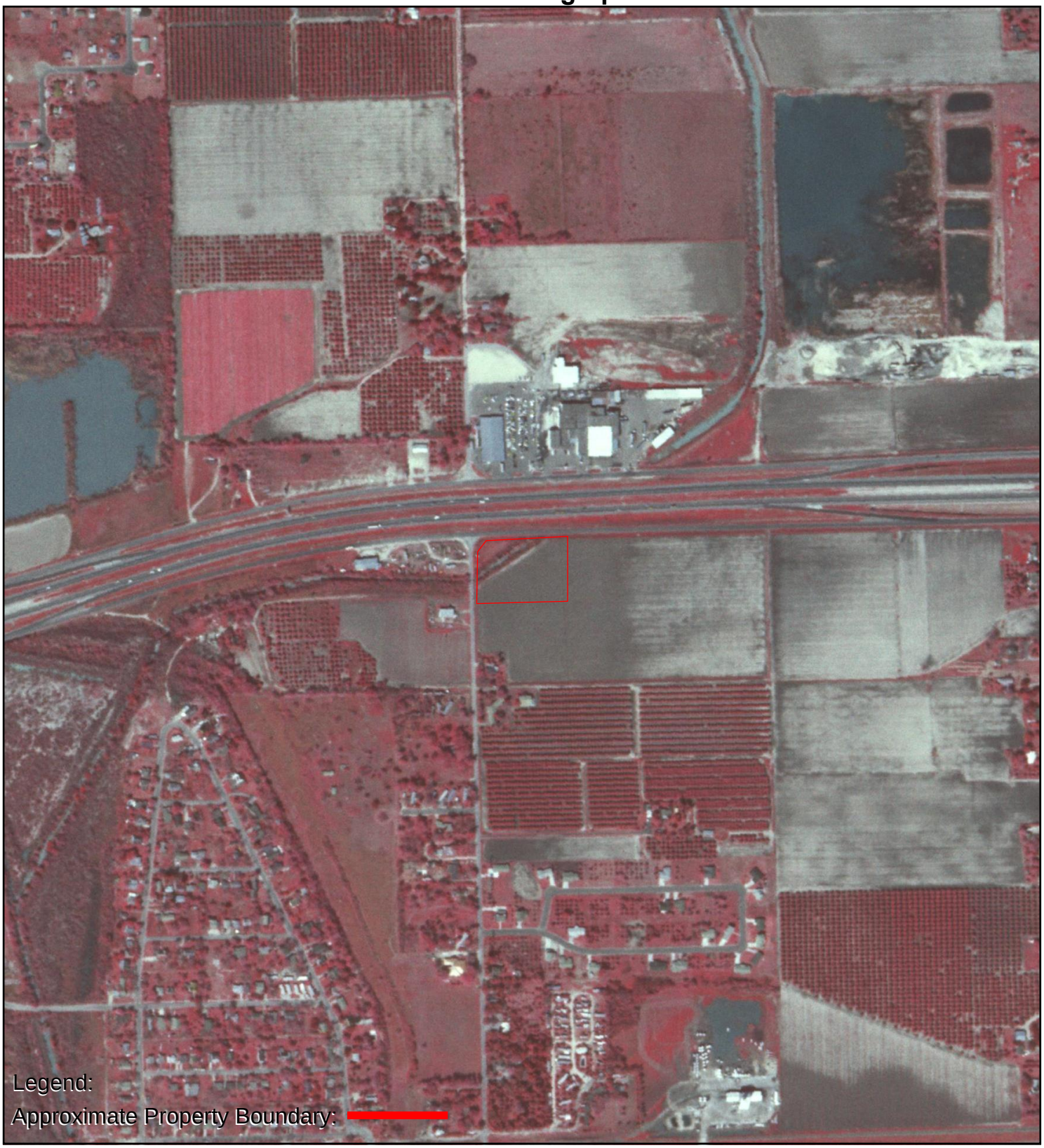
N

AERIAL PHOTOGRAPH - 1996

AEI

Aerial Photograph

1983



0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 1983

AEI

Aerial Photograph

1977

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 1977

AEI

Aerial Photograph

1975

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 1975

Aerial Photograph

1967

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 1967

AEI

Aerial Photograph

1953

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 1953

AEI

Aerial Photograph

1950

Legend:

Approximate Property Boundary:

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 1950

AEI

Aerial Photograph

1939

0 Feet 500 1000 2000

N

AERIAL PHOTOGRAPH - 1939

AEI

474878

2000 East Express 83

Mercedes, TX 78570

Inquiry Number: 7245729.3

February 07, 2023

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

02/07/23

Site Name:	Client Name:
474878	AEI Consultants
2000 East Express 83	2500 Camino Diablo
Mercedes, TX 78570	Walnut Creek, CA 94597
EDR Inquiry # 7245729.3	Contact: Cynthia

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AEI Consultants were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # 2A73-4ADD-A914

PO # 329134

Project 474878

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results

Certification #: 2A73-4ADD-A914

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

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474878
2000 East Express 83
Mercedes, TX 78570

Inquiry Number: 7245729.6
February 09, 2023

The EDR-City Directory Image Report

Environmental Data Resources Inc

6 Armstrong Road
Shelton, CT 06484
800.352.0050
www.edrnet.com

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with any questions or comments.

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EXECUTIVE SUMMARY

DESCRIPTION

Environmental Data Resources, Inc.'s (EDR) City Directory Report is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's City Directory Report includes a search of available city directory data at 5 year intervals.

RECORD SOURCES

EDR's Digital Archive combines historical directory listings from sources such as Cole Information and Dun & Bradstreet. These standard sources of property information complement and enhance each other to provide a more comprehensive report.

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Data by infoUSA®

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RESEARCH SUMMARY

The following research sources were consulted in the preparation of this report. A check mark indicates where information was identified in the source and provided in this report.

Year	Target Street	Cross Street	Source
2017	☑	☑	EDR Digital Archive
2014	☑	☑	EDR Digital Archive
2010	☑	☑	EDR Digital Archive
2005	☑	☑	EDR Digital Archive
2000	☑	☑	EDR Digital Archive
1995	☑	☑	EDR Digital Archive
1992	☑	☑	EDR Digital Archive
1987	☑	☑	Cole Criss-Cross Directory
1982	☑	☑	Cole Criss-Cross Directory
1977	☑	☑	Cole Criss-Cross Directory
1972	☑	☑	Cole Criss-Cross Directory
1967	☑	☑	Cole Criss-Cross Directory
1964	☑	☑	Cole Criss-Cross Directory
1959	☑	☐	Cole Criss-Cross Directory

EXECUTIVE SUMMARY

Year	Target Street	Cross Street	Source

FINDINGS

TARGET PROPERTY STREET

2000 East Express 83
Mercedes, TX 78570

Year	*CD Image*	*Source*
E EXPRESSWAY 83		
2017	pg A2	EDR Digital Archive
2014	pg A5	EDR Digital Archive
2010	pg A9	EDR Digital Archive
2005	pg A12	EDR Digital Archive
2000	pg A14	EDR Digital Archive
1995	pg A16	EDR Digital Archive
1987	pg A20	Cole Criss-Cross Directory
1987	pg A21	Cole Criss-Cross Directory
1982	pg A23	Cole Criss-Cross Directory
1982	pg A24	Cole Criss-Cross Directory
1977	pg A26	Cole Criss-Cross Directory
1972	pg A28	Cole Criss-Cross Directory
1967	pg A30	Cole Criss-Cross Directory
1964	pg A32	Cole Criss-Cross Directory
1959	pg A33	Cole Criss-Cross Directory
HIGHWAY 83 E		
1992	pg A18	EDR Digital Archive

FINDINGS

CROSS STREETS

Year	CD Image	Source	
DAWSON RD			
2017	pg. A1	EDR Digital Archive	
2014	pg. A4	EDR Digital Archive	
2010	pg. A7	EDR Digital Archive	
2005	pg. A10	EDR Digital Archive	
2000	pg. A13	EDR Digital Archive	
1995	pg. A15	EDR Digital Archive	
1992	pg. A17	EDR Digital Archive	
1987	pg. A19	Cole Criss-Cross Directory	
1982	pg. A22	Cole Criss-Cross Directory	
1977	pg. A25	Cole Criss-Cross Directory	
1972	pg. A27	Cole Criss-Cross Directory	
1967	pg. A29	Cole Criss-Cross Directory	
1964	pg. A31	Cole Criss-Cross Directory	
1959	-	Cole Criss-Cross Directory	Street not listed in Source
VOGEL DR			
2017	pg. A3	EDR Digital Archive	
2014	pg. A6	EDR Digital Archive	
2010	-	EDR Digital Archive	Street not listed in Source
2005	-	EDR Digital Archive	Street not listed in Source
2000	-	EDR Digital Archive	Street not listed in Source
1995	-	EDR Digital Archive	Street not listed in Source
1992	-	EDR Digital Archive	Street not listed in Source
1987	-	Cole Criss-Cross Directory	Street not listed in Source
1982	-	Cole Criss-Cross Directory	Street not listed in Source
1977	-	Cole Criss-Cross Directory	Street not listed in Source
1972	-	Cole Criss-Cross Directory	Street not listed in Source
1967	-	Cole Criss-Cross Directory	Street not listed in Source
1964	-	Cole Criss-Cross Directory	Street not listed in Source

FINDINGS

Year	***CD Image***	***Source***	
1959	-	Cole Criss-Cross Directory	Street not listed in Source

City Directory Images

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 2017

191	HALLER, MAEHELEN
198	BOWER, GUY W
202	RAMIREZ, MARIO
215	GARZA, ROBERTO
306	RIOS, BERNABE
308	GARCIA, VERONICA
	VALDERRAMA, G
315	MARTINEZ, ALEJANDRO
325	GONZALEZ, JOSE S
333	GARZA, ARACELI
350	CASTILLO, ANTONIO J
360	RODRIGUEZ, MARISVEL O
361	CARDONA, TERRY M
525	VALLEJO, JAVIER I
613	BARRIENTES, PEDRO D
615	RIVERA, MICHAEL L
681	GAMEZ, RAUL
700	CINTAS
805	KARIOS MACHINE SHOP INC

Target Street	Cross Street	Source
✓	-	EDR Digital Archive

E EXPRESSWAY 83 2017

1635	FLORES, GILBERTO Y
1649	CANO MOTORS
1653	ISLAS, MARCO
1747	CAMARGO MOTORS
1750	ANDERSON BEAN BOOT COMPANY
	OLATHE BOOT COMPANY
	RIOS OF MERCEDES
2000	LASERLUX
	NEUHAUS & CO LTD
2020	GUZMAN & MUNOZ ENGINEERING & SUR
4701	LA COPA INN
4801	WHATABURGER
4901	CHILIS

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

VOGEL DR 2017

301	BESOS Y CARICIAS ADULT DAYCARE III
701	ZIWA HOLDING

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 2014

112	WILSON, SOLY
191	HALLER, MIRIAM E
	NORMAN, ROYCE K
192	ALVARADO, VICTORIA
	GONZALEZ, MAGDIEL
	HERNANDEZ, CHRISTINA
	HERRERA, BLANCA E
	RAMOS, RACHEL
	VASQUEZ, ABEL
198	BOWER, GUY W
202	RAMIREZ, MARIO
215	GARZA, ROBERTO
225	OCCUPANT UNKNOWN,
306	OCCUPANT UNKNOWN,
	PRESA, LETICIA
308	OCCUPANT UNKNOWN,
315	MARTINEZ, ALEJANDRO
325	GONZALEZ, JOSE S
333	SAUCEDA, RUBEN J
350	BRAVO, BENITO J
360	RODRIGUEZ, MARISVEL O
361	CARDONA, RENE A
410	IGLESIABAUTISTA, FILADELFIA
525	OCCUPANT UNKNOWN,
613	BARRIENTES, PEDRO D
615	RIVERA, MICHAEL L
630	OCCUPANT UNKNOWN,
681	GAMEZ, RAUL
	OCCUPANT UNKNOWN,
700	CINTAS
	CINTAS FACILITY SERVICES OF BROWNSVI
	CINTAS FIRST AID SUPPLIES & SAFETY
	CINTAS UNIFORMS UNIFORM SERVICES & W
704	THE BODY SHOP
805	KARIOS MACHINE SHOP INC

Target Street	Cross Street	Source
✓	-	EDR Digital Archive

E EXPRESSWAY 83 2014

1635	LOZANO, HERNANDEZ A
1649	CANO MOTORS
1741	MERCEDES MOTOR MACHINE SHOP
1747	CAMARGO MOTORS
1750	ANDERSON BEAN BOOT COMPANY
	OLATHE BOOT COMPANY
	RIOS OF MERCEDES
2000	LASERLUX
2020	GUZMAN & MUNOZ ENGINEERING & SUR
4701	LA COPA INN
4801	WHATABURGER
4901	CHILIS

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

VOGEL DR 2014

301	BESOS Y CARICIAS ADULT DAY CARE
311	ORBIT BROADBAND

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 2010

112	CAVAZOS, FRANCISCO
191	COURTS, ANN L
	HALLER, MIRIAM E
192	ALVARADO, LAURA
	ALVAREZ, KARLA
	BOUTCHER, ERICK P
	BROCHIS, JOHN F
	CAMPOS, PETRA
	GARZA, JESSIE
	GONZALES, AMELIA
	LAVOIE, HELEN
	MARTINEZ, JOSE A
	MERCEDES ESCONDIDO APT & RV
	RAMOS, RACHEL
	SCHRAB, AMBER
	VASQUEZ, ABLE
195	HERNANDEZ, JUAN
198	GONZALES, MARIA
202	RAMIREZ, MARIO
215	GARZA, ROBERTO
225	OCCUPANT UNKNOWN,
304	DELEON, SANDRA
	LIN-AO, IMELDA
306	OCCUPANT UNKNOWN,
308	BRIONES, VIOLA
	DIAZ, JAIME
	OCCUPANT UNKNOWN,
315	MARTINEZ, ALEX
325	GONZALEZ, ISAAC
333	OCCUPANT UNKNOWN,
350	CASTILLO, ROBERTO R
360	LITTLE, ROBERT L
361	CARDONA, RENE A
400	BARBOSA, GLORIA M
402	OCCUPANT UNKNOWN,
403	OCCUPANT UNKNOWN,
404	OCCUPANT UNKNOWN,
405	OCCUPANT UNKNOWN,
408	AGUILAR, MIRIAM
410	IGLESIA BAUTISTA FILADELFIA
	IGLESIABAUTISTA, FILADELFIA
525	OCCUPANT UNKNOWN,
613	OCCUPANT UNKNOWN,
614	OCCUPANT UNKNOWN,
615	RIVERA, MICHAEL L
630	OCCUPANT UNKNOWN,
681	GAMEZ, FRANCISCO
	OCCUPANT UNKNOWN,
700	CINTAS FIRST AID & SAFETY
	CINTAS THE UNIFORM PEOPLE

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 2010 (Cont'd)

805 KARIOS KAR KARE CTR
KARIOS MACHINE SHOP INC

Target Street	Cross Street	Source
✓	-	EDR Digital Archive

E EXPRESSWAY 83 2010

1635	FLORES, GILBERTO Y
1649	CANO AUTO SALES
1750	RIOS OF MERCEDES
3824	DALLAS FORMICA COUNTER TOPS
3825	DALLAS CUSTOM COUNTER TOPS
4012	CAB TRUCK & AUTO SALES
4701	LA CPOA INN
4901	CHILIS GRILL & BAR

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 2005

112	CAVAZOS, FRANCISCO
182	FLORES, MARIBEL
191	HALLER, MIRIAM E
192	ACEVEDO, CLAUDIA
	ALMAZAN, MARIA D
	ARROYO, JOSE M
	BORROSO, DENISE
	BOUTCHER, ERICK P
	CABRERA, NOE A
	CAMPOS, PETRA
	CHAPPELLIE, JOE
	CONTRERAS, ROSALINDA
	DELANGEL, CRUZ
	GARCIA, TERESA
	GARZA, RAY
	GONZALES, AMELIA
	GUERRERO, R
	HARRISON, EDWARD L
	LAVOIE, HELEN
	LOPEZ, FELIPE
	MARES, JOSE
	MARTZLUF, GILES
	PEMPLETON, FRANCES
	RODRIGUEZ, MARTIN
	SALAZAR, JUANA
	TREVINO, LARRY
	VALDEZ, JUAN
	VASQUEZ, ABLE
	WORKMAN, GLEN
	ZABOLOTNY, WILLIAM
195	HERNANDEZ, JUAN
198	GONZALES, MARIA
202	OCCUPANT UNKNOWN,
215	GARZA, ROBERTO
304	DELEON, SANDRA
306	RODRIGUEZ, PEDRO
	WILLIAMS, JOSEPH N
308	BRIONES, VIOLA
	JONES, BERTHA
	OCCUPANT UNKNOWN,
315	MARTINEZ, ALEX
325	SANTISTEBAN, PATRICIA
350	CASTILLO BROTHERS
	CASTILLO, ROBERTO
360	LITTLE, ROBERT L
400	ORTEGA, CANDELARIA
402	OCCUPANT UNKNOWN,
403	OCCUPANT UNKNOWN,
404	OCCUPANT UNKNOWN,
405	RAMOS, JUAN C

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 2005 (Cont'd)

408	MERCADO, BALTAZAR
410	IGLESIABAUTISTA, FILADELFIA
525	TELLEZ, MANUEL
613	BARRIENTES, PEDRO D
615	HOFFMAN ENGINEERING M3
	RIVERA, MICHAEL L
681	OCCUPANT UNKNOWN,

Target Street	Cross Street	Source
✓	-	EDR Digital Archive

E EXPRESSWAY 83 2005

400	WHATABURGER
1635	FLORES, GILBERTO
1649	CANO AUTO SALES
	CANO, JESUS
1750	OLATHE BOOT CO
	RIOS OF MERCEDES

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 2000

104	OCCUPANT UNKNOWN,
112	CAVAZOS, FRANK
192	DEVLIN, BETTY J
	GARCES, G
	MAYER, GERHARD P
	MCCREA, DIANE
	PENA, G
	ROBLES, K
	TREVINO, MARIA
198	JENKINS, EARL
215	GARZA, JOSEFA C
225	OCCUPANT UNKNOWN,
304	TREVINO, F
306	OCCUPANT UNKNOWN,
308	GARIBAY, FRANK
	VILLANUEVA, HECTOR J
315	MARTINEZ, NORMA
350	CASTILLO, BLANCA
360	OCCUPANT UNKNOWN,
361	CARDONA, TERRY K
390	OCCUPANT UNKNOWN,
403	HERNANDEZ, C
404	FLORES, MARIA
613	BARRIENTES, DRENA
630	ROBBINS, CHRIS
704	COMPUTER SHOP
	HIGH TEC MECHANICAL INCORPORATED
	MISSION TRAVEL & TRANSLATION
714	KARIOS MACHINE SHOP INCORPORATED

Target Street	Cross Street	Source
✓	-	EDR Digital Archive

E EXPRESSWAY 83 2000

300	SPEEDY CHECK
	SPEEDY CHECK NO 45
	SPEEDY STOP NO 45
400	WHATABURGER RESTAURANTS
1649	CANO AUTO SALES
1741	SALAS, RUBY
1750	ANDERSON BEAN BOOT COMPANY

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 1995

112	CAVAZOS, FRANK
192	CORRAL, G
	FELLOWS, JOHNNY
	FONSECA, HECTOR
	KRAIMER, GERHARD
	MARTINEZ, ERNEST
	OPPELT, ROGER
	POSADAS, ERIC
	RUIZ, M
	TORRES, RUFINO
	TREVINO, LEONOR
198	PARRY, ANNA L
225	NEWMANN, W C
306	MICHAUD, J S
315	MARTINEZ, NORMA
325	HART, JAMES JR
350	CASTILLO, BLANCA
	LUNA, FRAK
360	BOURGEOIS, MAURICE
404	HALDER, DONALD
614	PAGE, JAMES
704	HIGH TEC MECHCL
714	KARIOS KAR KARE

Target Street	Cross Street	Source
✓	-	EDR Digital Archive

E EXPRESSWAY 83 1995

1649	CANO AUTO SALES
	CANO CONSTRUCTION
1750	ANDERSON BEAN BOOT

Target Street	Cross Street	Source
-	✓	EDR Digital Archive

DAWSON RD 1992

192	AUSTIN, GORDON
	GOMEZ, CECILIA
	MARTINEZ, DELFINA
	MISSIONARIES L D S
304	SABBAR, DAVID
306	MICHAUD, J S
315	LASERLUX
325	HART, JAMES JR
350	CASTILLO, BLANCA
614	PEREZ, LILLIE

Target Street	Cross Street	Source
✓	-	EDR Digital Archive

HIGHWAY 83 E 1992

1741 SALAS E&SONS MCHN

Target Street	Cross Street	Source
-	✓	Cole Criss-Cross Directory

DAWSON RD 1987

1 RESIDENCE

DAWSON DR

R R 2 78570

1- END CT 230 $B..H 8

NO #	Edward Cain	76		565-2189
NO #	Rene Cardona	84		565-9169
NO #	Juan Delafuente		-	565-3910
NO #	Louise Y Mills		⌑	565-3361
NO #	W C Newman	79		565-4263
NO # ★	D J Schwarz	76		565-2231
NO #	Fillip Sticha	86		565-4572
NO #	Mark F Talbott		⌑	565-2706
	Terry Ramirez		⌑	565-5464
	1/2 Mi N Dawson			
	Gloria Robledo		⌑	565-5464
	1/2 Mi N Dawson			
	Rudy Vela Jr	84		565-2255
	1/2 Mi N Dawson			

10 RESIDENCE 1 BUSINESS

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1987

2 RESIDENCE

● **EXPRESSWAY 83** 78570

1750	★	Mercedes Boot Co	86	565-4911
7015	★	Unit Source	⌑	565-6329
NO #	★	H&H Foods	86	542-7183
NO #	★	H&H Foods	68	383-5694
NO #	★	H&H Foods	⌑	423-2267
NO #	★	All Star Iron Work	83	565-4987
NO #	★	H&H Meat Prdt Inc	68	565-6363
NO #		Manuela Hernandez	⌑	565-9633
NO #	★	Jehovahs Witnesses	86	565-4134
NO #	★	Lariat Mbl Hm&Rv	85	565-3172
NO #	★	Methodist Retreat	78	565-9064
NO #	★	Ramiro Ramirez	86	565-1160
NO #	★	Rodeway Inn	70	565-3121
NO #	★	Ryder Truck Rntl	⌑	565-6834
NO #		Loren Sipes	83	565-2730
NO #	★	Sosas Used Cars	85	565-3861
NO #		Alejandro Soto Sr	86	565-1653
NO #		Maria Alicia Soto	86	565-1653
NO #	★	Vctry Prodc Market	86	565-1160
	★	Gunite Pools Inc	86	544-2447
		2 1/2 Mi Exp 83 W		
	★	Roberson Pools	82	797-1412
		2 Mi E Expy 83		
	★	Guinte Pools Inc	86	686-6967
		2 1/2mi W Expwy 83		
	★	All Vally Flea Mkt	79	565-2751
		2 Mi W Expressway		
		Vince Bierbaum	68	565-1481
		2 1/2 Mi EExpressway		
	★	Guinte Pools Inc	85	565-5261
		2 1/2 Exp 83 W		
	★	Landscape Irrgtrs	⌑	565-5261
		2 1/2 Mi W Expwy 83		
	★	Trlr Mounted Ferrs	71	565-1481
		2 1/2 Mi EExpressway		

5 RESIDENCE 22 BUSINESS

● FARM RD 491 78570

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1987

HIGHWAY 83 E 78570

100– 199 CT 230 $B..H 8

100	★	**Mercedes Disc Furn**	**.82**	**565-1721**
NO #		Dewey Acker	.79	565-1748
NO #	**★**	**All Str Iron**	**.83**	**565-2627**
NO #	**★**	**B&W Service Co**	**.86**	**565-9141**
NO #		Byron Campion	.81	565-6038
NO #		Antonio Campos	.86	565-2260
NO #		Eddie Conner	.75	565-1500
NO #		Harrison B Cord	¤	565-9318
NO #	**★**	**Discount Pckr**	¤	**565-3776**
NO #	**★**	**Future Glass**	**.80**	**565-4337**
NO #		Lupe Gomez	.86	565-5616
NO #		Raleigh Haney	¤	565-2750
NO #		Salvador Hernandez	–	565-3972
NO #		H H Hokanson	.85	565-3628
NO #		Anselmo Ligas	.79	565-4647
NO #		James H Looney	.81	565-1315
NO #		Noemi Lopez	¤	565-6404
NO #		Frances Pemelton	.78	565-5674
NO #		Ezekiel Pumarejo	.86	565-4014
NO #		Joe Saenz Jr	.81	565-4772
		Loran E Clark		565-1021
		1 1/2 E & Hwy		
		H W Cumming	¤	565-6168
		1/2 Mie State Hwy 83		
		Dora A Delaq	.82	565-4095
		1 1/4 Mi E Hwy 83		
		Katherine Gail	.86	565-3432
		1 1/4 Mi E Hwy 83		
		Isabel Garza	.74	565-1274
		2 1/4 Mi E Hwy 83		
		Raul Garza	.74	565-1274
		2 1/4 Mi E&Hwy 83		
		Allen Heggen	.81	565-5439
		1 1/4 Mi E Hwy 83		
	★	**Heggen Electric Co**		**565-1431**
		1 1/4 Mi E Hwy 83		
	★	**Heggen Electric**		**565-2770**
		1 1/4 Mi E Hwy		
	★	**Lloyd Heggen**	**.80**	**565-1431**
		1 1/4 Mi E Hwy		
	★	**Heggen Self Storge**	**.79**	**565-2770**
		1 1/4 Mi E Highway		
		George Hinds	.85	565-3324
		1/2 Mi E Hwy 83		
		Russel Hodges	.72	565-1810
		2 3/4 Mi E Hwy 83		
		Herbert Kraimer	–	565-6083
		1/2 Mie Hwy 83		
	★	**Longorias Welding**	**.84**	**565-5980**
		3 Mi E Old Hwy 83		
		Jorge Lopez	.82	565-4095
		1 1/4 E Hwy 83		
	★	**Orlando Wrecker Sv**	**.86**	**565-5722**
		2 3/4 E & Hwy 83		
		Jake B Pemelton	.80	565-1359
		1 1/2 Mi E Hwy		
		Yolanda Maria Pina	.84	565-6966
		1 1/2 Mi E Hwy 83		
		Domingo Rivas	¤	565-1202
		1 1/2 Mi E Hwy 83		
	★	**Salas&Sons Mchn**	–	**565-5856**
		1/2 Mi E Expwy 83		
	★	**Sisters St Benedct**	¤	**565-3911**
		1 1/4 Mi E Hwy 83		
		Alexander Solis	.77	565-1732
		2 1/2 Mi W&Hwy		
		Ricardo A Solis	.77	565-1732
		2 1/2 Mi W Highway		
	★	**Tide Products**	**.64**	**565-2436**
		3/4 Mi E State Hwy		
	★	**Ultralite Flitepark**	**.85**	**565-2015**
		1 1/2 E Hwy 83		
	★	**Vogue Motel**	**.79**	**565-9008**
		1/2 Mi E Hwy 83		
		Margarito Zepeda	.84	565-9635
		2 1/2 Rd E&Old 83		

32 RESIDENCE 16 BUSINESS

Target Street	Cross Street	Source
-	✓	Cole Criss-Cross Directory

DAWSON RD 1982

4 RESIDENCE

DAWSON DR

R R 2 **78570**

041670

No #	**★ Alvarado Auto Sply**		**565-6011**
No #	Bonnie Bazar	□	565-5571
No #	Edward Cain	76	565-2189
No #	Pedro Izaguirre	78	565-5812
No #	W C Newman	79	565-4263
No #	D J Schwarz	80	565-1867
No #	**★ D J Schwarz**		**565-2231**
No #	Rudy Vallejo	□	565-4812
No #	Don H Vogel	79	565-5855

7 RESIDENCE 2 BUSINESS

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1982

1 RESIDENCE

EXPRESSWAY 78570
See Highway E

EXPRESSWAY E 78570
See Highway E

EXPRESSWAY 83
See Highway 83 W
R R 2 78570

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1982

HIGHWAY E 78570
041980
No # Byron Campion.....81 565-6038
No # ★ Future Glass **565-4337**
No # ★ Methodist Retreat **565-9064**
No # Narciso Ortiz 81 565-4027
No # Hugh Roberts.....81 565-5296
No # ★ Rodeway Inn..... **565-3121**
★ All Vally Flea Mkt **565-2751**
mi 2 W&Expressway
Vince Bierbaum.....68 565-1481
mi 2 1/2 E&Exprswy
Loran E Clark..... 565-1021
mi 1 1/2 E&Highway
Eliseo Fuentes 80 565-5282
3 Mi E Hwy 83
Allen Heggen.....81 565-5439
1 1q Mi E Hwy 83
★ Heggen Electric Co..... **565-1431**
mile 1 1/4 E Hwy
★ Heggen Electric..... **565-2770**
mi 1 1/4 E Hwy
★ Heggen Self Storge..... **565-2770**
1 1/4 Mi E Highway
Glen Nordstrom .....□ 565-6479
1/2 Mi E State Mwy
★ Tide Products Inc..... **565-2436**
3/4 E State Highway
★ Trlr Mounted Ferrs..... **565-1481**
mi 2 1/2 E&Expresswy
F A Treadaway 81 565-6741
1/2 Mi E St Hwy
★ Vogue Motel..... **565-9008**
1/2 Mi E St Hwy 83
9 RESIDENCE 10 BUSINESS

HIGHWAY W 78570
041990
717 ..... NP
735 ★ Roberts Meats..... **565-1751**
No # ★ Jehovahs Witnesses..... **565-4134**
Ernest R Coil 565-3023
mi 2 1/2 W&Hwy
Mrs Leta Klefisch 71 565-2846
mi 2 3/4 W&Hwy
Alex Solis 77 565-1732
mi 2 1/2 W&Hwy
Ricardo A Solis.....77 565-1732
mi 2 1/2 W&Hwy
★ Valley Signs..... **565-2762**
mile 2 1/2 W Express
5 RESIDENCE 3 BUSINESS

HIGHWAY 83 W 78570
←←←←←R R 2→→→→→→
042000
2½ A&A Auto Sales..... **565-4031**
100 ★ Mercedes Disc Furn .....□ **565-1721**
717 G L Solis .....□ 565-5067
1045 ★ Almanza Phillip 66..... **565-9920**
1102 ★ B Bunton Auto Sup..... **565-2473**
1305 ★ Polo Guerrero Prdc..... **565-6705**
1307 ..... NP
No # ★ ABC Truck Rental..... **565-2439**
No # Dewey Acker 79 565-1748
No # Edward A Bringman .....□ 565-5976
No # ★ Cavazos Used Cars..... **565-9002**
No # Eddie Conner 75 565-1500
No # ★ Cortino Lath&Plstr..... **565-2309**
No # ★ Cortinos Itln Rstr..... **565-2309**
No # ★ Daughters Charity..... **565-6787**
No # Elias Davila 79 565-4713
No # Tony Delagarza 77 565-4232
No # ★ Fry Farm Equip..... **565-6431**
No # Heliodoro Garcia .....□ 565-5455
No # R Gonzales Jr 81 565-5515
No # ★ Gonzalez Const Mat.....□ **565-3600**
No # ★ Guerra Auto Body.....□ **565-4432**
No # ★ H&H Meat Products..... **565-6363**
No # ★ Heart of The Vally..... **565-3172**
No # Lupe Hernandez .....□ 565-6655
No # ★ Hoover Constrn.....□ **565-3901**
No # ★ Juans Welding Svce..... **565-3711**
No # Fieet S Lentz Jr 79 565-5332
No # Anselmo Ligas 79 565-4647
No # Samuel D Longoria 81 565-5980
No # James H Looney 81 565-1315
No # ★ Magic Vly Electrc..... **565-2451**
No # ★ McWhorter Lumber..... **565-2391**
No # ★ Midway Lumber Co..... **565-2651**
No # Anita Palacios 77 565-5616
No # Mario Palacios 79 565-2939
No # Frances Pemelton.....78 565-5674
No # Clemente Ramos Sr.....80 565-6649
No # ★ Red Horse Frontier.....□ **565-6560**
No # ★ Roberts Air Cg&Htg..... **565-4852**
No # Joe Saenz Jr. 81 565-4772
No # Armando Serrata 81 565-6696
No # Isabel Silva 78 565-4750
No # C J Simonson .....□ 565-3628
No # John Smith .....□ 565-6717
No # Jose Ruben Soto .....– 565-4987
No # ★ So Tx Lettuce Comm..... **565-2453**
No # Henry Sullivan.....□ 565-6277
No # R C Swain .....– 565-1902
No # ★ Tonys Used Furnitr..... **565-4232**
No # ★ Valley Electric..... **565-4182**
No # Clint Williams 78 565-2728
No # Jesus Zepeda 80 565-5536
B J Buchanan .....□ 565-4154
mi 3 E&Expwy 83
Charles Cortino 81 565-6779
2 3/4 Mi W Hwy 83
Dora A Delaq .....□ 565-4095
12/4 E Nwy 83
★ Dons Auto Parts.....□ **565-6161**
mi 2 1/2 W&Hy 83
★ Dons Auto Aprts..... **565-1742**
mi 2 1/2 W&Hy 83
Isabel Garza.....74 565-1274
mi 2 1/4 E&Hwy 83
Raul Garza 74 565-1274
mi 2 1/4 E&Hwy 83
★ Gunite Pools Inc.....□ **565-5261**
mi 22/2 W Expwy 83
★ Hiab Cranes&Loadrs.....□ **565-2626**
mi 2 1/4 W Expwy 83
Russel Hodges.....72 565-1810
2 3/4 Mi E Hwy 83
Jorge Lopez .....□ 565-4095
1 1/4 E Hwy 83
★ Pre-War Cars Inc.....□ **565-2626**
mile 2 1/4 W Expy 83
Domingo Rivas.....71 565-1202
mi 1 1/2 E&Hwy 83
C D Tennison .....□ 565-2386
mi 3 E&Expwy 83
★ Val-Pak of Texas..... **565-2626**
mi 2 1/4 W Exp 83
Bob Williams.....81 565-6121
2 1/2 W Hwy 83 Exp
38 RESIDENCE 31 BUSINESS

HIGHWAY 281 E 78570
←←←←←R R 2→→→→→→
042010
No # Richard L Bullion 79 565-5669
No # ★ Ceta.....□ **565-5301**
No # ★ Gonzalez Balde Wld.....□ **565-9922**
No # ★ B Gonzalez Welding..... **565-1002**
No # Jose Maldonado.....78 565-6567
No # Pedro Rodriguez.....79 565-5403
No # ★ Trevinos Place..... **565-9913**
No # Daniel Zuniga .....□ 565-3978
4 RESIDENCE 4 BUSINESS

HIGHWAY 2556
042020
No # P Echavarria Jr 81 565-6823
1 RESIDENCE

HILL 78570
042030
306 Eudalia L Cantu.....65 565-2709
Esmerelda Loredo 65 565-2709
312 ..... NP
848 Antonio Echavarria 74 565-3629
4 RESIDENCE

ILLINOIS N 78570
042040
101 ★ 101 Club.....□ **565-9910**
202 ★ Hidalgo & Cameron..... **565-1571**
215 ★ De Ronda Noche..... **565-9081**
219 ★ Maria Cniquitas Pl.....□ **565-9007**
263 ★ My Friends Lounge.....□ **565-9932**
266 ..... NP
294 ★ San Diego Lounge..... **565-9093**
344 ★ Monte Carlo Lounge..... **565-9925**
1 RESIDENCE 7 BUSINESS

ILLINOIS S 78570
042050
201 ★ Sosas Used Cars..... **565-3861**
208 ★ City Wtr Filtratn..... **565-2372**
310 ★ Gulf Westrn Supply..... **565-2633**
318 ..... NP
321 ★ Armando Auto Serv..... **565-5044**
348 ★ Wesley Gould Seed..... **565-1102**
500 ★ South Tx Utility..... **565-2489**
★ So Tx Utility Cont..... **565-2644**
★ Tx Migrant Council..... **565-6386**
502 ★ Rio Construction..... **565-3147**
519 ..... NP
537 M P Trevino 70 565-3396
545 Oralia Carrasco .....□ 565-6151
546 ★ Queen City Laundry..... **565-1882**
★ Queen City Lndry..... **565-1882**
6 & ★ Georges Elect Co..... **565-1928**
1025 Jose M Rodriguez 81 565-1773
1028 Juan Olivarez 78 565-4708
1032 Eloy Gonzalez 80 565-6285
1040 L Barry 75 565-1925
1046 Ramiro Aldape 565-2167
1051 ..... NP
1105 Jose Maria Cortez.....80 565-6167
1111 Eliseo Gonzalez 75 565-4057
1112 ..... NP
1113 V Bazar.....77 565-2777
1127 1133..... NP
1137 Cath Bocanegra..... 565-4308
G Bocanegra..... 565-4308
1138 Ramiro Cuellar 75 565-2623
1139 Joe Galvan 79 565-5939
1141 ..... NP
1207 Ramon Ocanas Jr 71 565-3067
1212 Mrs Rosemay Ribisl.....73 565-4017
1216 Joe Zavala Jr.....78 565-1206
1217 ..... NP
1227 David R King.....81 565-6444
Leonard C King 565-1860
1232 Judith E German 81 565-5508
1240 Bob Hinds 75 565-3774
1241 Pete Guajardo 66 565-1273
1247 Frances Sory 74 565-3284
1305 Rev Don Brynteson 80 565-4742
1326 ..... NP
1346 Henry D Lauderdale 71 565-1337
1404 Ruben E Hinojosa.....73 565-3032
1408 S M Hinojosa 78 565-1537
1427 Marvin A Schwarz.....66 565-1985
1453 C Marchant.....73 565-2581
L G Marchant.....□ 565-6798
No # ★ J&M Auto Sales.....□ **565-3850**
39 RESIDENCE 13 BUSINESS

INDIANA N 78570
042060
106 Jose L Hernandez 81 565-2775
109 ..... NP
114 Amparo Martinez 76 565-1194
138 Jose C Rodriguez 75 565-3344
141 Tirso Garza.....78 565-5872
154 Martin Gonzalez.....81 565-5306
163 Carmen Garza 77 565-2719
Maria Garza .....– 565-2719
210 Antonio Juarez.....70 565-3452
224 ..... NP
248 Olga Vela.....81 565-4758
252 Reynaldo Robles.....81 565-6670
430 ..... NP
438 Felipe Rodriguez.....73 565-4086
446 Matias Perez 73 565-1512
447 713 ..... NP
718 Guadalupe Rivera.....80 565-5007
720 Eleuterio Quiroga 70 565-3578
721 Andres Ayala .....□ 565-4279
726 731 810 813..... NP
818 Linda Ochoa .....□ 565-4140
819 Eloisa F Moreno.....79 565-2300
821 830 ..... NP
832 Maria Torres.....75 565-4167
838 Juana Torres 565-2733
911 Lorenzo Ortega 77 565-4550

GE MAY NOT BE KEYPUNCHED, ENTERED INTO A COMPUTER, OR PHOTOCOPIED IN ANY MANNER WHATSOEVER EXCEPT AS
isting to that Street; ★ — Business Listing; TZ — Trading Zone; 73,74,75,etc — Year First Listed 1973, '74, '75; 9A,9B,etc — Ce

Target Street	Cross Street	Source
-	✓	Cole Criss-Cross Directory

DAWSON RD 1977

2 RESIDENCE

DAWSON DR

R R 2 78570

No # Edward Cain 6 565-2189
No # Juan Galvan ..... ☐ 565-5535
No # Stephen Ray Hollon 6 565-1222
No # ★ **D J Schwarz** **565-2231**
No # John L Stapleton ..... ☐ 565-5203
Noemi Vela 5 565-1372
1/2 Mi N Dawson

5 RESIDENCE 1 BUSINESS

DOWLER 78570

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1977

GILMAN AVE 78570
511 Eugenio Mejia ..... □ 565-4662
601 Ramon Gonzales ..... – 565-4144
617 ..... NP
622 Julia Flores 4 565-3776
Maria M Rodarte 1 565-3776
Venancio Rodarte 1 565-3776
631 Guadalupe Reyna 4 565-4392
632 ..... NP
633 A B Martinez ..... □ 565-4349
Ruben Martinez 4 565-4349
646 Martina Ramirez 9 565-2359
Pedro Ramirez 9 565-2359
653 Rafael Garza 9 565-1430
13 RESIDENCE

GUADALAJARA 78570
+++++++R R 1+++++++
225 Rex C Pope ..... □ 565-4794
1 RESIDENCE

GUERRA ST 78570
+++++++++R R+++++++++
No # Ramiro Cardona ..... □ 565-2936
1 RESIDENCE

HARLINGEN TEX 78550
Direct Phone Lines
★Exterior Bldg&Sply ... 565-1261
★Ford Motor Credit ... □ 565-2571
★REA Express ... 565-4001
★Sears Roebuck&Co ... □ 565-3220
★Valco Chemicals ... 565-1581
★Vly Co-Op Oil Mill ... 565-1581
★Valley Hardwr Supp ... □ 565-5461
7 BUSINESS

HEIDRICK 78570
422 Lydia Ortiz 3 565-3476
433 Ramiro O Ortiz 0 565-3476
440 Dianna Garcia ..... □ 565-5883
446 Lorenza Garcia 3 565-2765
454 Francisca Trevino ..... □ 565-5265
542 Marcelino Rangel 1 565-3933
Isidro Salazar 1 565-3933
610 Juan F Reyna ..... □ 565-5344
618 ..... NP
628 Gregorio M Trevino 565-4663
632 Margarita E Salas 565-3703
V J Salas 565-3703
640 ..... NP
702 C Z Marin Jr 5 565-4322
711 George Sharp 6 565-1646
748 ..... NP
757 Abel Tomelloso ..... □ 565-1031
801 Gilberto Trevino 3 565-2216
810 Jose Noriega 5 565-4455
Lydia Noriega ..... □ 565-4455
825 ..... NP
834 ..... NP
903 Jose Luis Ortega 2 565-4885
910 Ismael Galvan ..... □ 565-1785
918 Alfredo Salazar 6 565-4587
926 Jose Luis Perez 6 565-3497
933 Daniel Sauceda ..... – 565-1284
935 Jose Garcia 0 565-3416
1006 Rosendo Cosme 6 565-4503
1034 Uvaldo Flores ..... □ 565-5443
30 RESIDENCE

HIDALGO 78570
440 Thomas Yanez 2 565-1188
533 Luz Champion 9 565-1323
536 ..... NP
546 F Dominguez 2 565-2246
Rolando Dominguez 6 565-2246
609 Demus Gonzales 565-2116
Genoveva Hinojosa 565-2116
626★Marin Taxi ... 565-9013
732 Pablo T Quiroga 565-2341
801★J F Kennedy Elmnty ... 565-1142
822 A J Gonzales 5 565-1630
Isabel Vela 565-1630
837 Vicente Gonzales 2 565-1235
901 Abel Saldana 565-2514
1045 ..... NP
1046 N Rodriguez 0 565-3594
1100 Eddie Briceno 3 565-3027
1216 Eliza Worbiski ..... □ 565-5533
1218 Gabriela Lopez 5 565-4451
1410 ..... NP
1430 David Flores ..... – 565-2788
19 RESIDENCE 2 BUSINESS

HIDALGO BANK BLDG
See 301 S Texas

HIGHWAY E 78570
No #★Canada Dry Distrs ... 565-2281
No #★Magic Valley Cnda ... □ 565-2281
No # Hugh Roberts ..... – 565-5296
Vince Bierbaum 8 565-1481
mi 2 1/2 E&Exprswy
J W Burcham 0 565-2853
mi 1 1/4 E&Hwy
Loran E Clark 565-1021
mi 1 1/2 E&Highway
Rubert Hackbert 5 565-3872
mi 2 1/2 E&Hwy
Allen Heggen 2 565-2770
mi 1 1/4 E&Hwy
★Heggen Electric Co ... 565-1431
mile 1 1/4 E Hwy
★Lloyd Heggen ... 565-1431
mi 1 1/4 E Hwy
Salvador Hernandez 2 565-3972
mi 1 1/4 E Hwy
Thomas C Hooker ..... □ 565-3827
mi 1 1/4 E&Hwy
Rene Leal 5 565-4263
mi 1 E Road&Expsswy
★Mercedes Auto Part ... 565-2531
mi 1 1/4 E&Hwy
Jake B Pemelton 565-1359
mi 1 1/2 E&Hwy
★Rodeway Inn Motel ... 565-3121
expressway&Mi 2 W
★Ansui Co Research ... – 565-3181
1 1/2 Mi S Expwy
★Tide Products Inc ... 565-2436
3/4 Mi E State Hwy
★Trlr Mounted Ferrs ... 565-1481
mi 2 1/2 E&Expressway
★Vogue Motel ... 565-9008
1/2 Mi E State Hwy
10 RESIDENCE 10 BUSINESS

HIGHWAY W 78570
523★Bazar Philip 66 Sv ... 565-1121
★Gregs Phillips 66 ... 565-1121
717 Mrs G L Solis 565-1506
735★Roberts Meats ... 565-1751
1045★Almanza Texaco Ser ... 565-9016
★A&E Auto Parts ... 565-1396
mi 2 1/2 W&Hwy
Donald C Andreson 565-4954
mi 2 1/2 W&Hwy
Ernest R Coil 565-3023
mi 2 1/2 W&Hwy
★Dons Mid Vly Auto ... 565-1742
mile 2 1/2 W&Hwy
★Jehovahs Witness ... 565-4134
mi 2 3/4 W&Exprswy
Mrs Leta Klefisch 1 565-2846
mi 2 3/4 W&Hwy
Alex Solis ..... □ 565-1732
mi 2 1/2 W&Hwy
Ricardo A Solis ..... □ 565-1732
mi 2 1/2 W&Hwy
★Tris End Mob Pk&Sl ... 565-2751
mi 2 W&Expressway
6 RESIDENCE 8 BUSINESS

HIGHWAY 83 W 78570
+++++R R 2+++++++
100★Mid Vly Slvg Dscnt ... 565-1721
710 Martin Lopez ..... □ 565-4371
★Mercedes Glass ... □ 565-4371
931★Mid Valley Shoe ... □ 565-9015
1045★Tonys Auto Part ... □ 565-4711
1401★Cavazos Used Cars ... – 565-9002
No # Jose M Alejandro ..... – 565-5603
No # Jack Brayn ..... □ 565-5115
No # R A Crenshaw ..... □ 565-5237
No # Tony Delagarza ..... □ 565-4232
No #★Mercedes Mfg Co ... □ 565-2615
No #★Mid-Way Auto Sales ... □ 565-9020
No # Anita Palacios ..... □ 565-5616
No #★Roberts Air Condtg ... □ 565-4852
No # Diana Tanguma 6 565-2939
No # Teodoro Tanguma 6 565-2939
No #★Tonys Auction ... □ 565-4232
No #★Tropical Tex Cntr ... □ 565-3921
No # Rosa C Villalobos ..... □ 565-5877
★Hector Benitez ... 565-9048
2 Mile W Hwy 83
Noe Cavazos 5 565-2676
mi 2 1/4 W&Hwy 83
Eddie Conner 5 565-1500
1 1/2 Mi E Hwy 83
John Cortino 9 565-2309
mi 2 3/4 W&Hwy 83
★Cortino Lthg&Plstg ... 565-2309
mi 2 3/4 W&Hwy 83
★Cortinos Itln Rstr ... 565-2309
mi 2 3/4 W&Hwy 83
Tony Delagarza 4 565-3551
3 Mi E Hwy 83
Isabel Garza 4 565-1274
mi 2 1/4 E&Hwy 83
Raul Garza 4 565-1274
mi 2 1/4 E&Hwy 83
★H&H Meat Products ... 565-3177
mi 1/2 E&Exprsswy 83
★H&H Meat Products ... 565-4442
mi 1/2 E&Expwy 83
★Heart of Vly Trvlr ... 565-3172
mile 3 E Expwy 83
Russel Hodges 2 565-1810
2 3/4 Mi E Hwy 83
★Juan Weldg&Auto Sv ... 565-3711
2 1/4 Mi W Hwy 83
★Lettuce&Onion Comm ... 565-2453
mile 3 W&Hwy 83
★Magic Valley Elect ... 565-2451
mi 1 3/4 W&Highwy 83
★McWhorter Lmbr Co ... 565-2391
mile 3 W&Hwy 83
★Midway Lumber Co ... 565-2651
mi 2 1/2 W Hwy 83
★Motormart ... 565-3711
2 1/4 Mile W Hwy 83
Bernardo Puga 3 565-4016
mi 1 1/4 E&Hwy 83
Domingo Rivas 1 565-1202
mi 1 1/2 E&Hwy 83
★Robles Appl Serv ... 565-4251
2 Mile W Hwy 83
★Robles Superette ... 565-4251
2 Mi West Hwy 83
★Robles Superette ... 565-9047
2 Mile W Hwy 83
Micaela R Saenz ..... □ 565-4323
mi 2 3/4 E&Hwy 83
Andres Salinas 4 565-4198
3 Mi E Hwy 83
D J Schwarz 5 565-1867
1/2 Mi E Rd&Bus 83
★S Tex Lettc&Onion ... – 565-2453
mi 3 W&Hwy 83
★Tonys Auction ... 565-3551
3 Mi E Hwy 83
★Vlly Elctrc Constr ... 565-4182
mi 1 3/4 W&Hwy 83
★Vly Mch Shop&Exch ... 565-1341
2 3/4 Mile W Hwy 83
★Wesmer Drv In Thtr ... 565-9048
2 Mile W Hwy 83
★B Williams&Son Wld ... 565-2661
2 1/2 W Hwy 83 Exprs
21 RESIDENCE 31 BUSINESS

HIGHWAY 281 E
No # Maria P Flores ..... □ 565-4441
1 RESIDENCE

HILL 78570
306 Eudalia L Cantu 565-2709
Esmerelda Loredo 565-2709
848 Antonio Echavarria 4 565-3629
3 RESIDENCE

n On This Page May Not Be Keypunched, Entered Into A Computer, Or Photocopied In Any Manner Whatsoever Except As Authorized In T
isting to that Street ★ — Business Listing TZ — Trading Zone 3,4,5,etc — Year First Listed 1973 '74 '75 SA,$B,etc — Cens

Target Street	Cross Street	Source
-	✓	Cole Criss-Cross Directory

DAWSON RD 1972

DAWSON DR

R R 2 78570
GEORGE F IRBY JR ¤5651580
3/4 MI N DAWSON RD
FLOYD R THORPE 1 5653552
MI 7 1/4 N&DAWSON ST
2 RESIDENCE

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1972

.E'S

□ = New Listing to the Directory
■ = New Listing to that Street
TZ = Trading Zone

7, 8, 9, etc. = Year First Listed 1967, 1968, 1969
SA, SB, etc. = Census Tract Wealth Rating
L10 = Map Location

HIDALGO BANK BLDG
SEE 301 S TEXAS

HIGHWAY
SEE 2ND ST W

HIGHWAY E
.....R R 2..... 78570
VINCE BIERBAUM 8 5651481
MI 2 1/2 E&EXPRSWY
A L BROWN □5652372
MI 2 1/2 E&EXPRESSWY
J W BURCHAM 0 5652853
MI 1 1/4 E&HWY
CANADA DRY BTLG CO 5652281
1/4 MI E STATE HWY
LORAN E CLARK 5651021
MI 1 1/2 E&HIGHWAY
*E CONNER AUTO PART 5652531
MI 1 1/4 E&HIGHWAY
JOE DUDZIENSKI 5652963
1 3/4 MI E HIGHWAY
REV P H EVERSOLE 1 5653713
MI 2 3/4 E&HWY
ALLEN HEGGEN □5652770
MI 1 1/4 E&HWY
HEGGEN ELECT CO IN 5651431
1 1/4 MI E HWY
*LLOYD HEGGEN 5651431
MI 1 1/4 E HWY
SALVADOR HERNANDEZ□5653972
MI 1 1/4 E HWY
ANN L HOWARD 5652213
MI 1/2 E STATE HWY
*MERCEDES AUTO PART 5652531
MI 1 1/4 E&HWY
JAKE PEMELTON 6 5651492
MI 1 1/2 E&HIGHWAY
J F RILEY 5652219
MI 1 1/4 E&HWY
*RIO MCH SHOP 5651492
MI 1 1/2 E&HWY
DAVID E RITCHE □5653942
MI 2 1/2 E&HWY
RODEWAY INN MOTEL 5653121
EXPRESSWAY&MI 2 W
RODEWAY INN RSTRNT 5653781
EXPRSSWY&MI 2 W
F G TAPPAN 5653033
MI 1 E&HWY
TIDE PRODUCTS INC 5652436
3/4 MI E STATE HWY
*TRLR MOUNTED FERRS 5651481
MI 2 1/2 E&EXPRESSWY
E J TREASURE □5653827
MI 1 1/4 E&HWY
MRS T E TREASURE 5651964
MI 1 E&HWY
VOGUE MOTEL 5659008
1/2 MI E STATE HWY
13 RESIDENCE 13 BUSINESS

HIGHWAY W 78570
523*BAZAR&IRBY BIG N 5651121
*BAZAR PHILIP 66 SV 5651121
717 MRS G L SOLIS 5651506
735*G GRAF REDICUT MTS 5651751
1045*ALMANZA TEXACO SER 5659016

.....R R 1..... 78570
*A&E ATO PARTS 5651396
MI 2 1/2 W&HWY
CHARLES E ANDERSON 5651732
MI 2 1/2 W&HWY
DONALD C ANDERSON 5652659
MI 2 1/2 W&HWY
ERNEST R COIL 5653023
MI 2 1/2 W&HWY
MRS LETA KLEFISCH1 5652846
MI 2 3/4 W&HWY
*MID-VALLEY AUTO MT 5651742
MI 2 1/2 W&HWY
P&W PRINTING 5653959
2 1/2 MI W EXPRESSWY
*WES-MER DRIVE IN 5652142
MI 2 1/4 W&HWY
*B WILLIAMS&SON WLD 5652661
MI 2 1/2 W&HWY
5 RESIDENCE 9 BUSINESS

HIGHWAY 83 W
.....R R 2..... 78570
717 CELIA GARCIA 1 5653618
*BORDER ANIMAL HOSP 9683858
MI 3 W&E HWY 83
NOE CAVAZOS 9 5652676
MI 2 1/4 W&HWY 83
JOHN CORTINO 9 5652309
MI 2 3/4 W&HWY 83
*DR W E CRENSHAW 9683858
MI 3 W&E HWY 83
*DELAROSA USED CARS 5659097
MI 2 W&HWY 83
*FARM BUILDERS 5653611
MI 3 W&HWY 83
H&H MEAT PRODUCTS 5653177
MI 1/2 E&EXPRSSWY 83
*HIL WAY TRACTR INC 5652626
MI 2 1/4 W&7 N EX 83
*GENE P HOBART ARCH 5652196
MI 2 W&HWY 83
RUSSEL HODGES □5651810
2 3/4 MI E HWY 83
E L JEFFRIES □5651362
MI 2 3/4 W&HWY 83
JEFFERY FLOWERS □5653489
MI 2 1/2 W&HWY 83
JUDSON FLOWERS □5653489
MI 2 1/2 W&HWY 83
ROGERS KELLEY 4 5651816
1/2 MI E&US HWY 83
*LA CASA BLANCA 5659043
MI 2 W&HWY 83
*MAGIC VALLEY ELECT 5652451
MI 1 3/4 W&HIGHWY 83
QUEEN CITY FERTLZR-5652761
1/2 MI E EXPRSSWY 83
DOMINGO RIVAS 1 5651202
MI 1 1/2 E&HWY 83
GUNITE ROBERSON 5653951
2 3/4 W&7 N EXPWY 83
M A SELLERS □5651606
MI 2 1/4 W&HWY 83
*SO TEX LTTCE&ONION 5652453
MI 3 W&HWY 83
*TONY USED FURN □5653551
3 MI E HWY 83
12 RESIDENCE 11 BUSINESS

HILL 78570
306 EUDALIA L CANTU 5 5652709
ESMERELDA LOREDO 5 5652709
2 RESIDENCE

ILLINOIS N 78570
202*HIDALGO & CAMERON 5651571
315*SOSA LOUNGE □5659082
332 EDDIE BRICENO 5653027
1 RESIDENCE 2 BUSINESS

ILLINOIS S 78570
201*SOSA USED CARS -5653861
310*JAMES A BARRY □5651691
*ATTEBERRYS MFCTS 5651691
348*WESLEY GOULD SEED 5651102
500*RIO LBR&SUPPLY 5651622
502 HOMER SALINAS □5653007
*HOMER SALINAS ATY □5651632
*ROBERT J SALINAS □5651632
*SALINAS&SALINAS 5651632
519 CASIMIRO C GALINDO
0 5653516
537 M P TREVINO 0 5653396
545 JOE GONZALES 9 5653171
546*QUEEN CITY LAUNDRY 5651882

6 &*GEORGES ELECT CO 5651928
1032 OSCAR GORENA 5651754
1040*VALLEY PAVING CO □5653385
RONNIE ST JOHN 0 5653385
*TENI-TRAK 5653385
1046 RAMIRO ALDAPE 5652167
1105 MRS DORA MCNEIL 5 5652355
1112 ELISA HERRERA RN 5651827
ROY B HERRERA 5651827
1113 E C BAZAR 5652777
1127 NORMA GARCIA 0 5651564
GUADALUPE G MENDEZ
8 5651564
1133 MIGUEL MESA □5653852
1135 ROLANDO GONZALES 1 5652653
1137 CATH BOCANEGRA 5 5652673
G BOCANEGRA 5 5652673
1207 RAMON OCANAS JR 1 5653067
1216 MISS O J DAVISON 5651558
1217 RICHARD E TERRY 5651456

R, OR PHOTOCOPIED, IN ANY MANNER WHATSOEVER EXCEPT AS AUTHORIZED IN WRITING BY THE PUBLISHER.

Target Street	Cross Street	Source
-	✓	Cole Criss-Cross Directory

DAWSON RD 1967

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.......................................
                                        1
      DAWSON DR                         1
.......................................
  240 ALVIN SMITH          -L052660     ..
 NO # W R DRESSLER       5 L052957     ..
        2 RESIDENCE
.......................................
.......................................  ..
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Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1967

.E'S MERCEDES TEXAS

607 SANTOS GARCIA ¤L051237
609 GENOVEVA HINOJOSA6 L052116
DEMUS GONZALES 6 L052116
626 SERGIO GONZALEZ 5 L051153
630*MARIN TAXI L059013
645 MARIA L CARABALLO6 L052362
*RICO PORTO LOUNGE L059078
732 PABLO T QUIROGA 1 L052341
801*J F KENNEDY ELEM L051142
822 ISABEL VELA 3 L051630
901 ABEL SALDANA ¤L052514
ERNESTO SALDANA ¤L052766
1045 MARTINA NAVARRO L051365
1046 JOSE C RODRIGUEZ 4 L051778
1430 MARIA L RODRIGUEZ4 L051185
14 RESIDENCE 6 BUSINESS

HIDALGO BANK BLDG

*N P BARTON&SONS L052382
*G H EVANS L052381
*CHARLIE H HUPP INS L051642
*LAUDER&DREW C P A L051162
*W B LAUDER JR L051162
*PACKAGE RESRCH LAB L052381
6 BUSINESS

HIGHWAY

717 G L SOLIS L051506
1 RESIDENCE

HIGHWAY E

.....R R 2..... 78570
GEORGE AVANT L052887
MI 2 1/2 E&HWY
ALFRED L BRODEN ¤L051415
MI 2 1/2 E&HIGHWAY
LORAN E CLARK L051021
MI 1 1/2 E&HIGHWAY
E CONNER AUTO PART L052531
MI 1 1/4 E&HIGHWAY
JOE DUDZIENSKI L052963
1 3/4 MI E HIGHWAY
LEROY FUQUA 6 L052926
MI 2 3/4 E&HIGHWAY
HEGGEN ELECT CO IN L051431
1 1/4 MI E HWY
LLOYD HEGGEN OFC L051431
1 1/4 MI E HWY
J R HOPKINS L052884
MI 2 1/2 E&HWY
GEORGE ISENHOWER 5 L051278
MI 2 1/2 E&HWY
MERCEDES AUTO PART L052531
MI 1 1/4 E&HWY
SIGMUND NAMETH 6 L053013
MI 3 E&HWY
JAKE PEMELTON 6 L051492
MI 1 1/2 E&HIGHWAY
J F RILEY L052219
MI 1 1/4 E&HWY
RIO MCH SHOP L051492
MI 1 1/2 E&HWY
L C RUSHTON L052884
MI 2 1/2 E&HWY
F G TAPPAN L053033
MI 1 E&HWY
MRS T E TREASURE L051964
MI 1 E&HWY
VALLEY WLDG&MACH L051451
MI 1 1/4 E&HWY
13 RESIDENCE 6 BUSINESS

HIGHWAY W

523*BAZAR&IRBY BIG N L051121
*BAZAR PHILIP 66 SV L051121
735*G GRAF REDICUT MTS L051751
1045*ALMANZA TEXACO SER L059016

.....R R 1..... 78570
A&E AUTO PARTS L051396
MI 2 1/2 W&HIGHWAY
ANDERSON BLDG&LBR L051742
MI 2 1/2 W&HIGHWAY
CHARLES E ANDERSON L051732
MI 2 1/2 W&HWY
DONALD C ANDERSON ¤L052659
MI 2 1/2 W&HIGHWAY
DONALD C ANDERSON L051742
MI 2 1/2 W&HIGHWAY
ERNEST R COIL L053023
MI 2 1/2 W&HWY
MRS LETA KLEFISCH L052846
MI 2 3/4 W&HWY
MID-VALLEY AUTO MT L051742
MI 2 1/2 W&HWY

ROBLES APPLNCE SER L051621
MI 1 3/4 W&HWY
WES MER DRIVE L052142
MI 2 1/4 W&HWY
B WILLIAMS&SON WLD L052661
MI 2 1/2 W&HWY
4 RESIDENCE 11 BUSINESS

HIGHWAY 83 W

.....R R 2..... 78570
BILL BILTON L052157
MI 2 1/4 W&HWY 83
GLYNN CARTER ¤L051600
MI 2 W&HWY 83
COUNTRY DISCOUNT L051282
MI 3 W&HIGHWAY 83
CORTINOS RESTRNT ¤L052309
MI 2 3/4 W&HWY 83
MARTIN CROSS 3 L051060
MI 2 1/4 W&HWY 83
W M ELLISON L051954
MI 2 1/2 E ST HY 83
GENE P HOBART ARCH L052196
MI 2 W&HWY 83
ROGERS KELLEY 4 L051816
1/2 MI E&US HWY 83
MAGIC VALLEY ELECT L052451
MI 1 3/4 W&HIGHWY 83
SOUTH TEX LETTUCE L052453
MI 2 W&HWY 83
MRS L O WILLIAMS 6 L051816
1/2 MI E&US HWY 83
6 RESIDENCE 5 BUSINESS

HILL

.....C C 3..... 78570
306 EUDALIA L CANTU 5 L052709
ESMERELDA LOREDO 5 L052709
312 IGNACIO ZAVALA ¤L052750
848 EMMA ORTEGA ¤L052586
4 RESIDENCE

ILLINOIS N

.....C C 3..... 78570
202*HIDALGO & CAMERON L051571
205*H&H MEAT PRODUCTS L051402
332 EDELMIRO BRICENO L051755
1 RESIDENCE 2 BUSINESS

ILLINOIS S

.....C C 1..... 78570
240*HOUSE OF SALADINO L051692
348*GOULD WESLEY SEED L051102
500*RIO LBR&SUPPLY L051622
545 LIBORIO HINOJOSA 2 L051593
546*QUEEN CITY LNDRY L051882
1032 OSCAR GORENA L051754
1040 MRS J R BARRY 6 L051310
1046 RAMIRO ALDAPE 0 L052167
1051 PAULINE RAMIREZ ¤L051655
1105 MRS DORA MCNEIL 5 L052355
1111 PABLO MUNOZ ¤L052569
1112 ELISA HERRERA RN 3 L051827
ROY B HERRERA 3 L051827
1113 E C BAZAR 2 L052777
1133 ROLANDO GONZALES -L052653
1137 CATH BOCANEGRA 5 L052673
G BOCANEGRA 5 L052673
1207 RENE HINOJOSA 6 L051264
1216 MISS O J DAVISON L051558
1217 RICHARD E TERRY L051456
1227 LEONARD C KING L051860
1232 G E BUDDY WATSON L051166
1240 J L BREWER L052224
1241 PETE GUAJARDO 6 L051273
1247 MARY F SORY 1 L051420
1305 REV FRANK E MACE 5 L052424
1326 J D BOUCHER ¤L051671
1346 JAMES H LAUDERDALE
5 L051552
1427 MARVIN A SCHWARZ 6 L051985
25 RESIDENCE 4 BUSINESS

INDIANA N

.....C C 2..... 78570
254 T F GONZALES L052210
721 FLORA VELA ¤L052439
838 JUANA TORRES ¤L052733
1015 GUADALUPE QUIROGA ¤L052520
4 RESIDENCE

Target Street	Cross Street	Source
-	✓	Cole Criss-Cross Directory

DAWSON RD 1964

DAWSON DR

240 J O CLARK -L051317
1 RESIDENCE

DOWLER

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1964

HIGHWAY E

.....R R 2..... 78570
GEORGE AVANT L052887
MI 2 1/2 E&HWY
LORAN E CLARK L051021
MI 1 1/2 E&HWY
*CONNER AUTO PARTS ▫L052531
MI 1 1/4 E&HIGHWAY
JOE DUDZIENSKI L052963
1 3/4 MI E HWY
*HEGGEN ELECT CO L051431
1 1/4 MI E HWY
*LLOYD HEGGEN L051431
1 1/4 MI E HWY
J R HOPKINS L052983
MI 2 1/2 E&HWY
*MERCEDES AUTO PRTS L052531
MILE 1 1/4 E&HWY
SIGMUND NAMETH L051913
3 MI E&HWY
JAKE PEMELTON L051492
1 1/2 MI E&HWY
J F RILEY L052219
MI 1 1/4 E&HWY
*RIO MACH SHOP L051492
MI 1 1/2 E&HWY
F G TAPPAN L051979
MI 1 E&HWY
MRS T E TREASURE L051964
MI 1 E&HWY
*VALLEY WLDG&MCH WK L051451
MI 1 1/4 E&HWY
9 RESIDENCE 6 BUSINESS

HIGHWAY W

.....C C 2..... 78570
523*BAZAR&IRBY BIG N L051121
*BLUE TWN BIG N DIS L051121
*BAZAR PHILIP 66 SV L051121
735*G GRAF REDICUT MTS L051751
1045*ALMANZA TEXACO SER L059016
1265*GENES BODY SHOP ▫L052761

.....R R 1..... 78570

*A&E AUTO PARTS L052469
MI 2 1/2 W&HIGHWAY
ROY W ADAMS ▫L051924
MI 2 3/4 W&HIGHWAY
*ANDERSON BLDG&LBR L051539
MI 2 1/2 W&HWY
CHARLES E ANDERSON L051732
MI 2 1/2 W&HWY
*DONALD C ANDERSON L051539
MI 2 1/2 W&HWY
ERNEST R COIL L051966
MI 2 1/2 W&HWY
SAMUEL GARZA 3L052763
2 MI W&HIGHWAY
MRS LETA KLEFISCH L052846
MI 2 3/4 W&HWY
*MAGIC VLY ELECT CP L052451
MI 1 3/4 W&HWY
*REA OFFICE L052451
1 3/4 MI W&HWY
*ROSE OF MEXICO L059008
2 1/2 MI W&HWY
*WES MER DRIVE L052142
MI 2 1/4 W&HWY
5 RESIDENCE 13 BUSINESS

HIGHWAY 83 W

.....R R 2..... 78570
BILL BILTON L052157
MI 2 1/4 W&HWY 83
MARTIN CROSS 3L051060
MI 2 1/4 W&HWY 83
*GENE P HOBART ARCH L052196
MI 2 W&HWY 83
ETHEL R KELLEY L051816
1/2 MI E&US HWY 83
ROGERS KELLEY ▫L051816
1/2 MI E&US HWY 83
TEODORO PADILLA ▫L059014
MILE 2 1/2 W&HWY 83
*VALLEY BRAKE&CLUTH▫L052661
2 3/4 MI W HWY 83
5 RESIDENCE 2 BUSINESS

Target Street	Cross Street	Source
✓	-	Cole Criss-Cross Directory

E EXPRESSWAY 83 1959

7 BUS

HIGHWAY

717 G L SOLIS L051506
1045*ALMANZA SERV STA L059016
1 RFS 1 BUS

HIGHWAY W

523*BAZAR PHILIP 66 SV L051121
*PHILLIPS 66 STA L051121
2 BUS

HILL

APPENDIX E

REGULATORY AGENCY RECORDS

Property Details

Account		
Property ID:	614408	Geographic ID: D0447-00-000-0008-00
Type:	Real	Zoning: IN
Property Use:		
Location		
Situs Address:	2000 E EXPWY 83 TX	
Map ID:	CMC VOL 37 PG 93	Mapsco:
Legal Description:	D. VOGEL BUSINESS PARK LOT 8 - AMENDED	
Abstract/Subdivision:	D044700 - D. VOGEL BUSINESS PARK (AMND) - SMC	
Neighborhood:	SMCEXPY83 SMC EXPWY 83 PROJECT	
Owner		
Owner ID:	1068444	
Name:	C & L BUSINESS ADVENTURES INC	
Agent:		
Mailing Address:	2000 EAST EXPRESSWAY 83 MERCEDES, TX 78570-9400	
% Ownership:	100.0%	
Exemptions:	For privacy reasons not all exemptions are shown online.	

Property Values

Improvement Homesite Value:	$0 (+)
Improvement Non-Homesite Value:	$330,625 (+)
Land Homesite Value:	$0 (+)
Land Non-Homesite Value:	$509,203 (+)
Agricultural Market Valuation:	$0 (+)
Market Value:	$839,828 (=)
Ag Use Value:	$0 (-)
Appraised Value:	$839,828 (=)
Homestead Cap Loss:	$0 (-)

Assessed Value:	$839,828

VALUES DISPLAYED ARE 2023 PRELIMINARY VALUES AND ARE SUBJECT TO CHANGE PRIOR TO CERTIFICATION.

Information provided for research purposes only. Legal descriptions and acreage amounts are for appraisal district use only and should be verified prior to using for legal purpose and or documents. Please contact the Appraisal District to verify all information for accuracy.

Property Taxing Jurisdiction

Owner: C & L BUSINESS ADVENTURES INC **%Ownership:** 100.0%

Entity	Description	Tax Rate	Market Value	Taxable Value	Estimated Tax	Freeze Ceiling
CAD	APPRAISAL DISTRICT	0.000000	$839,828	$839,828	$0.00	
CMC	CITY OF MERCEDES	0.775000	$839,828	$839,828	$6,508.67	
DR1	DRAINAGE DISTRICT #1	0.117900	$839,828	$839,828	$990.16	
GHD	HIDALGO COUNTY	0.575000	$839,828	$839,828	$4,829.01	
JCC	SOUTH TEXAS COLLEGE	0.161500	$839,828	$839,828	$1,356.32	
SMC	MERCEDES ISD	1.345000	$839,828	$839,828	$11,295.69	
SST	SOUTH TEXAS SCHOOL	0.049200	$839,828	$839,828	$413.20	

Total Tax Rate: 3.023600

Estimated Taxes With Exemptions: $25,393.05

Estimated Taxes Without Exemptions: $25,393.05

Property Improvement - Building

Type: COMMERCIAL **State Code:** F1 **Living Area:** 5,936.00sqft **Value:** $330,625

Type	Description	Class CD	Exterior Wall	Year Built	SQFT
DLW	LOADING WELL	100		2007	550.00
ASP3	ASPHALT 3	*		2007	27,940.00
WHS	WAREHOUSE	100		2007	5,536.00
CAN	CANOPY	*		2007	160.00
CAN	CANOPY	*		2007	20.00
CAN	CANOPY	*		2007	20.00
CAN	CANOPY	*		2007	160.00
OFF	OFFICE	100	CCBK	2007	400.00

Property Land

Type	Description	Acreage	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
L	LOT	2.03	88,557.00	0.00	0.00	$509,203	$0

Property Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap Loss	Assessed
2023	$330,625	$509,203	$0	$839,828	$0	$839,828
2022	$288,651	$323,233	$0	$611,884	$0	$611,884
2021	$294,834	$323,233	$0	$618,067	$0	$618,067
2020	$300,096	$323,233	$0	$623,329	$0	$623,329
2019	$233,157	$323,233	$0	$556,390	$0	$556,390
2018	$243,219	$323,233	$0	$566,452	$0	$566,452
2017	$247,865	$323,233	$0	$571,098	$0	$571,098
2016	$261,955	$309,950	$0	$571,905	$0	$571,905
2015	$203,880	$309,950	$0	$513,830	$0	$513,830
2014	$206,049	$309,950	$0	$515,999	$0	$515,999
2013	$178,292	$221,393	$0	$399,685	$0	$399,685
2012	$178,292	$221,393	$0	$399,685	$0	$399,685

Property Deed History

Deed Date	Type	Description	Grantor	Grantee	Volume	Page	Number
1/12/2016	WDV	WARRANTY DEED/VENDORS LIEN	SALINAS RICHARD D	C & L BUSINESS ADVENTURES INC			2676532
11/29/2010	SWD	SPEC. W/D	SALINAS RICHARD A & MINERVA	SALINAS RICHARD D			2158060
1/30/2003	WD	WARRANTY DEED	MERCEDES INDUSTRIAL FOUNDATION INC	SALINAS RICHARD A & MINERVA			1162544
	CONV	CONVERSION	LARA CARMEN	MERCEDES INDUSTRIAL FOUNDATION INC			

Property Details

Account		
Property ID:	842847	Geographic ID: C1400-00-065-0015-07
Type:	Real	Zoning: CNTY
Property Use:		
Location		
Situs Address:	EXPWY 83 TX	
Map ID:		Mapsco:
Legal Description:	CAPISALLO - SMC 0.71AC BNG AN IRR TR - N116'-S575' LYING S OF US EXPWY 83 LOT 15 BLK 65	
Abstract/Subdivision:	C140000 - CAPISALLO DISTRICT - SMC	
Neighborhood:	SMCEXPY83 SMC EXPWY 83 PROJECT	
Owner		
Owner ID:	140038	
Name:	HIDALGO & CAMERON CO DIST #9	
Agent:		
Mailing Address:	PO BOX 237 MERCEDES, TX 78570-0237	
% Ownership:	100.0%	
Exemptions:	EX-XV - Other Exemptions (including public property, religious organizations, charitable organizations, and other property not reported elsewhere) For privacy reasons not all exemptions are shown online.	

Property Values

Improvement Homesite Value:	$0 (+)
Improvement Non-Homesite Value:	$0 (+)
Land Homesite Value:	$0 (+)
Land Non-Homesite Value:	$114,432 (+)
Agricultural Market Valuation:	$0 (+)
Market Value:	$114,432 (=)
Ag Use Value:	$0 (-)
Appraised Value:	$114,432 (=)

Homestead Cap Loss:	$0 (-)
Assessed Value:	$114,432

VALUES DISPLAYED ARE 2023 PRELIMINARY VALUES AND ARE SUBJECT TO CHANGE PRIOR TO CERTIFICATION.

Information provided for research purposes only. Legal descriptions and acreage amounts are for appraisal district use only and should be verified prior to using for legal purpose and or documents. Please contact the Appraisal District to verify all information for accuracy.

Property Taxing Jurisdiction

Owner: HIDALGO & CAMERON CO DIST #9 **%Ownership:** 100.0%

Entity	Description	Tax Rate	Market Value	Taxable Value	Estimated Tax	Freeze Ceiling
CAD	APPRAISAL DISTRICT	0.000000	$114,432	$0	$0.00	
CMC	CITY OF MERCEDES	0.775000	$114,432	$0	$0.00	
DR1	DRAINAGE DISTRICT #1	0.117900	$114,432	$0	$0.00	
GHD	HIDALGO COUNTY	0.575000	$114,432	$0	$0.00	
JCC	SOUTH TEXAS COLLEGE	0.161500	$114,432	$0	$0.00	
SMC	MERCEDES ISD	1.345000	$114,432	$0	$0.00	
SST	SOUTH TEXAS SCHOOL	0.049200	$114,432	$0	$0.00	

Total Tax Rate: 3.023600

Estimated Taxes With Exemptions: $0.00

Estimated Taxes Without Exemptions: $3,459.97

Property Land

Type	Description	Acreage	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
AC	ACREAGE	0.71	30,927.60	0.00	0.00	$114,432	$0

Property Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap Loss	Assessed
2023	$0	$114,432	$0	$114,432	$0	$114,432
2022	$0	$114,432	$0	$114,432	$0	$114,432
2021	$0	$114,432	$0	$114,432	$0	$114,432
2020	$0	$114,432	$0	$114,432	$0	$114,432
2019	$0	$114,432	$0	$114,432	$0	$114,432
2018	$0	$114,432	$0	$114,432	$0	$114,432
2017	$0	$114,432	$0	$114,432	$0	$114,432
2016	$0	$114,432	$0	$114,432	$0	$114,432
2015	$0	$114,432	$0	$114,432	$0	$114,432
2014	$0	$114,432	$0	$114,432	$0	$114,432
2013	$0	$114,432	$0	$114,432	$0	$114,432

Property Details

Account		
Property ID:	131628	Geographic ID: C1400-00-065-0015-02
Type:	Real	Zoning: CNTY
Property Use:		
Location		
Situs Address:	EXPRESSWAY 83/VOGEL ST TX	
Map ID:		Mapsco:
Legal Description:	CAPISALLO AN IRR TR LOT 15 BLK 65 N33'-S608-W157.36 0.07AC	
Abstract/Subdivision:	C140000 - CAPISALLO DISTRICT - SMC	
Neighborhood:	SMCEXPY83 SMC EXPWY 83 PROJECT	
Owner		
Owner ID:	1223467	
Name:	SALINAS RICHARD	
Agent:		
Mailing Address:	2000 E EXPY 83 MERCEDES, TX 78570	
% Ownership:	100.0%	
Exemptions:	For privacy reasons not all exemptions are shown online.	

Property Values

Improvement Homesite Value:	$0 (+)
Improvement Non-Homesite Value:	$0 (+)
Land Homesite Value:	$0 (+)
Land Non-Homesite Value:	$10,154 (+)
Agricultural Market Valuation:	$0 (+)
Market Value:	$10,154 (=)
Ag Use Value:	$0 (-)
Appraised Value:	$10,154 (=)
Homestead Cap Loss:	$0 (-)

Assessed Value:	$10,154

VALUES DISPLAYED ARE 2023 PRELIMINARY VALUES AND ARE SUBJECT TO CHANGE PRIOR TO CERTIFICATION.

Information provided for research purposes only. Legal descriptions and acreage amounts are for appraisal district use only and should be verified prior to using for legal purpose and or documents. Please contact the Appraisal District to verify all information for accuracy.

Property Taxing Jurisdiction

Owner: SALINAS RICHARD **%Ownership:** 100.0%

Entity	Description	Tax Rate	Market Value	Taxable Value	Estimated Tax	Freeze Ceiling
CAD	APPRAISAL DISTRICT	0.000000	$10,154	$10,154	$0.00	
CMC	CITY OF MERCEDES	0.775000	$10,154	$10,154	$78.69	
DR1	DRAINAGE DISTRICT #1	0.117900	$10,154	$10,154	$11.97	
GHD	HIDALGO COUNTY	0.575000	$10,154	$10,154	$58.39	
JCC	SOUTH TEXAS COLLEGE	0.161500	$10,154	$10,154	$16.40	
SMC	MERCEDES ISD	1.345000	$10,154	$10,154	$136.57	
SST	SOUTH TEXAS SCHOOL	0.049200	$10,154	$10,154	$5.00	

Total Tax Rate: 3.023600

Estimated Taxes With Exemptions: $307.02

Estimated Taxes Without Exemptions: $307.02

Property Land

Type	Description	Acreage	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
AC	ACREAGE	0.07	3,049.20	0.00	0.00	$10,154	$0

Property Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap Loss	Assessed
2023	$0	$10,154	$0	$10,154	$0	$10,154
2022	$0	$10,154	$0	$10,154	$0	$10,154
2021	$0	$10,154	$0	$10,154	$0	$10,154
2020	$0	$10,154	$0	$10,154	$0	$10,154
2019	$0	$11,282	$0	$11,282	$0	$11,282
2018	$0	$11,282	$0	$11,282	$0	$11,282
2017	$0	$11,282	$0	$11,282	$0	$11,282
2016	$0	$11,282	$0	$11,282	$0	$11,282
2015	$0	$11,282	$0	$11,282	$0	$11,282
2014	$0	$11,282	$0	$11,282	$0	$11,282
2013	$0	$9,310	$0	$9,310	$0	$9,310
2012	$0	$9,310	$0	$9,310	$0	$9,310

Property Deed History

Deed Date	Type	Description	Grantor	Grantee	Volume	Page	Number
1/13/2022	GWD	GEN. W/D	SALINAS RICHARD	SALINAS RICHARD			3299995
11/29/2010	SWD	SPEC. W/D	SALINAS RICHARD & MINERVA	SALINAS RICHARD			2158059
8/4/2006	WD	WARRANTY DEED	CITY OF MERCEDES	SALINAS RICHARD & MINERVA			1647694
4/7/2005	WD	WARRANTY DEED	RUELAS JESUS & LUCY	CITY OF MERCEDES			1456418
9/10/1987	CONV	CONVERSION	MALOY O O	RUELAS JESUS & LUCY	2492	581	

2000 East Expressway 83, Mercedes, Texas - RRC Map

February 22, 2023

1:4,514

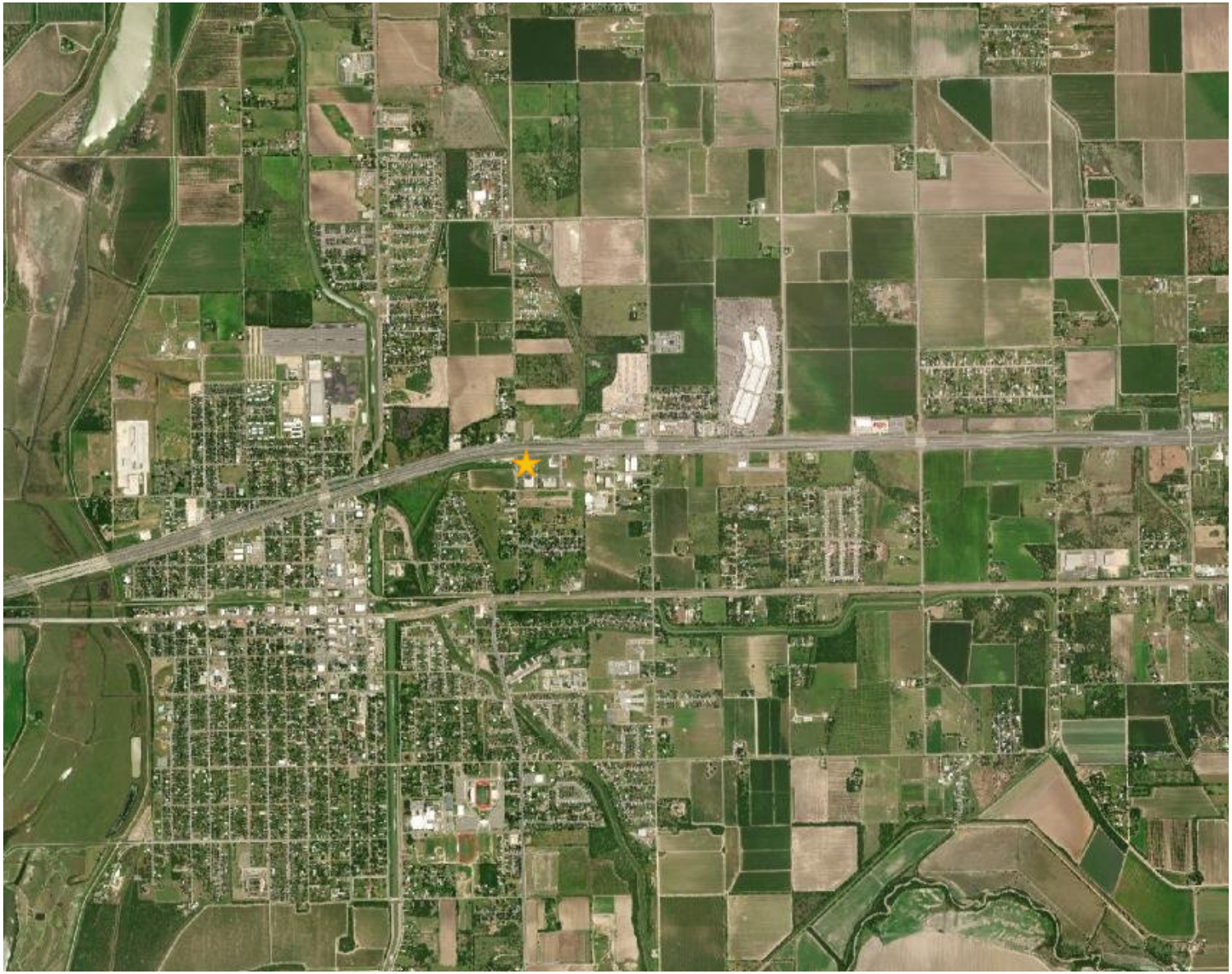
0 0.03 0.07 0.13 mi

0 0.05 0.1 0.2 km

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User

Pipeline and Hazardous Materials Safety Administration

NATIONAL PIPELINE MAPPING SYSTEM



Legend

- Accidents (Liquid)
- Incidents (Gas)
- Gas Transmission Pipelines
- Hazardous Liquid Pipelines

500 m
1000 ft

Pipelines depicted on this map represent gas transmission and hazardous liquid lines only. Gas gathering and gas distribution systems are not represented.

This map should never be used as a substitute for contacting a one-call center prior to excavation activities. Please call 811 before any digging occurs.

Questions regarding this map or its contents can be directed to npms@dot.gov.

Projection: Geographic

Datum: NAD83

Map produced by the Public Viewer application at www.npms.phmsa.dot.gov

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Date Printed: Feb 22, 2023

811 Know what's below. Call before you dig.

APPENDIX F

OTHER SUPPORTING DOCUMENTATION

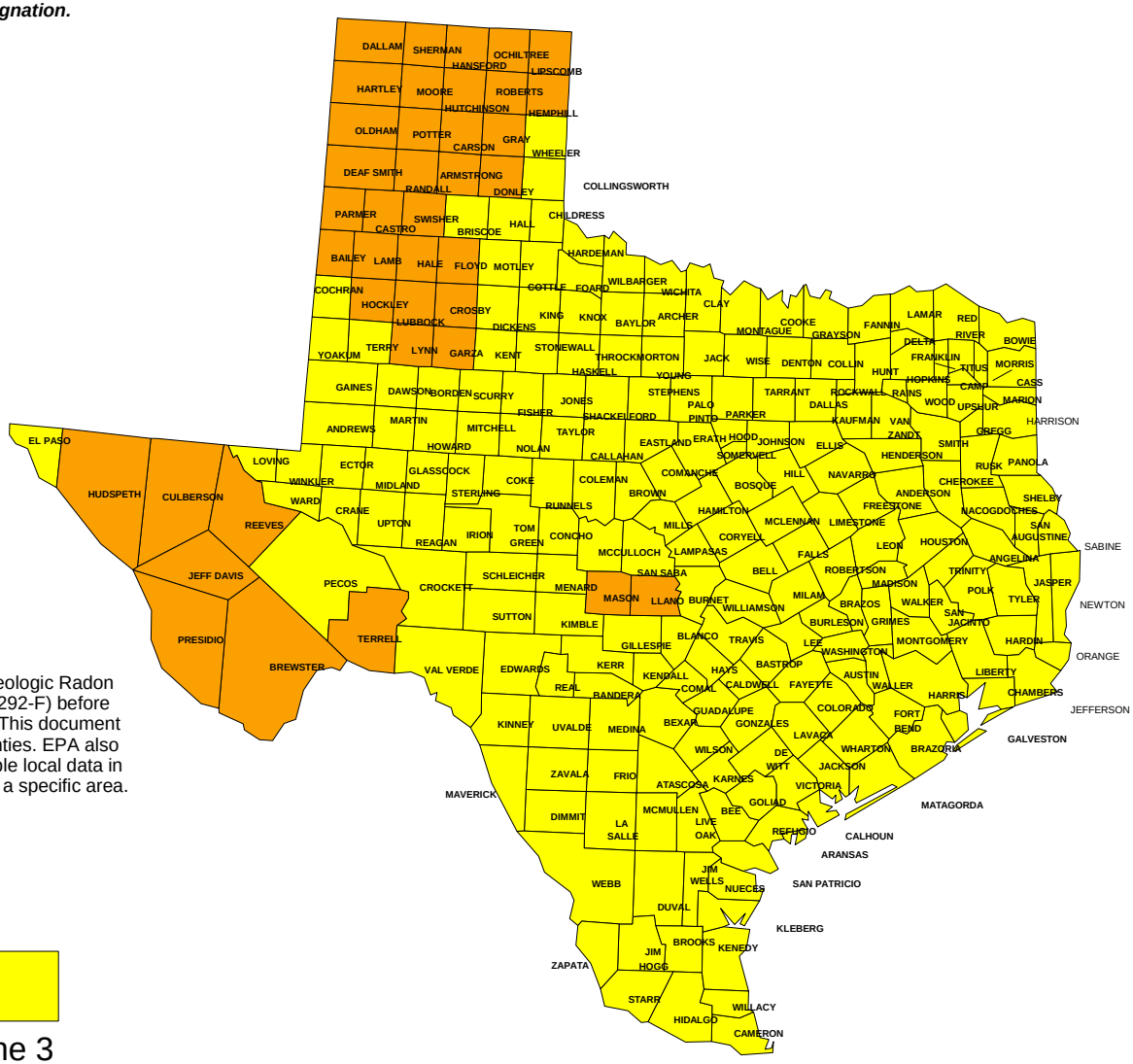
TEXAS - EPA Map of Radon Zones

http://www.epa.gov/radon/zonemap.html

The purpose of this map is to assist National, State and local organizations to target their resources and to implement radon-resistant building codes.

This map is not intended to determine if a home in a given zone should be tested for radon. Homes with elevated levels of radon have been found in all three zones.

All homes should be tested, regardless of zone designation.



IMPORTANT: Consult the publication entitled "Preliminary Geologic Radon Potential Assessment of Texas" (USGS Open-file Report 93-292-F) before using this map. http://energy.cr.usgs.gov/radon/grpinfo.html This document contains information on radon potential variations within counties. EPA also recommends that this map be supplemented with any available local data in order to further understand and predict the radon potential of a specific area.

Zone 1 Zone 2 Zone 3

APPENDIX G

QUALIFICATIONS

Alicia Sanchez

Project Manager, Due Diligence

EDUCATION

- B.S. – Environmental Science, Texas A&M University – Corpus Christi

SUMMARY OF PROFESSIONAL EXPERIENCE

Ms. Sanchez provides expertise in environmental project management, consulting, and due diligence services to ensure ASTM compliance and satisfaction of client requirements for Phase I Environmental Site Assessments, Environmental Transaction Screens, Regulatory Database and Historical Records Reviews for large- and small-scale industrial, commercial, multi-tenant residential, and rural properties.

PROJECT EXPERIENCE

Project experience for Ms. Sanchez includes:

- Phase I Environmental Site Assessments (PHI ESAs)
- Limited Environmental Site Assessments (LESAs)
- Environmental Transaction Screens (ETSs)
- Records Research with Risk Assessments (RSRAs)
- Regulatory Database Reviews
- Historical Records Reviews

As a Due Diligence Project Manager, Ms. Sanchez provides project management and technical expertise to ensure ASTM compliance and satisfaction of client requirements in the Texas, New Mexico, Oklahoma, Arkansas, and Louisiana areas.

In addition, prior to joining the environmental consulting industry, Ms. Sanchez spent two and a half years studying a diverse range of environmental disciplines including: environmental health, environmental regulations, climate change, and industrial hygiene.

Valoree Harkey

National Client Manager – Due Diligence

EDUCATION

- BS Geography, University of North Texas, Denton, Texas
- BS Biology, University of Houston, Houston, Texas

CERTIFICATIONS

- EPA Accredited Asbestos Building Inspector

SUMMARY OF PROFESSIONAL EXPERIENCE

Ms. Harkey is an experienced Environmental Professional serving as a due diligence specialist since 2013. Project history includes Phase I ESAs, Environmental Transaction Screens, Phase II ESA subsurface investigations, petroleum storage tank removals, corrective action for impacted properties, risk assessments, and asbestos inspection. Additional responsibilities include technical writing, project management, mentorship, and field oversight. Ms. Harkey's work experience prior to environmental consulting focused on management of sales and installation of home energy efficiency products.

PROJECT EXPERIENCE

Select project experience for Ms. Harkey includes:

- **Phase I, fast food restaurant (former filling station), Farmers Branch, Texas,** ▫ Ms. Harkey identified the historic use of the subject property as a fueling station and documented probable locations of potential orphan tanks. Recommendations were made to assess the presence or absence of former underground fueling tanks through ground penetrating radar and to characterize potential impacts to the subsurface through collection of soil and groundwater samples.
- **Phase I and Phase II, vacant commercial facility, 28,336 SF constructed in 1940, Dallas, Texas,** ▫ Ms. Harkey identified the historic use of the subject property as a dry-cleaning processing facility prior to regulatory oversight. She confirmed the presence of solvent contaminants beneath subject property through a Phase II ESA and characterized extent of on-site contamination. The subject property was entered into the Texas Voluntary Cleanup Program.
- **Phase I, 340 acres undeveloped land, Farmers Branch, Texas,** ▫ Ms. Harkey identified the historic use of the subject property as formerly developed with a manufacturing facility of lead automotive batteries. Recommendations were made to potential impacts to the subsurface through collection of soil and groundwater samples. The subject property was entered into the Texas Voluntary Cleanup Program.

As a National Client Manager for AEI, Ms. Harkey is responsible for staff and contractor management, and oversight of national client needs to ensure all projects meet client's goals and scope expectations and facilitating the delivery of consulting to meet those needs while also ensuring the accuracy, consistency and quality of services provided by AEI.

John Copman

Regional Director

EDUCATION

- B.S. - Natural Resource Management, with Option in Conservation and Applied Ecology, Rutgers University
- Business Administration Coursework, Kean University 2011-Present

CERTIFICATIONS

- AHERA Certified Asbestos Inspector
- NJ Lead Based Paint Inspector/Risk Assessor
- Hazardous Materials Handling & Response Certificate
- NJ Underground Storage Tank Closure & Subsurface Evaluation
- California Registered Environmental Assessor (former)

SUMMARY OF PROFESSIONAL EXPERIENCE

Mr. Copman has over 20 years of experience in the environmental assessment field. His scope of project related work includes numerous aspects of real estate due diligence for private and agency lenders, and equity clients. Mr. Copman has performed, reviewed, or managed approximately 8,000 Phase I and II Environmental Site Assessments; Property Condition Assessments; asbestos, radon, and lead-based paint screenings; Environmental Transaction Screens, storage tank closures, wetlands projects, compliance assessments, and environmental impact statements throughout the United States, Mexico, Europe, and the Caribbean Region.

Current duties involve management of AEI's Eastern Region, including staff development and training, business development, client management and subcontractor management.

Previously, while with two international consulting firms, Mr. Copman was a primary technical contact for clients throughout the United States. In addition, he has conducted training sessions to private and agency clients, including HUD, Freddie Mac, and Fannie Mae lenders, covering potential environmental and property condition issues. Mr. Copman has also given internal training on Phase I ESAs and Transaction Screens to new employees.

Previously, while working for a United States Government Contracting Firm, Mr. Copman performed Preliminary Assessments and Site Investigations in the eastern United States as part of the US EPA's Region II Field Investigation Team. These sites were all investigated as candidates for inclusion to the US EPA CERCLIS/Superfund Program.

Mr. Copman's original responsibilities included the performance of UST closure and remedial investigation studies; and the preparation of Site Assessments, Environmental Impact Statements, and Wetlands Delineations for local consulting engineering and environmental consulting companies. In addition, his responsibility included review and comment of various reports supporting civil engineering projects as part of municipal engineering services.

APPENDIX H

COMMONLY USED ACRONYMS & ABBREVIATIONS

UNITS

µg/L	Micrograms per Liter	**pCi/L**	PicoCuries per Liter
mg/kg	Milligrams per Kilogram	**ppb**	Parts per Billion
mg/L	Milligrams per Liter	**ppm**	Parts per Million

ABBREVIATIONS AND ACRONYMS

ACM	Asbestos-Containing Material	**NESHAP**	National Emission Standards for Hazardous Air Pollutants
ADJ	Adjacent site	**NFA**	No Further Action
AEI	AEI Consultants	**NFRAP**	No Further Remedial Action Planned
AHERA	Asbestos Hazard Emergency Response Act	**NLR**	No Longer Reporting
APN	Assessor's Parcel Number	**NOV**	Notice of Violation
AST	Aboveground Storage Tank	**NPL**	National Priorities List
AUL	Activity and Use Limitation	**O&M**	Operations and Maintenance
bgs	Below Ground Surface	**OEC**	Other Environmental Considerations
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes	**OSHA**	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response Compensation and Liability Act	**PCB**	Polychlorinated Biphenyl
CERCLIS	Comprehensive Environmental Response Compensation and Liability Information System	**PCE, PERC**	Perchloroethylene, Tetrachloroethylene, Tetrachloroethene
CESQGs	Conditionally Exempt Small Quantity Generators	**RCRA**	Resource Conservation and Recovery Act
COC	Contaminant of Concern	**REC**	Recognized Environmental Condition
CREC	Controlled Recognized Environmental Condition	**RP**	Responsible Party
EC	Engineering Controls	**SDS**	Safety Data Sheet
EDR	Environmental Data Resources, Inc.	**SEMS**	Superfund Enterprise Management System
EPA	Environmental Protection Agency	**SF**	Square Footage/Square Feet
ERIS	Environmental Risk Information Services	**SP**	Subject Property
ERNS	Emergency Response Notification System	**SQG**	Small Quantity Generator
ESA	Environmental Site Assessment	**SWLF**	Solid Waste Landfill
GPR	Ground-Penetrating Radar	**SVOC**	Semi-Volatile Organic Compound
HREC	Historical Recognized Environmental Condition	**TCE**	Trichloroethylene, Trichloroethene
HVAC	Heating, Ventilation and Air Conditioning	**TPH**	Total Petroleum Hydrocarbons
HWS	Hazardous Waste Site	**TPHd**	Total Petroleum Hydrocarbons (diesel range)
IC	Institutional Controls	**TPHg**	Total Petroleum Hydrocarbons (gasoline range)
LBP	Lead-Based Paint	**TPHo**	Total Petroleum Hydrocarbons (oil range)
LCP	Lead-Containing Paint	**TRPH**	Total Recoverable Petroleum Hydrocarbons
LLP	Landowner Liability Protection	**TSDF**	Treatment, Storage, and Disposal Facility
LQG	Large Quantity Generator	**USDA**	United States Department of Agriculture
LUST	Leaking Underground Storage Tank	**USGS**	United States Geological Survey
MCL	Maximum Contaminant Level	**UST**	Underground Storage Tank
MTBE	Methyl Tertiary Butyl Ether	**VCP**	Voluntary Cleanup Program
ND	None Detected	**VOC**	Volatile Organic Compound

SECTION 01 01 00
GENERAL SCOPE OF WORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: The Project generally consists of, but is not necessarily limited to, the following:

The project consists of a site area of 2.03 acres, interior renovations to the existing building 5,992.40 S.F., and an expansion of 6,972.60 S.F. The improvements consist of six classroom additions, including a new laboratory, computer lab, IT closet, server room, riser room, Electrical room, and four standard classrooms, and installation of new finishes. Other site improvements include the re-surfacing of the service drive and adjustments connecting to the covered walkway.

Project is located at:
2000 East Expressway 83
Mercedes, TX 78570

1. Site Work as noted in the Construction Documents.

B. Work Not Included, must meet Requirements:

1. Furnishings.

2. All Items Noted “N.I.C.” (Not In Contract) on Drawings.

1.02 CONTRACT DOCUMENTS

A. Requirements for all Work shall be executed in strict accordance with the following:

1. The Contract.

2. The Drawings.

3. The Approved Shop Drawings.

4. The General Conditions and Supplementary General Conditions.

5. The Specifications, Addenda and Bulletins.

6. The Change Orders and Directives received from the Owner and/or Architect.

7. Warranties and Guarantees in accordance with requirements of the Contract Documents, with period of Warranty as stated therein; except if Contractor neglects to correct or complete Work in Punch Lists during period of Warranty and/or Guaranty, Contractor is still responsible and required to do so after expiration dates of Warranty or Guaranty until the corrective Work is completed and accepted by the Owner.

8. The governing Building Code, all governing laws, ordinances, rules, permits, regulations and directives from governing authorities having jurisdiction over this Work.

9. The approved Construction Time and Sequence Schedule.

10. Cooperation with other Contractors employed on the Project by the Owner under separate contracts. Cooperation shall include, but not be limited to, written notices to others when required to implement proper coordination of the Work and to maintain the Construction Time and Sequence Schedule.

B. Intent of Contract Documents: Work not particularly detailed, marked, or specified shall be the same as similar parts that are detailed, marked, or specified. Should an error occur in the Specifications or Drawings, or in Work by others affecting this Work, the Contractor shall at once notify the Architect who will issue instructions as to procedure. If the Contractor proceeds with the Work based on such an error without instructions from the Owner, the Contractor shall make good any resulting damage or defects. This includes Specification typographical errors and Drawing notational errors where the intent is doubtful.

C. Conflicts: In the event of a conflict or need for interpretation between the Working Drawings and Specifications, the Architect shall be the sole interpreter of the Drawings and Specifications, to determine which, if any will take precedence.

D. Requirements of Regulatory Agencies: Furnish and install materials in strict compliance with the laws, codes, ordinances and regulations of the public authorities having jurisdiction over this Project, including “ICC/ANSI - A117.1 - Standard for Accessible and Usable Buildings and Facilities” and “Title III of The Americans with Disabilities Act (ADA), Public Law 101-336”.

1.03 QUALITY ASSURANCE

A. Standards: All exterior building materials and systems shall meet local building code requirements for fire spread, uplift resistance, and wind loads.

1.04 PROHIBITED SUSPENSION OF MATERIALS FROM METAL DECK

A. Suspension of any material or equipment from metal deck is strictly prohibited. Items not allowed to be attached to or suspended from the metal deck include but are not limited to mechanical or electrical equipment, ducts, piping, light fixtures, or other decorative structures.

1.05 HAZARDOUS MATERIALS

A. The building shall be free of hazardous materials according to applicable federal, state, and local environmental regulations.

1.06 ASBESTOS FREE MATERIALS

A. No asbestos, or products containing asbestos, shall be installed in this Project. General Contractor shall provide to the Owner at completion of construction, an affidavit certifying that the Project is free of all asbestos - containing materials.

1.07 ACCESS TO SITE

A. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.08 WORK RESTRICTIONS

A. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 011000
SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Summary of the Work including any work by OWNER, OWNER furnished products, work sequence and future work.

1.02 DESCRIPTION OF WORK

A. General location of Work: Northwest corner of Conway and 495, Mission Texas

B. Legal Description:Shops at 495 Phase I

C. Description of Work: Work, in general, under this Contract consists of furnishing, installing and constructing pavement improvements to provide access from Conway to 495 through the plaza and grading and drainage improvements to serve the Shops at 495 Subdivision. .

1. As indicated on the PLANS, improvements include:
   a. Paving Improvements - Onsite paving improvements to serve the property vehicular and pedestrain traffic.
      1) Paving improvements for this site consist of a concrete and asphalt drive to the adjacent public road, and onsite pavement. Pavement section recommendation are provided by geotechnical engineer.
   b. Stormwater Improvements - Onsite stormwater improvements to provide positive drainage throughout the property and designate an area for the required detention/retention volume.
   c. Erosion Control - The provided plan is a suggested erosion control plan. Contractor is to adjust accordingly based off site condition and needs. It's the Contractor's responsibilty to obtain all the required permits, if any, prior to construction.
   d. Clean up project area upon completion including repair of staging area and other areas damaged as a result of the CONTRACTOR's activities.
   e. Owner/Engineer/Contractor (OEC) Meetings - Attend monthly progress meetings of project.
   f. Under this Contract, CONTRACTOR shall furnish all materials, appliances, tools, equipment, transportation, services, and all labor and superintendence for the construction of the work as described in these TECHNICAL SPECIFICATIONS and as shown on the PLANS. The completed installation shall not lack any part which can be reasonably implied as necessary to its proper functioning or any subsidiary item which is customarily furnished, and CONTRACTOR shall deliver the installation to OWNER in operating condition.
   g.

D. Sequence of Work: Contractor to submit a schedule with monthly updates outlining the start and completion of major task. This must be submitted with each request for payment/payment application.

1. OWNER reserves the right to schedule sequence of construction; that is, which portion of the project will be constructed first. The contractor may perform construction operations during daylight hours only, unless written approval is given by the ENGINEER and the OWNER. All existing utilities to remain operational during all construction activities.

END OF SECTION

SECTION 01 15 00
CONTRACT STANDARDS AND PROCEDURES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: This section consists of establishing standards and procedures.

1.02 OPERATIONS

A. Layout: Locate and layout the Work, and establish lines and levels accurately. Report any discrepancies to the Architect immediately upon discovery.

B. Use of Premises: Confine apparatus, storage of materials, and operations of workmen to limits indicated by law, ordinance, permit, or arrangement with the Owner. Do not unreasonably encumber the premises with materials.

C. Project Meetings:

1. Progress Meetings: Schedule and conduct regular periodic progress meetings. All Key personnel of contractor and subcontractors shall attend. Notify other parties as the Owner’s Representative or Architect might designate, as job conditions and progress might warrant.

a. Contractor’s Construction Schedule: Review progress since last meeting, determine whether each activity is on time, ahead schedule, or behind schedule, in relation to the Contractor’s construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that correct and subsequent activities will be completed within Contract Time.

1) Review schedule for next scheduled progress meeting period.

b. Agenda: Review present and future needs of each entity present, including the following:

1) Interface requirement.

2) Sequence of operations.

3) Status of submittals.

4) Deliveries.

5) Off-site fabrication.

6) Access and site utilization.

7) Temporary facilities and controls.

8) Progress Cleaning

9) Quality and work standards

10) Status of correction of deficient items.

11) Field observations.

12) Status of RFIs.

13) Status of proposal requests.

14) Pending changes and Status of Change Orders.

15) Pending claims and disputes.

16) Documentation of information for payment requests.

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

2. Pre-construction Meeting: Schedule and conduct a preconstruction meeting before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after execution of the Agreement. All Key personnel of owner, design professionals and contractors shall attend. Notify other parties as the Owner's Representative or Architect might designate, as job conditions and progress might warrant.

a. Agenda: Discuss items of significance that could affect progress, including the following:

1) Tentative construction schedule.

2) Phasing and Staging.

3) Critical work sequencing and long-lead items.

4) Designation of key personnel and their duties.

5) Lines of communications.

6) Procedures for processing field decisions and Change Orders.

7) Procedures for RFIs.

8) Procedures for testing and inspecting.

9) Procedures for processing Application for Payment.

10) Distribution of the Contract Documents.

11) Submittal procedures.

12) Preparation of record documents.

13) Use of the premises.

14) Work restrictions.

15) Working hours.

16) Owner's occupancy requirements.

17) Responsibility for temporary facilities and controls.

18) Procedures for moisture and mold control.

19) Procedures for disruptions and shutdowns.

20) Construction waste management and recycling.

21) Parking Availability.

22) Office, work, and storage areas.

23) Equipment deliveries and priorities.

24) First Aid.

25) Security.

26) Progress cleaning.

27) Safety.

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

4. Pre-installation Meetings: Conduct a preinstallation meeting at Project site before each construction activity that requires coordination with other construction. All Key personnel of contractor, subcontractors, manufacturer representative and Owner's Commissioning Authority shall attend. Notify other parties as the Owner's Representative or Architect might designate, as job conditions and progress might warrant.

a. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

1) Contract Documents.

2) Options.

3) Related RFIs.

4) Related Change Orders.

5) Purchases and Deliveries.

6) Submittals.

7) Review of Mockups.

8) Possible conflicts and Compatibility problems.

9) Time schedules and weather limitations.

10) Manufacturer's written recommendations.

11) Warranty requirements.

12) Compatibility of materials and acceptability of substrates.

13) Temporary facilities and controls.

14) Space and access limitations.

15) Regulations of authorities having jurisdiction.

16) Testing and inspecting requirements.

17) Installation procedures and coordination with other work.

18) Required performance results.

19) Protection of adjacent work, construction and personnel.

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

5. Project Closeout Meetings: Schedule and conduct a Project closeout meeting, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion. All Key personnel of contractor, subcontractors, owner, owner's commissioning authority and design professionals shall attend. Notify other parties as the Owner's Representative or Architect might designate, as job conditions and progress might warrant.

a. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

1) Submission of record documents.

2) Procedures required prior to inspection for Substantial Completion and for Final inspections for acceptance.

3) Submittal of written warranties.

4) Requirements for preparing operations and maintenance data.

5) Requirements for demonstrations and training.

6) Preparation of Contractor's punch list.

7) Procedures for processing Applications for Payment at Substantial Completion and for final payment.

8) Submittal Procedures.

9) Coordination of separate contracts.

10) Owner's partial occupancy requirements.

11) Installation of Owner's furniture, fixtures, and equipment.

12) Responsibility for removing temporary facilities and controls.

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

1.03 RECORDS

A. Record Drawings: Maintain on site a complete set of Construction Documents and Shop Drawings as required by Section 01 70 00 - Project Closeout.

B. Construction Photographs: Refer to Sections 01 32 33 - Photographic Documentation.

1.04 SUBMITTALS

A. Subcontractor List: Submit list of subcontractors with addresses, telephone numbers and e-mail addresses for approval within twenty-four (24) hours after notification of intent to enter into Contract. Prepare list on the form of a sworn statement attesting to the validity of such. Do not change the name of subcontractors or vendors on the approved list without the specific written form stating sufficient reason to warrant such a change.

B. Schedule of Values: Prepare detailed accounting of Contract Sum on the basis of "trades" Sections indicated in the Table of Contents. Submit and obtain approval before first application for payment. Use only approved breakdown for payment requests.

C. Payment Schedule: Submit to the Architect at least twenty (20) days prior to the submission of the first request for payment, a schedule detailing projected monthly requests for payment for the duration of the Project.

D. Shop Drawings and Samples:

1. Refer to Section 01 33 23 - Shop Drawings and Samples.

2. In addition to Section 01 33 23, the Contractor shall furnish the Owner with one (1) copy of all approved Shop Drawings and manufacturers product data bound in loose leaf form, for the Owner's records, prior to Owner issuing the Certificate of Substantial Completion.

E. Test Reports: Submit copies as required herein, with distribution as directed by the Architect.

1.05 DOCUMENTS

A. Performance and Labor and Material Payment Bonds:

1. If required, deliver to the Owner within ten (10) days of the date of the notification of intent to enter into Contract.

2. Condition bonds for the faithful performances of the Contract and for the payment of labor and material, each in the sum of 100% of the amount of the Contract as set forth in notification of intent to enter into Contract.

3. The Owner, at the Owner's discretion, reserves the right to accept or reject the company underwriting the bonds on the basis of their previous performance.

B. Agreement: Use AIA Form A111.

C. Application for Payment: Use AIA Form G702 and G703.

D. Sworn Statements: Use uniform commercial format designated by the Owner.

E. Insurance Certificate: Use form selected by Owner. Owner may, at the Owner's option, require a certified copy of Contractor's insurance policies in addition to insurance certificates.

1.06 QUALITY CONTROL

A. Standards: Establish a quality control system to perform sufficient inspection and tests of all Work, including subcontractors, to ensure conformance to applicable Specifications and Drawings, with respect to materials, workmanship, construction, finish, functional performance, and identification. Control system shall specifically include observation, supervision, and tests required in the Specifications.

B. Testing: Provide testing in accordance with Section 01 45 23 - Testing and Inspecting Services.

1.07 SCHEDULE

A. Dates: Work shall commence and be substantially completed as specified in the Contract Agreement.

B. Schedule:

1. Prepare a “Plan of Operations and Progress Schedule” to indicate the manner in which different phases of the Work are to be started, when Shop Drawings and submittals are to be submitted, colors selected, methods and speed for progressing different phase actions, and dates upon which subcontractors are dependent upon other sub-contracts. Schedule shall indicate major items of Work, including foundations, column footings, steel erection, floor finishes, underfloor plumbing and electrical Work, roof mounted HVAC equipment, concrete floor pours, partition Work, and date of Final Completion.

2. Plan of Operations and Progress Schedule shall be “weighted” to schedule each trade in proportion to the entire Project, physically and financially.

3. Revise schedule monthly to indicate actual progress compared to the estimated progress.

4. Post schedule in the Contractor’s field office and distribute copies to the Owner, Architect, Project Representative, and all prime Subcontractors.

1.09 PAYMENT

A. Requests:

1. On or before the tenth (10th) day of each month, the Contractor shall make application for payment in quadruplicate based on percentage of completion of items of cost breakdown.

2. Each application after the first one shall be accompanied by waivers of lien and sworn statements that all labor, materials, and services included in the previous and prior statements have been paid, less only the retained percentage stated herein, and any disputed amounts which shall be stated. In addition, the Contractor shall request and file with the request for payment a sworn statement from each Subcontractor that the Contractor has direct contractual relations with.

B. Payment: The Owner shall make payments on account of each contract as provided herein. Within thirty (30) days after submission and approval of the application for payment the Owner will pay ninety (90) percent of the value except as may be modified as follows, based on the Contract prices, including executed change orders amending the Contract, on labor and materials incorporated in the Work, and material suitably stored at the site up to the first day of that month as certified by the Architect, less the aggregate of the previous payments.

C. Retained Percentage:

1. Five (5%) percent of the estimated amounts shall be retained until the final completion and acceptance of all Work covered by the Contract.

2. The retained percentage shall be paid thirty-five (35) days after Owner's acceptance of the building, providing that all requirements of the Contract are met. Refer to Closing Procedure.

D. Substantial Completion Payment: Upon issuance of Certificate of Substantial Completion, a sum shall be paid sufficient to increase the payments to the total of the Contract, less the retained percentage.

E. Final Certificate:

1. After the Contractor has complied with the closing requirements specified herein, and provided the Architect with appropriate documentation, the Architect shall certify such, issuing a Final Certificate.

2. Issuance of such Certificate does not relieve the Contractor of the responsibilities related to guaranteeing the performance of the facility, as specified herein or otherwise provided.

1.10 CLEANING

A. Keep the premises free from accumulation of waste materials or rubbish caused by Work operations at all times. At the completion of the Work remove all waste materials and rubbish from and about the Project, as well as all tools, construction equipment, machinery, and surplus materials.

B. Establish and enforce a daily system for collecting and disposing waste materials from construction areas and elsewhere at Project site. Do not hold collected materials at site for more than three (3) days. Handle hazardous, dangerous, unsanitary, contaminating, pollution and similar harmful wastes separately from inert materials by containerizing in an appropriate manner. Dispose of each category of waste material in a lawful manner. Do not bury or burn waste materials on Owner's property.

1.10 CLOSING PROCEDURES

A. Financial:

1. Furnish ample evidence to Architect and Owner that all financial obligations have been met, including sworn statements and final waivers of lien.
2. Obtain a written statement releasing the Owner and the Architect from any and all obligations which might arise out of any unpaid, defaulted, or otherwise unsatisfied accounts.

B. Punch List:

1. Complete and correct all items on the Punch List as originally issued, and amended.
2. If contemplating application for final payment, schedule a joint inspection visit to the

Project with the Architect one (1) week in advance to determine if the Contracts have been fully executed.

C. Record Drawings: Deliver not less than three (3) sets of documents to the office of the Architect.

D. Warranties and Guarantees:

1. Submit all written warranties and guarantees.
2. Submit as applicable, list of contacts, including company name, personal contact, address, telephone number, and e-mail address for building equipment and components which may require periodic service, including roofing, power actuated doors, mechanical equipment, fire protection, plumbing, and electrical equipment.

C. Other Documents:

1. Furnish reports of all tests and the performance of completed systems, as required in the Specifications, and all certificates of approval.
2. Furnish all schedules, instructions, and equipment operation and service manuals as necessary to ensure safe and proper operation and maintenance of products installed in the building.

E. Final Certificate: Issuance of Final Certificate does not relieve the Contractors of the responsibilities related to warranting and guarantying the performance of the Work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Quantity allowances.
3. Contingency allowances.
4. Testing and inspecting allowances.

C. Related Requirements:
1. Section 01 40 00 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight**,** and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner and/or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

D. All Allowances remaining balance at the end of the project shall be returned/credited back to the Owner.

E. The allowance shall appear on the schedule of value as a line item.

1.8 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

Allowance No. 1: Lump-Sum Allowance: General Contractor to include Owners Contingency Allowance in the amount of $25,000.00 (Twenty-Five Thousand U.S. Dollars).

Allowance No. 2: Lump-Sum Allowance: General Contractor to include Architect Design Contingency-Betterment Allowance in the amount of $25,000.00 (Twenty-Five Thousand U.S. Dollars).

Allowance No. 3: Lump-Sum Allowance: General Contractor to include Signage Contingency Allowance in the amount of $30,000.00 (Thirty Thousand U.S. Dollars).

END OF SECTION

DOCUMENT 01 23 00
ALTERNATES

1.1 BID INFORMATION

A. Bidder: _____.

B. Prime Contract: _____.

C. Project Name: Triumph Public High School New Mercedes Campus.

D. Owner: Triumph Public High Schools
1208 South Presa
San Antonio, Texas 78210-2838

E. Architect: Laura Nassri Warren, AIA, NCARB /Principal, The Warren Group Architects, Inc., 804 S. Main Street, McAllen, Texas 78501.

F. Architect Project Number: 2012301.

1.2 BID FORM SUPPLEMENT

A. This form is required to be attached to the Bid Form.

1.3 DESCRIPTION

A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.

1. Cost-Plus-Fee Contract: Alternate price given below includes adjustment to Contractor's Fee.

B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."

C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

D. The Bidder shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.

E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within 60 days of the Notice of Award unless otherwise indicated in the Contract Documents.

F. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

1.4 SCHEDULE OF ALTERNATES

A.

Alternate No. 1: General Contractor to provide add on price to remove and replace existing metal roof, gutters, and insulation. New roof Is to be MBCI Standing Seam Metal Roof W/30 Reinforced Vinyl Faced Insulation Downspouts and gutter to match existing size and configuration.

1. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.

2. _____Dollars

   ($_____).

3. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

1.5 SUBMISSION OF BID SUPPLEMENT

Respectfully submitted this ____ day of _____, 2023.

Submitted By: _____
(Name of bidding firm or corporation)

Authorized Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President)

END OF DOCUMENT

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2. SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use Industry Standard Form

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES, NFPA, end related codes adopted by the City of **Mercedes, Texas**.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Substitution request is fully documented and properly submitted.

c. Requested substitution will not adversely affect Contractor's construction schedule.

d. Requested substitution has received necessary approvals of authorities having jurisdiction.

e. Requested substitution is compatible with other portions of the Work.

f. Requested substitution has been coordinated with other portions of the Work.

g. Requested substitution provides specified warranty.

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

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.

c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

d. Substitution request is fully documented and properly submitted.

e. Requested substitution will not adversely affect Contractor's construction schedule.

f. Requested substitution has received necessary approvals of authorities having jurisdiction.

g. Requested substitution is compatible with other portions of the Work.

h. Requested substitution has been coordinated with other portions of the Work.

i. Requested substitution provides specified warranty.

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

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

    a. Application for Payment forms with continuation sheets.
    b. Submittal schedule.
    c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 01 01 00 "General Scope of Work."

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

      1) Labor.
      2) Materials.
      3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

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

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

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

D. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

3. Provide summary documentation for stored materials indicating the following:

   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

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

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

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or proceeded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Submittal schedule (preliminary if not final).
   5. List of Contractor's staff assignments.
   6. List of Contractor's principal consultants.
   7. Copies of building permits.
   8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   9. Initial progress report.
   10. Report of preconstruction conference.
   11. Certificates of insurance and insurance policies.

J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Pre-construction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Pre-installation meetings.

G. Equipment electrical characteristics and components.

H. Cutting and patching.

I. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

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

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

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

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

E. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

A. Employ a Land Surveyor registered in the State of project and acceptable to Architect/Engineer.

B. Contractor shall locate and protect survey control and reference points. Promptly notify Architect/Engineer of any discrepancies discovered.

C. Control datum for survey is that established by Owner provided survey.

D. Verify set-backs and easements; confirm drawing dimensions and elevations.

E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

F. Submit a copy of site drawing and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.

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

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

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

J. Promptly report to Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

K. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

1.4 PRECONSTRUCTION MEETING

A. Owner and Architect/Engineer will schedule a meeting after Notice of Award.

B. Attendance Required: Owner, Architect/Engineer, and Contractor.

C. Agenda:

1. Execution of Owner-Contractor Agreement.

2. Submission of executed bonds and insurance certificates.

3. Distribution of Contract Documents.

4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.

5. Designation of personnel representing the parties in Contract, Owner and the Architect/Engineer.

6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

7. Scheduling.

8. Scheduling activities of a Geotechnical Engineer.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, participants, and those affected by decisions made.

1.5 SITE MOBILIZATION MEETING

A. Architect/Engineer and Owner will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required: Owner, Architect/Engineer, Special Consultants, Contractor, Contractor's Superintendent, and major Subcontractors.

C. Agenda:

1. Use of premises by Owner and Contractor.

2. Owner's requirements.

3. Construction facilities and controls provided by Owner.

4. Temporary utilities provided by Owner.

5. Survey and building layout.

6. Security and housekeeping procedures.

7. Schedules.

8. Application for payment procedures.

9. Procedures for testing.

10. Procedures for maintaining record documents.

11. Requirements for start-up of equipment.

12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distributes copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, participants, and those affected by decisions made.

1.6 PROGRESS MEETINGS

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

B. Contractor shall coordinate with Architect/Engineer arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:

1. Review minutes of previous meetings.

2. Review of work progress.

3. Field observations, problems, and decisions.

4. Identification of problems, which impede planned progress.

5. Review of submittals schedule and status of submittals.

6. Review of off-site fabrication and delivery schedules.

7. Maintenance of progress schedule.

8. Corrective measures to regain projected schedules.

9. Planned progress during succeeding work period.

10. Coordination of projected progress.

11. Maintenance of quality and work standards.

12. Effect of proposed changes on progress schedule and coordination.

13. Other business relating to Work.

E. Record minutes and distributes copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, participants, and those affected by decisions made.

1.7 PREINSTALLATION MEETING

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

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

C. Notify Architect/Engineer seven days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of installation, preparation and installation procedures.

2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect/Engineer, Owner, participants, and those affected by decisions made.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Motors: Specific motor type is specified in individual specification sections.

B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.

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

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affect:

1. Structural integrity of element.

2. Integrity of weather-exposed or moisture-resistant elements.

3. Efficiency, maintenance, or safety of element.

4. Visual qualities of sight exposed elements.

5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:

1. Fit the several parts together, to integrate with other Work.

2. Uncover Work to install or correct ill-timed Work.

3. Remove and replace defective and non-conforming Work.

4. Remove samples of installed Work for testing.

5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

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

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

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

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

K. Identify hazardous substances or conditions exposed during the Work to the Architect/Engineer for decision or remedy.

3.2 SPECIAL PROCEDURES

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

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to provide for proper installation of new work and finishes.

G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring products and finishes to specified condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Architect/Engineer for review.

L. Where a change of plane of ¼ inch or more occurs, submit recommendation for providing a smooth transition to Architect/Engineer for review.

M. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

N. Patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections.

O. Finish surfaces as specified in individual product sections.

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project Web site.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 01 15 00 "Contract Standards and Procedures" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 70 00 "Project Closeout" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 10 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.

2. Preparation of the schedule of values.

3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.

5. Progress meetings.

6. Preinstallation conferences.

7. Project closeout activities.

8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

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

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

    b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

    f. Indicate required installation sequences.

    g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:

   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.

   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.

   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.

   d. Location of pull boxes and junction boxes dimensioned from column center lines.

8. Fire-Protection System: Show the following:

   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are

not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.

2. Project number.

3. Date.

4. Name of Contractor.

5. Name of Architect and Construction Manager.

6. RFI number, numbered sequentially.

7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.

9. Drawing number and detail references, as appropriate.

10. Field dimensions and conditions, as appropriate.

11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.

    b. Requests for approval of substitutions.

    c. Requests for approval of Contractor's means and methods.

    d. Requests for coordination information already indicated in the Contract Documents.

    e. Requests for adjustments in the Contract Time or the Contract Sum.

    f. Requests for interpretation of Architect's actions on submittals.

    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly Include the following:

1. Project name.

2. Name and address of Contractor.

3. Name and address of Architect and Construction Manager.

4. RFI number including RFIs that were returned without action or withdrawn.

5. RFI description.

6. Date the RFI was submitted.

7. Date Architect's and Construction Manager's response was received.

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

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

2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT WEB SITE

A. Use Architect's Project Web site for purposes of hosting and managing project communication and documentation until Final Completion when file size surpasses e-mail max attachment limit, and when otherwise directed by Architect.

B. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013233
PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.
   4. Preconstruction video recordings.
   5. Periodic construction video recordings.

1.02 MEASUREMENT AND PAYMENT

A. No separate measurement and payment are made under this section. Include cost for work under this Section in related items listed on the Unit Price Schedule.

1.03 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 8 megapixels.
   2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by brief description including location.
   3. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Owner and Engineer.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of vantage point, indicating location and direction (by compass point).
      g. Unique sequential identifier.

B. Video Recordings: Submit video recordings within seven days of recording.
   1. Submit video recordings by USB and/or digital video disc acceptable to the Engineer.
   2. Identification: With each submittal, provide the following information:
      a. Name of Project.
      b. Name and address of photographer.
      c. Name of Owner and Engineer.
      d. Name of Contractor.
      e. Date video recording was recorded.
      f. Description of vantage point, indicating location and direction (by compass point).
      g. Weather conditions at time of recording.

1.04 USAGE RIGHTS

A. The owner shall be given copyright usage rights for unlimited reproduction of photographic documentation.

PART 2 PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

B. Digital Video Recordings: Provide high-resolution, digital video disc, and/or USB in format acceptable to Engineer.

PART 3 EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Date and Time: Include date and time in file name for each image.
   2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Owner and Engineer.

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

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

E. Owner and Engineer - Directed Construction Photographs: From time to time, Owner and Engineer will instruct the Contractor about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take color photographs after date of Substantial Completion for submission as project record documents. Owner or Engineer will inform photographer of desired vantage points.
   1. Do not include date stamp.

G. Additional Photographs: Owner or Engineer may request photographs in addition to periodic photographs specified.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a. Special events planned at Project site.
      b. Immediate follow-up when on-site events result in construction damage or losses.
      c. Photographs to be taken at fabrication locations away from Project site.
      d. Substantial Completion of a major phase or component of the Work.
      e. Extra record photographs at time of final acceptance.
      f. Owner's request for special publicity photographs.

3.02 CONSTRUCTION VIDEO RECORDINGS

A. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Engineer.
   1. Flag construction limits before recording construction video recordings.
   2. Show existing conditions adjacent to Project site before starting the Work.
   3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of construction.
   4. Show protection efforts by Contractor.

B. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

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

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

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

1.4 ACTION SUBMITTALS

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

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

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

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

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

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

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

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Digital Drawing Software Program: The Contract Drawings are available in PDF drawings.

c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
d. Digital data drawing files will be made available in PDF Format.

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

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

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

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

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Insert list of submittals requiring sequential review in first subparagraph below, or delete and identify submittals in Sections where they are specified. Structural, HVAC, plumbing, and electrical components are examples of the Work that often require sequential review.
6. Allowing procedure in "Concurrent Consultant Review" Subparagraph below may cause tracking problems for Architect and Construction Manager, if any. Delete if not allowed. See Evaluations.
7. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

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

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

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

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

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

    a. Transmittal Form for Paper Submittals: Use AIA Document G810.
    b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of Construction Manager.
        7) Name of Contractor.

8) Name of firm or entity that prepared submittal.
9) Names of subcontractor, manufacturer, and supplier.
10) Category and type of submittal.
11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number, numbered consecutively.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

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

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

   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

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

   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Names of subcontractor, manufacturer, and supplier.
   h. Category and type of submittal.
   i. Submittal purpose and description.
   j. Specification Section number and title.
   k. Specification paragraph number or drawing designation and generic name for each of multiple items.
   l. Drawing number and detail references, as appropriate.
   m. Location(s) where product is to be installed, as appropriate.
   n. Related physical samples submitted directly.

o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

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

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

F. Options: Identify options requiring selection by Architect.

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

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

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

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

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.

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

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

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

3. Action Submittals: Submit submittals in PDF Format or three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
4. Informational Submittals: Submit in PDF Format or submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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

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

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

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

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

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

a. PDF electronic file.
b. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.

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

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

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

a. PDF electronic file.
b. Two opaque (bond) copies of each submittal. Architect, will return one copy(ies).
c. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

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

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

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

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

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

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

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

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

    a. PDF electronic file.
    b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017000 "Project Closeout."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

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

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

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

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

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

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

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

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

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

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

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

2.2 DELEGATED-DESIGN SERVICES

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

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

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

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

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

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

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

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

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

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 GENERAL

A. Contractor shall submit documentation as required by the Contract Documents and as reasonably requested by the Owner and Engineer to:

B. Record the products incorporated into the Project for the Owner.

C. Provide information for operation and maintenance of the Project.

D. Provide information for the administration of the Contract.

E. Allow the Engineer to advise the Owner if products proposed for the project by the Contractor conform, in general, with the design concepts of the Contract Documents.

F. Contractors responsibility for full compliance with the Contract Documents is not relieved by the Engineers review of submittals, Contract modifications may only be approved by Change Order or Field Directive.

1.02 CONTRACTORS RESPONSIBILITIES

A. Review all submittals prior to submission.

B. Determine and verify:
   1. Field measurements.
   2. Field construction requirements.
   3. Location of all existing structures, utilities and equipment related to the submittals.
   4. Submittals are complete for their intended purpose.
   5. Conflicts between the submittals related to the various subcontractors and suppliers have been resolved.
   6. Quantities and dimensions shown on the submittals.

C. Submit information per the procedures described in this section and the detailed specifications.

D. Furnish the following submittals:
   1. As specified in the attached Submittal Schedule.
   2. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions.
   3. Submittals as required in the detailed specifications.

E. Submittals not required will be returned without Engineer's review.

F. Submit a schedule indicating the date submittals will be sent to the Engineer and proposed dates that the product will be incorporated into the project. Make submittals promptly in accordance with the schedule so as to cause no delay in the project.
   1. Submittals shall be sent to Engineer allowing a reasonable time for delivery, review and marking submittals. Time for review is to include time for resubmission if necessary and to allow adequate time for the ordering, fabrication, and delivery of the product.
   2. Schedule submittal to provide all information for interrelated work at one time. No review will be performed on submittals requiring coordination with other submittals. Engineer will return submittals for resubmission as a complete package.

G. Installation of any products prior to the approval of shop drawings is done at the Contractors risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owners option.

H. Payment will not be made for products for which submittals are required until the submittals have been approved. Payment will not be made for products for which shop drawings or samples are required until these are approved by the Engineer.

1.03 QUALITY ASSURANCE

A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting this criterion will be returned without review.

B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including drawings and specifications as modified by Addenda, Field Directive and Change Orders.

C. Furnish and install products that fully comply with the information included in the submittal.

D. Review and approve submittals prior to submitting them to the Engineer for review. Submittals will not be accepted from subcontractors, suppliers, or anyone other than the Contractor.

1.04 SUBMITTAL PROCEDURES

A. Deliver submittals to the Engineer.

B. Assign a number to the documents originated to allow tracking of the submittal during the review process.

C. Submit documents with uniform markings and page sizes.
   1. Paper size shall allow for ease of reproduction.
      a. Submit documents on 8-1/2” x 11” paper here practical.
      b. Use 11” x 17” paper for larger drawings and schematics.
      c. Use full size blueline sheets for fabrications and layout drawings. Reproducible drawings may be submitted in lieu of bluelines.
   2. Mark submittals to:
      a. Indicate Contractors corrections in green.
      b. Highlight items pertinent to the products being furnished in yellow and delete items that are not when the Manufacturers standard drawings or information sheets are provided.
      c. Cloud items and highlight in yellow where selections by the Engineer or Owner are required.
      d. Mark dimensions with the prefix FD to indicate field verified dimensions on the drawings.
      e. Provide a blank space 8” x 3” for Contractor’s and Engineers stamp.

D. Mark submittals to reference the drawing number and/or section of the specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used

1.05 REVIEW PROCEDURES

A. Priority submittals will be reviewed before other submittals for this project which have been received but not reviewed.

1.06 REQUIREMENTS

A. Certifications. Warranties and Service Agreements include documents as specified in the detailed specifications as shown in the submittal schedule or as follows:

B. Certified Test Reports (CTR) - A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the specifications.
   1. Certification of Local Field Service (CLS) - A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300 mile radius of the project site. List names, addresses, and telephone numbers of approved service organizations on or attach to the certificate.
   2. Extended Warranty (EW) - A guarantee of performance for the product or system beyond the normal one (1) year warranty described in the General Conditions, Issue the warranty certificate in the name of the Project Owner.
   3. Extended Service Agreement (ESA) - A contract to provide maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a

definite period of time beyond the warranty period. Issue the service agreement in the name of the Project Owner.

4. Certification of Adequacy of Design (CAD) - A certified letter from the manufacturer of the equipment stating that they have designed the equipment to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter shall state that mechanical and electrical equipment is adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
5. Certification of Applicator/Subcontractor (CSQ) - A certified letter stating that the Applicator or Subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

C. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the project and allow replacement or repair at some future date.

D. Provide record data for all products. Record data is not required for items for which shop drawings and/or operations and maintenance manuals are required.
   1. Provide information only on the specified products. Submit a Contractor's Modification Request for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting Record Data.
   2. Record data will be received by the Engineer, logged, and provided to Owner for his/her record.
      a. Record data may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings may be returned as unacceptable.
      b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.

1.07 SUBMITTALS FOR SUBSTITUTIONS

A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product.

B. If the Contractor desires to submit a manufacturer or product which is not specified, the Contractor must submit the following for consideration of approval of the substitution:

C. Contractor's Modification Request for deviation from the Contract Documents
   1. Prove that the product is acceptable as a substitute. It is not the Engineers responsibility to prove the product is not acceptable as a substitute.
      a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
      b. Make a direct comparison with the specified manufacturers published data sheets and available information. Provide this printed material with the submittal.
      c. The decision of the Engineer regarding the acceptability of the proposed substituted product is final.
   2. Provide a typewritten certification that, in making the substitution request. The Contractor:
      a. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.
   3. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.
      a. Will assume all responsibility to coordinate and modifications that may be necessary to incorporate the substituted product into the project and will waive all claims for additional work which may be necessary to incorporate the substituted product into the project which may subsequently become apparent.
      b. Will maintain the same time schedule as for the specified product.

1.08 GUARANTEES

A. Warranties and guarantees shall be submitted as required by the Contract Documents and submitted with the shop drawings or record data.

1.09 RESUBMISSION REQUIREMENTS

A. Make all corrections or changes in the submittals required by the Engineer and resubmit until approved.

B. Need for more than one resubmission or any other delay of obtaining Engineer's review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor's expense.

1.10 ENGINEER'S DUTIES

A. Revise the submittals and return with reasonable promptness.

B. Affix stamp, indicate approval with or without comments, rejection, and the need for re-submittal.

C. Distribute documents.

END OF SECTION

SECTION 01 33 23
SHOP DRAWINGS AND SAMPLES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SUBMITTALS

A. Summary Listing and Schedule: General Contractor shall prepare a summary listing and schedule for submission of Shop Drawings, Samples, and Product Data to the Architect for review of the various items of Work. Schedule shall allow approximately two (2) calendar weeks or ten (10) working days for review; however, this may vary depending upon the quantity of the material submitted. Schedule shall also allow time for submission of Shop Drawings, Samples, and Brochures which may not be approved.

B. Substitution Requests: Submit three copies of each request for consideration. Indentify product or fabrication or installation method to be replaced. Include specification section number and title and drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the work and to construction performed by owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of signification qualities of proposed substitution with those of the work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirement included. Indicate deviations, if any, from the work specified.

d. Product Data, including drawings and descriptions of product and fabrications and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

h. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the work, including effect on overall contract time. If specified product or method of construction cannot be provided within contract time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

i. Cost information, including a proposal of change, if any, in contract sum.

j. Contractor's certification except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through General Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the work.

b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

c. Conditions of Acceptance: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

(1) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.

Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

(2) Requested substitution does not require extensive revisions to the contract documents.

(3) Requested substitution is consistent with the contract documents and will produce indicated results.

(4) Substitution request is fully documented and properly submitted.

(5) Requested substitution will not adversely affect Contractor's construction schedule.

(6) Requested Substitution has received necessary approvals of authorities having jurisdiction.

(7) Requested Substitution is compatible and has been coordinated with other portions of the work.

(8) Requested Substitution provides specified warranty.

(9) If requested Substitution involves more than one contractor, requested substitution has been coordinated with other products, and is acceptable to all contractors involved.

C. Submittals: Each Subcontractor shall submit through the General Contractor, to the Architect at proper times, all Shop Drawings, Product Data, and setting diagrams which the Architect may deem necessary to illustrate the Work intended or show its relation to Work of other trades. Shop Drawings and Product Data shall contain manufacturer's name, material description, sizes and dimensions, and other pertinent information. All submittals, including resubmittals, shall have Product Data identifying the materials to be supplied by circling or denoting the intended materials on the Product Data sheets.

1. Prohibited Submittals: Contractors shall not duplicate Design/Working Drawings for use as Shop Drawings. Duplicated Drawings of this nature shall be rejected.

2. Required Information: Include in submittals sufficient drawings, plans, elevations, sections, performance data, dimensions, bolt locations, inserts, sound data, weights and schematics to clearly describe the equipment and to show compliance with the Specifications. Provide a cover or title sheet for each submittal containing the following:

a. Name of Contractor originating the submittal.

b. Name of Project for which the submittal is made.

c. An index of all items submitted.

d. Identification of each item of material and equipment.

e. Date of submittal.

f. Contractor's certification.

D. Deviations: Any and all deviations from the Specifications and/or Drawings must be brought to the Architect's attention by circling all items submitted for review.

E. Identification: Shop Drawing submittals and transmittal letters shall be identified with title and location of Project, names of the Architect, the Contractor, and the submission date.

F. Compliance Review: All Shop Drawings and Product Data submitted to the Architect shall be stamped by the General Contractor to indicate that the submittal has been reviewed for compliance with the Contract Documents, coordination between other Trade Work, and related details.

G. Reimbursement of Architect's Costs:

1. In the event substitutions are proposed to the Architect after the Contract has been awarded, the Architect will record all time used by the Architect and the Architect's consultants in evaluation of each proposed substitution.

2. Whether or not the Architect approves a proposed substitution, the Contractor shall promptly upon receipt of the Architect's billing, reimburse the Architect at the rate of two and three-quarter (2-3/4) times the direct cost of the Architect and the Architect's consultants for all time spent in evaluating the proposed substitution.

H. Architectural and Structural Shop Drawings: The General Contractor shall submit to the Architect, for review, one (1) reproducible and three (3) prints of each Drawing.

1. If the Shop Drawings are returned "Revise & Resubmit", the effected Contractor shall correct the original Drawings and resubmit the Shop Drawings as originally required, i.e., one (1) reproducible and three (3) prints, to the Architect for review, file, and distribution.

2. Submit six (6) copies of Product Data such as catalog cuts and brochures.

I. Mechanical and Electrical Shop Drawings: Submit for review six (6) copies of all equipment and products in a brochure type format.

J. Required Shop Drawings: Shop Drawings are required for, but are not necessarily limited to the items as required by the Drawings and/or Specifications within the Project Manual.

K. Review of Shop Drawings:

1. It shall be distinctly understood that the review of Shop Drawings shall be for General Scheme only. Review does not relieve the Contractor from the necessity of correcting, without charge, details on the Drawings and completed Work found deficient in strength or otherwise faulty.

2. The Architect assumes no responsibility for “figured dimensions” of Shop Drawings.

3. The review of Shop Drawings does not relieve or modify the responsibility for compliance with the Contract Documents or dimensions or errors contained in the submittal or quantity count. It is clearly understood that in the review process, noting of some discrepancies, but overlooking others, does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, layout drawings, catalog data and brochures, the Contract Documents govern the Work, and are neither waived nor suspended in any way by the review of Shop Drawings, layout drawings, catalog data and brochures.

4. Upon completion of the Project the Owner shall be given one (1) set of reviewed Shop Drawings.

L. Authorization: Unless specifically otherwise required by the Architect and the Owner, no materials shall be ordered, delivered, fabricated, or erected until the proper written review by the Architect has been received by the General Contractor.

1.02 SAMPLES AND LETTERS OF INTENT

A. Summary Listing: General Contractor shall prepare a summary listing of the Samples and Letters of Intent submittal requirements for review by the Architect and the Owner’s Supervising Engineer.

B. Material Samples and Letters of Intent: Samples and Letters of Intent as listed and requested in the respective trade Specifications enumerate, but do not necessarily limit, the material Samples or Letters of Intent indicating materials, specifications, and/or installation procedures, which shall be submitted for approval PRIOR to purchase or

installation of materials. All material Samples shall be reviewed by the Architect, and/or Owner PRIOR to erection or fabrication.

C. Samples: Submit to Architect for review, four (4) actual Samples of all materials to be used in the Work. All Samples shall have the same finish as that to be used in the completed Work. Manufacturer's color charts and/or color swatches shall not be acceptable as Samples. Samples shall be accompanied by a letter requesting approval and presenting all required data.

D. Materials: All materials furnished shall be fully equal to the reviewed Samples.

E. Selections: Where the choice of more than one make or style of article or material is specified, the final selection of the article or material shall be made by the Owner.

F. Quality, Fitness, and Workmanship: The quality or fitness of materials or workmanship shall be based on the requirements that all Work done or materials furnished shall be first class in every respect, and what is usual or customary on other projects shall in no way enter into any consideration or decision.

G. Differences in Price: Where any difference occurs in price of such articles or materials, such differences are to be given before the Contracts are signed. After the Contracts have been signed, the Owner reserves the right to choose whichever article or material the Owner desires, assuming, unless previously advised to the contrary, the price is not changed thereby. Where the Specifications require a specific item "equal or comparable products" or other words to that effect, the final selection will be by the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control and control of installation.

B. Tolerances

C. References.

D. Mock-up requirements.

E. Testing and inspection services.

F. Manufacturers' field services.

G. Examination.

H. Preparation.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

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

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

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

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

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on Shop Drawings or as instructed by the manufacturer.

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

1.3 TOLERANCES

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

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

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

1.4 REFERENCES

A. For products or workmanship specified by association, trades, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

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

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

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

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

1.5 MOCK-UP REQUIREMENTS

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

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

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect/Engineer.

1.6 TESTING AND INSPECTION SERVICES

A. Owner will employ services of an independent firm to perform testing and inspection. Contractor shall pay for services.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by the Architect/Engineer and Owner, or Authority having jurisdiction.

1. Laboratory: Authorized to operate in location in which Project is located.

2. Laboratory Staff: Maintain a full time specialist on staff to review services.

3. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect/Engineer or the Owner.

D. Reports will be submitted by the independent firm to the Architect/Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.

1. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.

2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing or re-inspection will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.

H. Agency Responsibilities:

1. Test samples of mixes submitted by Contractor.

2. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.

3. Perform specified sampling and testing of products in accordance with specified standards.

4. Ascertain compliance of materials and mixes with requirements of Contract Documents.

5. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or products.

6. Perform additional tests required by Architect/Engineer.

7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit four copies of report to Architect/Engineer and to Contractor. When requested by Architect/Engineer, provide interpretation of test results. Include the following:

1. Date issued.

2. Project title and number.

3. Name of inspector.

4. Date and time of sampling or inspection.

5. Identification of product and specifications section.

6. Location in the Project.

7. Type of inspection or test.

8. Date of test.

9. Results of tests.

10. Conformance with Contract Documents.

J. Limits On Testing Authority:

1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency or laboratory may not approve or accept any portion of the Work.

3. Agency or laboratory may not assume any duties of Contractor.

4. Agency or laboratory has no authority to stop the Work.

1.7 MANUFACTURERS' FIELD SERVICES

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

B. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.

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

D. Refer to Section 01 33 0 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

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

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

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

3.2 PREPARATION

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

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

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

END OF SECTION

SECTION 014200
DEFINITIONS AND TERMINOLOGY

PART 1 GENERAL

1.01 SPECIFICATION TERMINOLOGY

A. "Engineer" the Consulting Engineering Firm under contract with the Owner for this particular project, or its designated representative.

B. "Furnish" means to supply, deliver and unload materials and equipment at the project site ready to install.

C. "Install" means the operations at the project site including unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, training and similar operations required to prepare the materials and equipment for use, verify conformance with Contract Documents and prepare for acceptance and operation by the Owner.

D. "Provide" means to furnish and install materials and equipment.

E. "Perform" means to complete the operations necessary to comply with the Contract Documents.

F. "Indicated" means graphic representations, notes, or schedules on drawings, or other requirements in Contract Documents. Words such as "shown", "noted", "scheduled", are used to help locate the reference. No limitation on the location is intended unless specifically noted.

G. "Specified" means written representations in the bid documents or the technical specifications.

H. "Regulation" means laws, statutes, ordinances, and lawful orders issued by authorities having jurisdiction, as well as, rules, conventions, and agreements within the construction industry that control performance of work, whether they are lawfully imposed by authorities having jurisdiction or not.

I. "Installer" means an entity engaged by Contractor, either as an employee, subcontractor, or sub subcontractor to install materials and/or equipment. Installers are to have successfully completed a minimum of five projects similar in size and scope to this project, have a minimum of five years of experience in the installation of similar materials and equipment, and comply with the requirements of the authority having jurisdiction.

J. "Manufacturer" means an entity engaged by Contractor, as a subcontractor, or sub subcontractor to furnish materials and/or equipment. Manufacturers are to have a minimum of five years' experience in the manufacture of materials and equipment similar in size, capacity and scope to the specified materials and equipment.

K. "Project site" means the space available to perform the work, either exclusively or in conjunction with others performing construction at the project site.

L. "Testing laboratory" means an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report and interpret the results of those inspections or tests.

M. "Listed" means equipment is included in a list published by a nationally recognized laboratory which makes periodic inspection of production of such equipment and states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

N. "Labeled" means equipment that embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc. and production is periodically inspected in accordance with nationally recognized standards or tests to determine safe use in a specified manner.

O. "Certified" used in context with materials and equipment means the material and equipment has been tested and found by a nationally recognized testing laboratory to meet specification requirements, or nationally recognized standards if requirements are not specified, and is safe

for use in the specified manner. A nationally recognized testing laboratory must periodically inspect production of the equipment and the equipment must bear a label, tag, or other record of certification.

P. "Certified" used in context with labor performance or ability to install materials and equipment means that the abilities of the proposed installer have been tested by a representative of the specified testing agency authorized to issue certificates of competency and has met the prescribed standards for certification.

Q. "Certified" used in context with test reports, payment requests or other statements of fact means that the statements made on the document are a true statement as attested to by the certifying entity.

1.02 SPECIFICATION SENTENCE STRUCTURE

A. Specifications are written in modified brief style. Requirements apply to all work of the same kind, class, and type even though the word "all" is not stated.

B. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words "furnish", "install", "provide", or similar words include the meaning of the phrase "The Contractor shall." before these words.

C. It is understood that the words "directed", "designated", "requested", "authorized", "approved", "selected", or similar words include the meaning of the phrase "by the Engineer" after these words unless otherwise stated. Use of these words does not extend the Engineer's responsibility for construction supervision or responsibilities beyond those defined in the General Conditions.

D. "At no additional cost to Owner", "With no extra compensation to Contractor", "At Contractor's own expense", or similar words mean that the Contractor will perform or provide specified operation of work without any increase in the Contract Amount. It is understood that the cost for performing all work is included in the amount bid and will be performed at no additional cost to the Owner unless specifically stated otherwise.

1.03 DOCUMENT ORGANIZATION

A. Organization of Contract Documents is not intended to control or to lessen the responsibility of the Contractor when dividing work among subcontractors, or to establish the extent of work to be performed by any trade, subcontractor or vendor. Specification or details do not need to be indicated or specified in each specification or drawing. Items shown in the contract documents are applicable regardless of location in the Contract Documents.

B. Standard paragraph titles and other identifications of subject matter in the specifications are intended to aid in locating and recognizing various requirements of the specifications. Titles do not define, limit, or otherwise restrict specification text.

C. Capitalizing words in the text does not mean that these words convey special or unique meanings or have precedence over other parts of the Contract Documents. Specification text governs over titling and it is understood that the specification is to be interpreted as a whole.

D. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer. Provide any work, materials or equipment required for a complete and functional system even if they are not detailed or specified.

1.04 INTERPRETATIONS OF DOCUMENTS

A. Comply with the most stringent requirements where compliance with two (2) or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, unless Contract Documents indicate otherwise.

1. Quantity or quality level shown or indicated shall be minimum to be provided or performed in every instance.

2. Actual installation may comply exactly with minimum quality indicated, or it may exceed that minimum within reasonable limits.
3. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for context of requirements.
4. Refer instances of uncertainty to the Engineer for a decision before proceeding.

B. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the drawings but are not included in the specifications.

1.05 REFERENCE STANDARDS

A. Comply with applicable construction industry standards as if bound or copied directly into the Contract Documents regardless of lack of reference in the Contract Documents. Apply provisions of the Contract Documents where Contract Documents include more stringent requirements than the referenced standards.
1. Standards referenced directly in the Contract Documents take precedence over standards that are not referenced but recognized in the construction industry as applicable.
2. Comply with standards not referenced but recognized in the construction industry as applicable for performance of the work except as otherwise limited by the Contract Documents. The Engineer determines whether code or standard is applicable, or which of several are applicable.

B. Consider a referenced standard to be the latest edition with supplements or amendments when a standard is referred to in an individual specification section but is not listed by title and date.

C. Trade association names and title of general standards are frequently abbreviated. Acronyms or abbreviations used in the Contract Documents mean the recognized name of trade association, standards generating organization, authority having jurisdiction, or other entity applicable in the context of the Contract Documents. Refer to "Encyclopedia of Associations," published by Gale Research Company.

D. Make copies of reference standards available as requested by Engineer or Owner.

1.06 SUBSTITUTIONS AND EQUAL PRODUCTS

A. Provide materials and equipment manufactured by the entities specifically listed in each technical specification section. Submit a Contractor's Modification Request for substitution of materials and equipment of manufacturers not specifically listed or for materials and equipment that does not strictly comply with the Contract Documents.

B. Contractor may provide "equal" products manufactured by manufacturers other than those specifically listed in the technical specification section unless it is specifically stated that only the materials and equipment of the specified manufacturers shall be provided. Provide a request for approval of proposed equals for any materials or equipment not specifically listed. Submit a Contractor's Modification Request for substitution of materials and equipment of other manufacturers or for materials and equipment that does not strictly comply with the Contract Documents. A Field Order or Change Order will be issued if the contract modification is approved.

END OF SECTION

SECTION 01 45 23
TESTING AND INSPECTING SERVICES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included:

1. Owner will obtain the services of an Independent Testing Laboratory to perform testing services for concrete, steel and other materials as required, specified or directed. The Testing Laboratory shall evaluate and approve all soils testing performed by the Project Soils Engineer.

2. Requirements for testing are described in various sections of the Specifications. Where no testing requirements are described, but the Owner determines that testing is required, the Owner may require testing to be performed under currently recognized standards for testing.

B. Related Work:

1. Selection of Testing Laboratory: The Owner will select and approve a qualified, unbiased, and recognized independent commercial testing agency.

1.02 CODES AND STANDARDS

A. Testing, when required, shall be in accordance with all pertinent codes and regulations, and with selected ASTM International Standard Specifications.

1.03 TEST REPORTS AND RELATED INSTRUCTIONS

A. Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay to progress of the Work.

1.04 PAYMENT FOR TESTING SERVICES

A. Initial Services: Triumph Public High Schools is to pay for all Owner Selected initial testing services.

B. Retesting: When the initial tests indicate non-compliance with Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same agency, and the costs thereof will be paid by the General Contractor.

1.05 CODE COMPLIANCE TESTING

A. Responsibility of Inspection and Testing: Inspection and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities or a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.06 TESTING LABORATORY DUTIES

A. Cooperation: Cooperate with Architect/Engineer and Contractor; provide qualified personnel after due notice.

B. Perform Specified Inspections, Sampling and Testing of Materials and Methods of Construction:

1. Take all specimens and samples.

2. Provide all sampling equipment and personnel.

3. Make all deliveries of specimens and samples to the Testing Laboratory.

4. Comply with specified standards.

5. Ascertain compliance of materials, and Work, with requirements of Contract Documents.

C. Irregularities and Deficiencies: Immediately notify Architect/Engineer, Owner's Supervising Engineer, and Contractor of observed irregularities or deficiencies of Work or products in the field or laboratory as a result of testing. All irregularities and deficiencies encountered shall not go unresolved. Testing reports submitted to Architect/Engineer shall be for file purposes only and shall include the resolution of these irregularities and/or deficiencies.

D. Reports of Tests and Inspections: Promptly submit written report of each test and inspection; one (1) copy each to Owner's Supervising Engineer, Owner, and Contractor, and three (3) copies to Architect/Engineer. Each report shall include:

1. Date issued.

2. Detailed listing.

3. Project title and number.

4. Testing Laboratory name, address and telephone number.

5. Name and signature of laboratory inspector.

6. Date and time of sampling or inspection.

7. Record of temperature and weather conditions.

8. Date of test.

9. Identification of product and Specification section.

10. Location of sample or test in the Project.

11. Name of person taking sample or making test.

12. Type of inspection or test.

13. Results of tests and compliance with Contract Documents.

14. Interpretation of test results, when requested by Architect/Engineer.

E. Additional Tests: Perform additional tests as required by Architect/Engineer, Owner's Supervising Engineer, or Owner.

F. Special Inspections: Submit “Statement of Special Inspections” and a certified written report of each special inspection, test or similar service; one (1) copy each to Owner's Supervising Engineer, Owner, and Contractor, and three (3) copies to Architect/Engineer. Submit additional copies of each report to governing authority, when the authority so directs.

1. Report Data: Written inspection or test reports for the Project shall include, but shall not necessarily be limited to applicable special inspections listed below:

a. Inspection of Fabrication per Building Code Section 1704.2, and as required by Structural Drawings.

b. Inspection of Steel Construction per Building Code Section 1704.3, and as required by Structural Drawings.

c. Inspection of Concrete Construction per Building Code Section 1704.4, and as required by Structural Drawings.

d. Inspection of Masonry Construction per Building Code Section 1704.5, and as required by Structural Drawings.

e. Inspection of Soils per Building Code Section 1704.7, and as required by Structural Drawings.

f. Inspection of Pier Foundations per Building Code Section 1704.9, and as required by Structural Drawings.

g. Inspection of Wall Panels and Veneers (seismic) per Building Code Section 1704.10, and as required by Structural Drawings.

h. Inspection of Exterior Insulation and Finish Systems (EIFS) per Building Code Section 1704.12.

1.07 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.08 CONTRACTOR'S RESPONSIBILITIES

A. General: Cooperate with laboratory personnel, provide access to Work, to material manufacturer’s operations.

B. Samples: Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Preliminary Design Mixes: Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the Testing Laboratory.

D. Test Reports: Furnish copies of Products test reports as required.

E. Furnish Incidental Labor and Facilities:

1. To provide access to Work to be tested.

2. To obtain and handle samples at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

F. Notification to Laboratory: Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Contractor's Convenience Testing: For testing performed exclusively for Contractor's convenience, employ and pay for the services of a separate, equally qualified Independent Testing Laboratory.

1.09 SCHEDULES FOR TESTING

A. Time Required for Testing: By advance discussion with the testing agency selected by the Owner, determine the time required for the testing agency to perform its tests and to issue each of its findings. Provide all required time within the construction schedule.

B. Changes in Construction Schedules: When changes of construction schedules are necessary during construction, coordinate all such changes of schedules with the testing agency as required.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, transportation, protection, and services necessary for, and incidental to, the proper execution and completion of all Temporary Facilities and Control Work, as indicated on the Drawings and as specified herein. Work includes, but is not necessarily limited to the following:

1. Temporary Utilities: Water service and distribution, Temporary electric power and light, temporary heat, Telephone service and sanitary facilities, including drinking water.

2. Support Facilities: Field Offices, Storage sheds, Temporary Enclosures, Construction Aids and Miscellaneous services and facilities.

3. Security and Protection Facilities: Temporary fire protection, Barricades, Warning signs and Lights.

1.02 USE CHARGES

A. General: Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and faculties without, including, but not limited to, the Owner, the Design Professional, occupants of the Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: The General Contractor will pay sewer service use charges for sewer usage by all entitles for construction operations.

C. Water Service: The General Contractor will pay water service use charges for water usage by all entitles for construction operations.

D. Electric Power Service: The General Contractor will pay electric power service use charges for electricity usage by all entitles for construction operations.

1.03 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, Utility hookups, Staging areas, and Parking areas for construction personnel.

B. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit of authorities having jurisdiction, whichever is more stringent. Coordinate with the Civil Engineer's drawings and specifications.

C. Moisture Protection Plan: Describe procedures and controls for protecting materials and construction form absorption and damage; including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed work, and replacing water damaged work.

1. Indicate sequencing of work that requires water, such as plastering and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

D. Dust Control and HVAC Control Plan: Submit coordination drawing and narrative that indicated the dust-control and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operations. Dust Control shall be per TCEQ (Texas Commission of Environmental Quality) and City Ordinance requirements. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Location of dust control partitions at each phase of the work.

2. HVAC system isolation schematic drawing.

3. Location of proposed air filtration system discharge.

4. Other dust control measures.

5. Waste management plan.

1.04 QUALITY ASSURANCE

A. General: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, Building Code, City Ordinance Requirements, Health and safety regulations and Utility Company Regulations.

B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations,” ANSI A10 Series standards for “Safety Requirements for Construction and Demolition,” and NECA Electrical Design Library “Temporary Electrical Facilities.”

1. Electrical Service: Comply with NECA, NEMA, and UL Standards and regulations and requirements of authority having jurisdiction for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code.”

2. Accessible Temporary Egress: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ANSI A117.1.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

B. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before the Owner’s acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Chain Link Fencing: Minimum 0.148 inch thick, galvanized steel, chain link fabric fencing; minimum 8 feet high with galvanized steel pipe posts; minimum 2 3/8 inch OD line posts and 2 7/8 inch OD corner and pull posts, with 1 5/8 inch OD top rails.

C. Portable Chain Link Fencing: Minimum 0.148 inch thick, galvanized steel, chain link fabric fencing; minimum 8 feet high with galvanized steel pipe posts; minimum 2 3/8 inch OD line posts and 2 7/8 inch OD corner and pull posts, with 1 5/8 inch OD top and bottom rails. Provide galvanized steel bases for supporting post.

D. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry.”

E. Tarpaulins: Provide waterproof, fire resistant, UL Labeled tarpaulins with flame spread rating of 15 of less per ASTM E84. For temporary enclosures, provide translucent, nylon reinforced, laminated polyethylene or poly vinyl chloride, fire retardant tarpaulins.

F. Polyethylene Sheet: Reinforced, fire resistance sheet, 10 mils minimum thickness, with flame spread rating of 15 of less per ASTM E84.

G. Dust control Adhesive Surface Walk-Off Mats: Provide mats minimum 36 by 60 inches.

H. Insulation: Unfaced mineral fiber blanket, manufacturer from glass, slag wool, or rock wool; with maximum flame spread of 25 and smoke developed indexes of 50 per ASTM E84.

I. Water: Provide potable water approved by local health authorities.

2.02 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls and foundations adequate for normal loading.

B. A Job Site Trailer: Of sufficient size to accommodate needs of the Owner and construction personnel office activities and to accommodate project meetings. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for project site documents including file cabinets, plan table, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meeting of 10 individuals. Provide electrical power service and 120 V AC duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4 foot square tack and marker boards.

3. Drinking water and private toilet.

4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.

5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.03 EQUIPMENT

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide ¾ inch, heavy-duty, abrasion resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA polarized outlets to prevent insertion of 110 to 112 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. Do not exceed safe length-voltage ratio.

E. Lamps and Light fixtures: Provide general service efficient 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. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system; provide vented, self contained, liquid propane gas or fuel oil heaters with individual thermostatic control.

1. Use of gasoline burning heaters, open flame heaters, or salamander type heating units is prohibited.

2. 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.

3. Permanent HVAC Systems: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at the end of construction and clean HVAC system as required in Division 01 Section “Closeout Procedures.”

G. Temporary Offices: Provide prefabricated or mobile units or similar job built construction with lockable entrances, operable windows, and serviceable finishes. Provide heat heated and air conditioned unit on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self contained, single occupant toilet units of chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

I. 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 NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

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.

1. Locate facilities to limit site disturbance as specified in Division 01 Section “Summary.”

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.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if 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.

3. Use Charges: Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders. The contractor can connect to existing water and electrical service and the owner will pay use charges for water and electricity. The contractor shall provide all other use charges including cost for temporary heat.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use. Obtain all required permits.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have harmful effects on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems to maintain the facilities when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Provide power service and distribution system of sufficient size, number of phases, capacity, and power characteristics required for construction operation and testing of all installed equipment.

1. Install electric power service overhead, unless otherwise indicated.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating the entire system.

H. Telephones Service: Provide temporary telephone service in Owner’s use facilities for use by all construction personnel. Install two telephone lines for each field office. One telephone to be dedicated for facsimile machine in each field office.

1. At each telephone, post a list of important telephone numbers, including but not limiting to, Police & Fire departments, Contractor's home Office, Design Professional's office, Testing Consult's office, Owner's office, principal subcontractors' field & home offices and superintendent's cellular telephone.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within the construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with requirements of NFPA 241

2. Maintain support facilities until near Substantial Competition inspection date is scheduled. Remove prior to substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2. Prepare sub grade and install sub base and base for temporary roads and paved areas specified in individual specification sections.

3. Delay installation of final course of permanent hot mix asphalt pavement until immediately before Substantial Completion. Repair hot mix asphalt base course pavement before installation of final course.

C. Traffic Controls: comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for firefighting equipment and access to fire hydrants.

D. Parking: Provide temporary areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain the project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding the project or adjoining properties nor endanger permanent work of temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

F. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, freezing, other construction operations, and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. 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 sq. ft. or less with plywood or similar material.

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 sq. ft. in area, use UL labeled, fire retardant treated material for framing and main sheathing.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil bearing water runoff and airborne dust to undisturbed areas and to

adjacent properties and walkways, according to erosion and sedimentation control drawings.

C. Storm water Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and sub grade construction to prevent flooding by runoff of storm water from heavy rains.

D. Tree and Plant Protection: Install temporary fencing outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Site Enclosure Fence: Before construction operations begin furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to the Owner.

F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

I. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the type 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.

2. Store combustible materials in containers in fire safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, 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.

3.05 MOSTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.

2. Protect stored and installed material from flowing or standing water.

3. Keep porous and organic materials from coming into prolonged contact with concrete.

4. Remove standing water from decks.

5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with High organic content, into partially enclosed building.

2. Keep interior spaces reasonably clean and protected from water damage.

3. Periodically collect and remove waste containing cellulose or other organic matter.

4. Discard or replace water-damaged material.

5. Do not install material that is wet.

6. Discard, replace or clean stored or installed material that begins to grow mold.

7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.

2. Use permanent HVAC system to control humidity.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.

b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to the Design Professional.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.06 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 conditional until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24 hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, 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. Material and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period. Comply with final cleaning requirements specified in Section 01 70 00 – Project Closeout.

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish temporary facilities, including field offices, storage sheds, and temporary utilities needed to complete the work.

B. Furnish, install, and maintain temporary project identification signs. Provide temporary on-site informational signs to identify key elements of the construction facilities. Do not allow other signs to be displayed.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

A. Provide new or used, wood or metal, in sound condition for structure and framing. Materials are to be structurally adequate and suitable for the indicated finish

B. Provide 3/4" exterior grade A/D face veneer plywood with medium density overlay for sign surface.

C. Bolts, brackets, fasteners, and other hardware are to be galvanized or stainless steel.

2.02 TEMPORARY STORAGE BUILDINGS

A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the site that might be affected by weather.

2.03 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the job site from the commencement of the project to its conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.

B. Contractor's workmen shall use these sanitary facilities at all times. Restrooms within existing or Owner-occupied buildings shall not be used.

2.04 TEMPORARY UTILITIES

A. Provide the temporary utilities needed by the trades during construction, including electrical power, water, and telephone.
   1. Provide a source of temporary electrical power of adequate size for the construction procedures.
      a. Electrical pole and service shall comply with OSHA and other safety requirements and the requirements of the power company.
      b. Make the electrical power available to the trades as needed.
      c. Provide extensions to the various parts of the building as needed.
      d. Provide junction boxes in such an arrangement that distribution boxes are available within 75' of any part of the structure.
   2. Provide temporary water. Extend water to the construction site and maintain source until such time that the permanent water supply can be extended to the site.
   3. Provide telephone service to the site and install telephones inside the Contractor's and the Engineers office.

B. Make arrangements with the local utility company, comply with utility company's requirements and pay for the utility costs during construction.

C. Make utilities available to the trades during construction

PART 3 - EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

A. Locate all temporary facilities in an area that will not interfere with any work to be performed under this contract.

B. Construct and install signs at locations as required by applicable regulatory agencies or as selected by the Owner. Install informational signs at the height of optimum visibility, on ground-mounted poles, or attach to temporary structural surfaces.

3.02 REMOVAL OF TEMPORARY FACILITIES

A. Remove temporary buildings, shed, and utilities at the conclusion of the project and restore the site to original condition or finished in accordance with the drawings.

B. Remove informational signs upon completion of construction.

C. Remove project identification signs, framing, supports, and foundations upon completion of the project.

D. Furnish storage buildings of adequate size to store any materials or equipment delivered to the site that might be affected by weather.

3.03 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the job site from the commencement of the project to its conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.

B. Contractor's workmen shall use these sanitary facilities at all times. Rest rooms within existing or Owner-occupied buildings shall not be used.

C. Owner-occupied buildings shall not be used.

D. Contractor's workmen shall use these sanitary facilities at all times. Rest rooms within existing or Owner-occupied buildings shall not be used.

3.04 TEMPORARY UTILITIES

A. Provide the temporary utilities needed by the trades during construction, including electrical power, water, and telephone.

B. Provide a source of temporary electrical power of adequate size for the construction procedures.

C. Electrical pole and service shall comply with OSHA and other safety requirements and the requirements of the power company.

D. Provide junction boxes in such an arrangement that distribution boxes are available within 75' of any part of the structure.

E. Provide temporary water. Extend water to the construction site and maintain source until such time

F. Provide telephone service to the site and install telephones inside the Contractor's and the Engineers

G. Make arrangements with the local utility company, comply with utility company's requirements and pay for the utility costs during construction.

H. Make utilities available to the trades during construction.

END OF SECTION

SECTION 015600
CONSTRUCTION TRAFFIC CONTROL

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This item shall consist of the construction, manipulation, maintenance and removal, if required, of detours of the length and to the lines, grades and typical sections indicated and providing for installing, moving, replacing, maintaining, cleaning and removing upon completion of the work, as required, all detour markers, signs, barricades and other devices used in traffic control and handling at the construction site as indicated or as directed by the Engineer.

B. This item shall also consist of providing installing, moving, replacing, maintaining, cleaning and removing temporary or permanent street closure barricades, signs or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform traffic Control Devices of Street and Highways and as indicated or directed by the Engineer.

1.02 SUBMITTAL

A. Conform to requirements of Section 013300, Submittal Procedures.

B. Submit proposed traffic routing plan, in accordance with the Texas Manual on Uniform Traffic Control Devices (TxMUTCD), latest edition. or FHWA MUTCD

PART 2 - PRODUCTS

2.01 CONSTRUCTION TRAFFIC CONTROL SIGNS

A. Construction traffic control signs shall be constructed by plywood.
   1. Construction traffic control signs used herein shall be fabricated using sheeting conforming to the requirements of the manufacturer.
   2. The substrate for construction signs need only be sufficiently durable to last the life of the project and sufficiently rigid to hold the sheeting in a flat plan.

2.02 SIGN SUPPORTS

A. Supports for construction traffic control signs shall be grade #2 fir or yellow pine, pressure treated with pentachlorophenol.

B. Supports shall have a minimum nominal size of 4-inches x 4-inches and conform to the details shown on the plans.

2.03 PORTABLE SIGN SUPPORT

A. Materials for portable sign supports shall comply with the details shown on the plans. Portable sign supports other than those shown on the plans shall be submitted to the Project Manager for approval prior to use.

2.04 BARRICADES

A. Barricades shall be classified as Type I, Type II or Type III and shall comply with the details shown on the plans and the TxMUTCD.
   1. Barricade rails shall be fabricated using S4S Grade #2 fir or yellow pine and reflectorized sheeting conforming to the requirements.

2.05 VERTICAL PANELS

A. Materials for vertical panels shall conform to the details shown on the plans. Vertical panels shall be reflectorized with orange and white reflective sheeting or tape in accordance with the requirements.

2.06 ABBREVIATED PAVEMENT MARKINGS FOR CONSTRUCTION

A. The pavement-marking material shall consist of an adhesive-back reflective tape which can get applied to the pavement. Markings shall be of goof appearance, have straight, unbroken edges and have a color that complies with all federal regulations.
   1. Color

a. The markings, as well as retro reflected light from the markings, shall be white or yellow as indicated.

2. Visibility
   a. The pavement markings (during daylight hours) shall be distinctively visible of ra minimum of 300 feet unless sigh distance is restricted by geometric roadway features.
   b. The pavement markings (when illuminated by automobile low beam headlights at night) shall be distinctively visible for a minimum of 160 feet unless sight distance is restricted by geometric features.
   c. The above day and night visibility requirements shall be met when viewed from an automobile traveling on the roadway.

2.07 CHANNELIZATION DEVICES

A. Barrels
   1. Barrels shall be of metal or nonmetal composition approved by the Engineer and of 30 to 55-gallon capacity. Only one size may be used on the project. The barrels shall be reflectorized with orange and white reflective sheeting or tape in accordance with the requirements of TxMUTCD. The markings on the barrels shall be horizontal, circumferential, orange wide. There shall be a minimum of 55 alternating orange and white stripes on each barrel. Barrels shall also conform to the details shown on the plans.
   2. Type "B" barrels shall be equipped with either Type "A" low intensity or Type "C" steady-burn warning lights complying with the provisions to TMUTCD and the ITE standard for flashing and steady-burn lights. The use warning light shall be as directed by the Engineer.

B. Traffic Cones
   1. Traffic cones shall conform to the details shown on the plans.

C. Tubular Traffic Markers
   1. Post
      a. The post shall be of a thermoplastic or pliable elastomer composition meeting the manufacturer's requirements.
      b. Dimensions:
         1) Outside Diameter = 2.23 inches to 4 inches
         2) Wall Thickness = 0.125 inch minimum
         3) Length= 18 to 36 inches
         4) Color= Orange
   2. Base
      a. The base shall be of thermoplastic or pliable elastomer composition meeting the manufacturer's requirements.
      b. Dimensions:
         1) Height = 1.2 to 2 inches
         2) Outside Diameter = 7 to 12 inches
         3) Color = black or same color as post
   3. Assembly Units
      a. Assembly units which are inherent with the particular marker shall be as per manufacturer's recommendations.
   4. Adhesives
      a. Adhesive shall be epoxy type (permanent installation or butyl type (temporary installation) as per manufacturer's recommendations.
   5. Reflectorization
      a. If used at night, tubular traffic markers shall have two 3-inch, circumferential reflective bands, no more than 2-inches from the top with no more than 6-inches separating the bands. Reflective material shall be SIA-250 or higher sheeting conforming to the provisions of this Section. The color of reflective material shall be as shown in the plans.

2.08 SEQUENTIAL ARROW DISPLAYS

A. Sequential arrow displays shall be sequentially lighted, and roof or trailer mounted. The minimum panel size shall be 30 inches high and 54-inches wide. The display shall have 22 hooded sealed beam amber lamps rated at a maximum intensity of 8800 candlepower.

B. Light intensity shall be adjustable by dimmer switch. The operating modes shall be as follows:
   1. Pass Left. 3 chevrons of 5 lamps each sequence in right to left pattern 40 to 50 times per minute.
   2. Pass Right. 3 chevrons of 5 lamps each sequence in left to right pattern 40 to 50 times per minute.
   3. Pass Either Side. The two outermost chevrons on each end of the panel pointing like arrowheads and flashing 40 to 50 times per minute with crossing row of lamps burning continuously.
   4. Warning. 4 lamps, one at each corner of the panel, flashing 40 to 50 times per minute.

PART 3 - EXECUTION

3.01 CONSTRUCTION TRAFFIC CONTROL SIGNS AND SIGN SUPPORTS

A. Construction traffic control signs and sign supports shall be installed at locations noted on the plans in conformance with the TMUTCD or as directed by the Engineer.

3.02 PORTABLE SIGN SUPPORTS

A. Portable sign supports for traffic control devices for detours shall be furnished by the Contractor, shall be installed at the locations shown on the plans, unless otherwise shown on the plans, and shall remain the property of the Contractor.

B. Unless otherwise specified, portable sign supports shall be of the dimensions shown on the plans.

3.03 BARRICADES

A. Barricades shall be installed in conformity with the details noted on the plans or as directed by the Engineer.

3.04 VERTICAL PANELS

A. Vertical panels shall be installed in conformity with the details noted on the plans or as directed by the Engineer.

3.05 ABBREVIATED PAVEMENT MARKINGS FOR CONSTRUCTION

A. Abbreviated markings meeting all specification requirements shall be in place on all roadways on which traffic is allowed and where suitable standard pavement marking is not in place. The transverse location of the line(s) formed by the markings shall be as determined by the Engineer.

B. Unless otherwise indicated, the abbreviated markings shall be placed as follows:

Condition	Spacing	Length of Stripe
Straight	40 FT Approx.	48-Inch
Curve Greater than 2 degrees	20 FT. Max.	48-Inch
Curve Less than or Equal 2 Degrees	40 FT Max.	48-Inch

C. Pavement markings shall be a minimum of 3 7/8 inches wide. Length and spacings will be in accordance with these specifications.

D. The spacing of stripes may be modified by the Engineer. However, the maximum spacing specified above shall not be exceeded in any case.

E. The Contractor will be responsible for maintaining the abbreviated pavement markings until standard pavement markings are in place.

F. Abbreviated pavement markings shall be removed after all permanent markings have been in place.

3.06 CHANNELIZATION DEVICES

A. Type "A" Barrels
   1. Type "A" barrels shall be used during daylight hours only and shall not be equipped with warning lights of any type.

B. Type "B" Barrels
   1. Type "B" barrels shall be equipped with warning lights. Type "B" barrels shall be used during nighttime hours only, unless otherwise shown on the plans or directed by the Project Manager.
   2. The term "daylight hours" refers to those hours between dawn and dusk. The term "nighttime hours" refers to those hours between dusk and dawn.

C. Traffic Cones
   1. Traffic cones shall be installed in conformity with the plans and the TMUTCD or as directed by the Engineer.

D. Tubular Traffic Markers
   1. The metal, concrete or bituminous surface where the tubular traffic markers are to be placed shall be thoroughly cleaned.
   2. Metal and concrete surfaces shall be sandblasted, or wire brushed. Bituminous surfaces shall be cleaned in accordance with manufacturer's recommendations.
   3. All loose sand, dust and other deleterious debris from cleaned mounting surfaces shall be removed.
   4. Tubular traffic markers shall be installed in conformity with details and at locations shown on the plans or as directed by the Engineer and in accordance with the manufacturer's recommendation.
   5. In the event that removal of an installation (temporary or permanent) is affected and the metal, concrete, or bituminous surface is damaged the Contractor shall repair and otherwise restore said surface to its original condition at no additional cost to the Owner.
   6. All defective post(s), base(s), assembly unit(s), adhesive(s) or reflective sheeting contributing to the detriment of the intended function of the tubular traffic markers shall be replaced by the Contractor at no addition cost to the Owner.
   7. Channelization devices shall be and installed in accordance with the details shown on the plans, except that barrels shall be as noted herein.

3.07 SEQUENTIAL ARROW DISPLAY

A. Sequential arrow displays shall be used according to the requirements shown on the plans and shown in TMUTCD AND FHWA MUTCD

3.08 CONSTRUCTION DETOURS

A. The detours shall be constructed at the locations and to the lines and grades indicated and it shall be the entire responsibility of the Contractor to provide for the passage of traffic in comfort and safety without creating a dust problem.

3.09 CONSTRUCTION METHODS

A. Prior to commencing construction, suitable "Construction Traffic Control" devices shall be installed to protect the workers and the public.

B. The Contractor shall be responsible for installing all markers, signs and barricades conforming to the Texas Manual on Uniform Traffic Control Devices and/or as indicated. If, in the opinion of the Engineer, additional markers, signs or barricades are needed in the interest of safety, the Contractor will install such as are required or as directed by the Engineer.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
   1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

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

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

C. Submittal Time: Comply with requirements in Section 01 77 00 "Project Closeout."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

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

2.2 COMPARABLE PRODUCTS

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

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

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 70 00
PROJECT CLOSEOUT

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Closeout Work shall include preparation for final acceptance, occupancy, and similar actions evidencing completion of the Work. The time of closeout is recognized to be directly related to “Substantial Completion”, and therefore may be either a single time period for the entire Work or a series of time periods for individual parts of the Work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section, regardless of whether resulting from “phased completion” originally specified by the Contract Documents or subsequently agreed upon.

1.02 PREREQUISITES FOR SUBSTANTIAL COMPLETION

A. General: Prior to Certification of Substantial Completion, submit one (1) set of the following documents to the Owner, and list known exceptions:

1. Submit statement showing final accounting of changes to the Contract Sum.

2. Advise of pending insurance change-over requirements.

3. Submit guarantees, warranties, workmanship bonds, maintenance agreements, final certifications and similar documents. Submit list of contacts, including company name, personal contact, address, telephone number and e-mail for building equipment and components which may require periodic service, including roofing, mechanical and electrical equipment.

4. Obtain and submit occupancy permits, operating certificates, final inspection/test certificates, and similar releases enabling full and unrestricted use of the Work and access to services and utilities.

5. Submit record (As-Built) Drawings, operation and maintenance manuals, Subcontractor listing with address, telephone number and e-mail, final Project photographs, damage or settlement survey, property survey, and similar final record information.

B. Tools, Spare Parts, and Extra Stock Materials: Deliver tools, spare parts, extra stocks of materials, and similar physical items.

C. Locks and Keys: Make final change-over of locks and transmit keys to Owner or Tenant, and advise to change-over in security provision.

D. Testing of Systems: Complete start-up testing of systems, and instruction of operating/maintenance personnel.

E. Temporary Facilities and Services: Discontinue (or change over) and remove from the Project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar elements.

F. Final Cleaning: Complete the final cleaning.

G. Exposed Finish Surfaces: Touch-up, repair, and restore marred exposed finishes.

H. Meter Readings for Temporary Utilities: Submit final meter readings for temporary utilities, measured record of stored fuel, and similar data as of the time of substantial completion or when Owner took possession of, and responsibility for, corresponding elements of the Work.

1.03 PREREQUISITES TO FUNCTIONAL COMPLETION

A. All TAB (Test, Adjust and Balance) work must be complete prior to Functional Completion, unless approved in writing by the Owner's Project Manager. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems, but is not limited to:

1. Completed and signed start-up and prefunctional checklist documentation.

2. Requested trend log data.

3. Submission of final approved TAB report.

4. Completion of all functional testing.

5. Required training of Owner personnel completed and approved.

6. Submission of the approved O & M manuals.

7. All identified deficiencies have been corrected or are approved by the Owner to be accepted from this milestone.

B. The Owner's Project Manager will determine the date of Functional Completion.

1.04 RECORD DOCUMENT SUBMITTALS

A. General: Specific requirements for record documents are indicated in individual sections of the Specifications. The general requirements are indicated in the General Conditions, with additional provisions indicated in Section 01 01 00 - General Scope of Work, and Specification Divisions as required for Mechanical and Electrical Work, respectively. DO NOT USE record documents for construction purposes; protect from deterioration and loss in a secure fire-resistive location.

B. Record Drawings:

1. Contractors shall keep an accurate record of “As-Built” conditions as the Work progresses. Mark-up Drawings to indicate variance, at the time the variance occurs.

2. Maintain a white print set (blue line or black line) of complete Construction Documents and Shop Drawings, in clean undamaged condition, for the purpose of checking and recording all installations which vary substantially from the Work as originally shown. The records shall include changes in sizes, locations, and dimensions, as well as any resulting from Bulletins, Change Orders, or Field Orders.

3. Mark whichever Drawing is most capable of showing the “As-Built” condition fully and accurately; however, where Shop Drawings are used for mark-up, record a cross-reference at the corresponding location on the Contract Drawings.

4. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations of separate categories of Work.

5. Mechanical and Electrical Contractors shall give particular attention to concealed Work, and record all concealed mechanical and electrical services by color code. Record shall include exact locations of pipe, conduit, wire and cable, valves and all underground or otherwise concealed Mechanical and Electrical Work, properly dimensioned from adjacent building walls and with invert elevations noted. Record shall include all principal dimensions of concealed Work and any special notations such as valve numbers.

6. Obtain a complete set of reproducibles using the Architect’s original tracings and any Shop Drawings used for Record Drawings. Transfer all corrections, changes, and revisions from the job record set to the reproducibles and add to the legend “Record Drawings” and the date of printing to each reproducible. Within thirty (30) days of completion of job, print one (1) complete set of blacklines or blueprints. The reproducible and blacklines or blueprints shall become the property of the Owner.
7. Organize Record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Maintenance Manuals:

1. Organize maintenance and operating manual information into individual binders properly identified, indexed, and thumb tabbed, such as Building Maintenance, Tile Maintenance, Roof Maintenance. Include names, addresses, telephone numbers, and e-mails of equipment vendors and Subcontractors. Submit one (1) copy to the Owner within thirty (30) days of Substantial Completion to be retained by the Owner for his records and use.

2. Include information such as emergency instructions, spare parts listing, warranties and guarantees with name, telephone number and e-mail of contact person, wiring diagrams, recommended “turn-around” cycles, inspection procedures, Shop Drawings, Product Data, names and addresses of each supplier, names and addresses of contractor and sub-contractors with contact person telephone number, e-mails, and similar applicable information.

3. Bind each manual of each set in a heavy-duty, 3-ring, vinyl-covered binder (not less than 2" capacity), and include pocket folders for folded sheet information. Mark identification on the front and spine of each binder.

1.05 CLOSEOUT PROCEDURES

A. General Operating/Maintenance Instructions: Arrange for each installer of Work requiring continuing maintenance or operation, to meet with personnel at the Project site to provide instructions needed for proper operation and maintenance of all equipment or components.

1. Include instructions by manufacturer’s representatives where installers are not expert in the required procedures.

2. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and similar procedures and facilities.

3. For operational equipment, demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations.

4. Review maintenance and operations in relation with applicable guarantees, warranties, agreements to maintain, bonds, and similar continuing commitments.

1.06 FINAL CLEANING

A. General: Provide cleaning for specific units of Work as specified within the Specifications Sections listed under the Table of Contents in the Project Manual. Provide final cleaning of the Work, at the time indicated, consisting of cleaning each surface or unit of Work to the normal “clean” condition expected for a first-class building cleaning and maintenance program. Comply with manufacturers' instructions for cleaning operations.

B. Cleaning Requirements: The following are examples, but not by way of limitation, of the cleaning levels required, including removing all marks, stains, soil, and fingerprints from all completed Work.

1. Remove manufacturer's or contractor's labels which are not required as permanent. Remove protective coverings and tags, except for those required to demonstrate compliance with building codes, fire-ratings and testing. Also remove all residue and glue remaining on the surface.

2. Clean transparent and reflective glass materials, including window/door glass and mirrors with ammonia-type, non-streaking glass cleaner, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken or damaged glass and mirrors.

3. Clean exposed exterior and interior hard-surface finishes, including metals, masonry, stone, concrete, painted surfaces, plastics, tile, wood, and similar surfaces, to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated; avoid the disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.

4. Wipe surfaces of mechanical and electrical equipment clean, and remove excess lubrication and other substances. Change filters within HVAC equipment.

5. Remove debris and surface dust from limited-access spaces including roofs, plenums, trenches, manholes, attics and similar spaces.

6. Clean concrete floors in non-occupied spaces broom clean.

7. Vacuum clean soft material surfaces, such as carpeted and similar surfaces.

8. Clean, sanitize and polish all fixtures, and washable surfaces in the Toilet Rooms. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.

9. Damp wipes and cleans all fixtures, including light fixtures and lamps so as to function with full efficiency. Replace burned-out or broken lamps.

10. Wash, clean and polish all porcelain and/or ceramic tile surfaces.

11. Remove and dispose of all trash, scraps, packing, and all other construction debris.

12. Clean Project site (yard and grounds), including landscape, development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition;

remove stains, petro-chemical spills and other foreign deposits. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface.

C. Damages: Any damage caused by Contractors with cleaning equipment shall be repaired or replaced by the Contractor responsible for the damage.

D. Time of Final Cleaning: Following certification of “Substantial Completion”.

1.07 PEST CONTROL

A. Engage an experienced exterminator to make a final inspection of the Project, and to eliminate the Project of rodents, insects, and other pests. Comply with governing regulations and applicable health and safety standards.

1.08 REMOVAL OF PROTECTION

A. Except as otherwise indicated or requested, remove temporary protection devices and facilities which were installed during the course of the Work to protect previously completed Work during the remainder of the construction period.

1.09 COMPLIANCES

A. Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site, or bury debris or excess materials on the Owner’s property, or discharge volatile or other harmful or dangerous materials into drainage systems; remove waste materials from the site and dispose of in a lawful manner. At no time during or at completion of construction, place any excess material, into Owner’s compactor or container.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 01 33 23 "Shop Drawings and Samples”.
2. Section 01 70 00 "Project Closeout” Procedures for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
3. Section 078456 and 079000 for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

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

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor professional engineer.

B. Certificates: Submit certificate signed by land surveyor professional engineer certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.

3. Products: List products to be used for patching and firms or entities that will perform patching work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

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

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety. Operational elements include the following; but not limited to:

a. Primary operational systems and equipment.

b. Fire separation assemblies.

c. Air or smoke barriers.

d. Fire-suppression systems.

e. Mechanical systems piping and ducts.

f. Control systems.

g. Communication systems.

h. Fire-detection and -alarm systems.

i. Conveying systems.

j. Electrical wiring systems.

k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or those results in

increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.

b. Membranes and flashings.

c. Exterior curtain-wall construction.

d. Sprayed fire-resistive material.

e. Equipment supports.

f. Piping, ductwork, vessels, and equipment.

g. Noise- and vibration-control elements and systems.

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

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

1. Description of the Work.

2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.

4. Recommended corrections.

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

3.2 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

B. General: Engage a land surveyor professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

2. Establish limits on use of Project site.

3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

4. Inform installers of lines and levels to which they must comply.

5. Check the location, level and plumb, of every major element as the Work progresses.

6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.

7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

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

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

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

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

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect and Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

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

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

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

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

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

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

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

2. Allow for building movement, including thermal expansion and contraction.

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

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

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

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

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

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

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

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

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

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.7 OWNER- INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Pre-installation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

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

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

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

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

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

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

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

3.9 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Construction Contract.

1.02 SUBMITTALS

A. Submit affidavits and releases.

1.03 SUBSTANTIAL COMPLETION

A. Submit written notification that the work or designated portion of the work is substantially complete to the Engineer when the work is considered to be substantially complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the project will be considered complete.

B. Engineer shall visit the project site to observe the work within a reasonable time after notification is received to determine the status of completion.

C. Engineer shall issue notification to the Contractor that the work is either substantially complete or that
additional work must be performed before the project may be considered substantially complete.
   1. Engineer shall notify the Contractor in writing of items that must be completed before the project can be considered substantially complete.
      a. Correct the noted deficiencies in the work.
      b. Issue a second written notice with a revised list of deficiencies when work has been completed.
      c. Engineer shall revisit the site and the procedure shall begin again.
   2. Engineer shall issue a tentative Certificate of Substantial Completion to the Project Owner when the project is considered substantially complete. Certificate shall include a tentative list of items to be corrected before final payment.
      a. Owner will review and revise the list of items and notify the Engineer of any objections or other items that are to be included in the list.
      b. Engineer shall prepare and send to the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be corrected or completed.
      c. Review the list and notify the Engineer in writing of any objections within 10 days of receipt of Certificate of Substantial Completion.

1.04 FINAL PUNCHLIST VISIT

A. Submit written certification when the project is complete and:
   1. Contract Documents have been reviewed.
   2. Work has been completed in compliance with the Contract Documents.
   3. Specified spare parts and special tools have been provided.
   4. Work is complete and ready for final punchlist visit.

B. Engineer shall make an site visit with the Contractor and appropriate regulatory agencies to determine the status of completeness within a reasonable time after the receipt of the Certificate.

C. Engineer shall issue notice that the project is complete or notify the Contractor that work is not complete or is defective.
   1. Submit the request for final payment with Closeout submittals if project is complete and the work is acceptable.
   2. Upon receipt of notification from the Engineer that work is incomplete or defective, take immediate steps to remedy the stated deficiencies. Send a second certification to the Engineer when work has been completed or corrected.

3. Engineer shall re-visit the site and the procedure will begin again.

1.05 RE-OBSERVATION FEES

A. Pay fees to the Contractor to compensate the Engineer for repunchlist site visit of the work required by the failure of the work to comply with the claims of status of completion made by the Contractor.

B. Owner may withhold the amount of these fees from the Contractor's final payment.

C. Cost for additional observation visit will be billed to the Contractor by the Engineer for the actual hours
required for the inspection and preparation of related reports in accordance with the foll owing rates:

Principal in Charge	$250.00
Project Manager	$150.00
Design Engineer	$125.00
Engineering Technician	$ 95.00
Clerk	$ 70.00

1.06 CLOSEOUT SUBMITTALS TO THE ENGINEER

A. Record Drawings.

B. Keys and keying schedule.

C. Warranties and bonds.

D. Evidence of payment or release of liens on the forms and as required by the General Conditions.

E. Consent from Surety to Final Payment

F. Record data, and other submittals as required by the Contract Documents.

G. Specified spare parts and special tools.

H. Evidence of final, continuing insurance, and bond coverage as required by the Contract Documents.

I. TWDB required documents.

1.07 FINAL PAYMENT REQUEST

A. Submit a preliminary final payment request. This request is to include adjustments to the Contract Amount for:
   1. Approved Change Orders
   2. Allowances not previously adjusted by Change Order
   3. Unit prices
   4. Deductions for defective work that has been accepted by the Owner
   5. Penalties and bonuses
   6. Deductions for liquidated damages
   7. Deductions for reinspection payments per Paragraph 1.05
   8. Other adjustments

B. Engineer shall prepare a final Change Order, reflecting the approved adjustments to the contract amount which have not been covered by previously approved Change Orders.

C. Submit the final application for payment per the General Conditions, including the final Change Order.

1.08 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

A. Provide warranties, bonds, and service agreements required by Section 01300, SUBMITTALS or by the individual sections of the specifications.

B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.

C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.
   1. Each document is to be signed by the respective manufacturer, supplier, and subcontractor.
   2. Each document is to include:
      a. The product or work item description
      b. The firm, with the name of the principal, address, and telephone number
      c. Scope of warranty, bond or services agreement
      d. Date, duration and expiration date for each waranty bond and service agreement.
      e. Procedures to be followed in the event of a failure
      f. Specific instances that might invalidate the warranty or bond

D. Submit two (2) copies of each document to the Engineer for review and transmittal to the Owner.
   1. Submit duplicate sets.
   2. Documents are to be submitted on 8-1/2" x 11" paper, punched for a standard three-ring binder.
   3. Submit each set in a commercial quality three-ring binder with a durable and cleanable plastic cover. The title "Warranties, Bonds, and Services Agreements", the project name and the name of the Contractor are to be typed and affixed to the cover.

E. Submit warranties, bonds and services agreements:
   1. At the time of final completion and before final payment.
   2. Within 10 days after inspection and acceptance for equipment or components placed in service during the progress of construction.

1.09 CLAIMS AND DISPUTES

A. Claims and disputes must be resolved prior to recommendations of final payment. Acceptance and final payment by the Contractor will indicate that any outstanding claims or disputed issues have been resolved to the full satisfaction of the Contractor.

END OF SECTION

SECTION 01 81 19
INDOOR AIR QUALITY REQUIREMENTS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, transportation, protection, and services necessary for, and incidental to, the proper execution and completion of all Indoor Air Quality Requirements, as specified herein. Work includes, but is not necessarily limited to the following:

1. Construction procedures to promote adequate indoor air quality after construction.

2. Building flush-out after construction and before occupancy.

3. Testing indoor air quality after completion of construction.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. HVAC Filters - Section 24 40 00.

2. Testing, adjusting, and balancing for HVAC - Section 23 05 93.

1.02 PROJECT GOALS

A. Maintain a healthy environment for the present and future occupants of the building. Therefore, the Contractor shall conduct the work in such a way as to avoid creating indoor air quality problems.
Required procedures:

1. Limiting use of products that may contribute to poor indoor air quality.

2. Maintaining work procedures which contain and alleviate dusts and odors and air-borne contaminants.

3. Protection of materials from moisture.

B. The Contractor’s attention is directed to provisions throughout the Contract Documents intended to maintain indoor air quality during construction and after completion of the Project. These provisions will be strictly enforced. The Contractor shall notify and require

each subcontractor, sub-subcontractor and materials vendors to comply with such provisions.

1.03 DEFINITIONS

A. Definitions Pertaining to Sustainable Development: As defined in ASTM E2114.

B. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.

C. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabric, fibrous insulation, and other similar products.

D. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

E. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.

1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

F. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.

G. Interior final finishes: Materials and products that will be exposed at interior occupied spaces; including flooring, wall covering, finish carpentry, and ceilings.

H. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

I. Particulates: Dust, dirt, and other airborne solid matter.

J. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

K. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.04 REFERENCE STANDARDS

A. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE): ASHRAE Standard 62 -2007, Ventilation for acceptable Indoor Air Quality.

B. American National Standards Institute (ANSI)/ASHRAE Standard 52.2 -1999: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

C. Sheet Metal and Air Conditioning National Association (SMACNA): “IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition 2007” and Duct Cleanliness for New Construction Guideline.” D. U.S. Environmental Protection Agency Compendium of Method for Determination of Air Pollutants in Indoor Air.

1.05 PERFORMANCE REQUIREMENTS

A. VOC Emissions: Products have been selected for this Project with respect to their emissions of Volatile Organic Compounds, in order to limit concentrations of VOC’s in occupied spaces.

1. Substitution for any specified VOC-containing product specified will be considered with the condition that acceptable VOC-emission data are available for the proposed product, or the Contractor arranges to have that product tested for VOC emissions by an independent laboratory.

B. Airborne Dust: Dust Partitions, site dust control measures and other construction practices shall be maintained to prevent airborne dust from leaving the site or accumulating in the building interior.

C. Moisture: Weather protection, scheduling of the work, restoration drying techniques using desiccants drying, dehumidification and other construction practices shall be used to maintain the schedule and to prevent construction materials from reaching moisture levels that will support the growth of mold, bacteria and other biological contaminants.

1. Maximum Equivalent Moisture Content (EMC) of substrates installed wet or wetting during the construction process such as concrete, and concrete block shall be measured before application of mold-sensitive finishes. Installation of the following products shall not proceed until the relative humidity in the substrate does not exceed 70 percent relative Humidity (RH) as measured using ASTM F 2170, or in accordance with the manufactures ‘s written limitations, whichever is lower:

a. Non-preservative-treated wood products.

b. Gypsum Wallboard.

c. Carpet.

d. Acoustical Ceiling Tile.

e. Fabric-covered acoustical panels and tack boards.

f. Fixed upholstered seating.

2. Wood-based finish products such as flooring, architectural woodwork, casework, etc. shall additionally follow the environmental temperature and RH criteria limits established within the respective sections.

1.06 SUBMITTALS

A. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Temporary HVAC Filters: Provide product data for during construction, at flush-out, and installed at Substantial Completion, Highlighting MERV and other performance data.

C. Indoor Air Quality (IAQ) Management Plan: Not less than 10 days before the Pre-construction meeting, prepare and submit an IAQ Management Plan; use SMACNA IAQ Guidelines for Occupied Buildings Under Construction as a guide including, but not limited to, the following:

1. Identify potential sources of odor and dust.

2. Identify construction activities likely to produce odor and dust.

3. Identify porous materials and absorptive materials.

4. Identify areas of project potentially affected, especially occupied areas.

5. Evaluate potential problems by severity and describe methods of control.

6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters, and scheduled for replacement of filters.

7. Describe cleaning and dust control procedures.

8. Describe storage and moisture protection control procedure.

9. Describe the building flush-out procedures including the dates when flush-out will begin and completed.

10. Describe coordination with commissioning procedures.

11. Describe the air contaminant test procedures including the following:

    a. Identify the Testing Agency qualifications.

    b. Identify the locations and scheduling of the air sampling.

    c. Describe Test procedures in detail.

    d. Identify the Test instruments and apparatus.

    e. Describe the sampling method.

D. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to absorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

E. Construction Documentation: Size photographs on three different occasions during construction along with brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive material.

F. Duct and Terminal Unit Inspection Report.

G. Air Contaminant Test Reports: Provide the follow information in the Air Contaminant Test Report, but is not limited to, the following:

    1. Location where each sample was taken and time.

    2. Test values for each air sample; average the values of each set of 3.

    3. HVAC operating conditions.

    4. Certification of test equipment calibration.

    5. Other conditions or discrepancies that might have influenced the results.

H. Moisture Testing: Evidence of testing of each substrate to receive mold-sensitive finishes in accordance with ASTM F 2170.

1.07 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

E. Maintain at the contraction site a complete and up-to-date binder of MSDS for all products on-site containing VOC's. Upon the request of the Owner, make the binder available for review.

PART 2 - PRODUCT

2.01 MATERIALS

A. Through the Work, use products, materials which contribute the minimum practicable dust, odors, and contaminants to indoor environment.

B. Products containing Volatile Organic Compounds (VOC's):

1. Comply with the following criteria for VOC Limits for the following field-applied products.

2. No urea formaldehyde-containing products will be permitted for use in this project.

C. Indoor Chemical and Pollutant Source Control:

1. Provide temporary walk-off mats to reduce the entry of dust, moisture, and other contaminants into the building during construction.

2. Refer to Section 12 48 13 - Entrance Floor Mats and Frames, for permanent floor grilles to be installed at building entrances. These floor grilles shall be protected from dust, moisture, and other contaminants until Substantial Completion.

D. Mechanical Systems and Controls: Refer to specification sections in Divisions 21, 22, 23 and 26 for mechanical and electrical provisions for maintaining Indoor Air Quality.

PART 3 - EXECUTION

3.01 GENERAL PROCEDURES FOR PROTECTING INDOOR AIR QUALITY

A. General: Provide physical barriers, ventilation, and other controls as specified to reduce potential for odors, dust, and fumes from affecting present and future occupants of the building, and to meet performance criteria specified herein.

B. Material Transport and Storage:

1. Store construction materials, including ductwork, in clean, dry areas protected from moisture and dust. Refer to individual specification sections for additional on-site storage requirements for individual materials and equipment.

2. No Storage of construction material or debris will be permitted within mechanical rooms.

3. Adsorptive materials shall be protected throughout storage at the site in their original wrapping material.

4. Keep waste materials that can release dust or odors covered and sealed when on-site, and dispose of them promptly.

C. Installation Sequence: Schedule material installation and construction activities so as to avoid adsorption of VOC's and dust into adsorptive materials.

1. Provide protective cover for adsorptive materials that will be subjected to VOC off-gassing and dust.

a. Wrap adsorptive materials in polyethylene or other impermeable material and seal edges with tape.

b. Refer to SMACNA Guidelines for minimum requirements.

c. Protective cover is required for uninstalled materials stored in the construction area, as well as for installed materials.

2. Containers of VOC containing fluids shall be kept tightly sealed. When not in use, such containers shall be stored in a location remote from adsorptive materials or occupied areas.

3. Apply wet materials such as paints, coatings and products installed with adhesives, allowing them time to off gas before applying adsorptive or "sink" type products such as.

a. Acoustical ceiling tiles.

b. Carpet.

c. Fabric materials, upholstered products or fabric-wrapped panels for use as tack boards or acoustical purposes.

4. Permit carpeting to off gas for 48 hours at the plant prior to wrapping in plastic wrappings. Otherwise, before installation, open up carpet rolls and spread carpet

out in an offsite location and ventilate in an area protected from weather, sources of moisture or other VOC's.

D. Regular Cleaning during Construction: The intent of these documents is to prevent accumulation of contaminant-containing dirt and dust within the building during construction.

1. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

2. Use cleaning methods that minimize airborne dust. Recommended methods include:

a. Immediate removal of spills, excess applications of cleaning products, and accumulated water.
b. Increased frequency of cleaning during construction, to maintain surfaces free of dust accumulation.
c. Use of wetting agents and sweeping compounds, and of efficient dust collection equipment such as damp mops and HEPA-filtered vacuum cleaners.
d. Refer to SMACNA Guidelines for additional cleaning recommendations.

E. Protection of HVAC:

1. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

2. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

3. HVAC equipment and ductwork may NOT be used for ventilation during construction:

a. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.

b. Exhaust directly to outside.

c. Seal HVAC air inlets and outlets immediately after duct installation.

4. HVAC equipment and supply air ductwork may be used for ventilation during construction:

   a. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.

   b. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.

   c. Do not use return air ductwork for ventilation.

   d. Do not use return air ductwork for ventilation unless absolutely necessary.

   e. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.

   f. Where return air ducts must be used for ventilation, install auxiliary filters at return inlets, sealed to ducts; use filters with at least the equivalent efficiency as those required at supply air side; inspect and replace filters when they lose efficiency.

5. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.

   a. Inspect duct intakes, return air grilles, and terminal units for dust.

   b. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduits.

   c. Clean tops of doors and frames.

   d. Clean mechanical and electrical rooms, including tops of pipes, ducts, conduits, equipment, and supports.

   e. Clean return plenums of air handling units.

   f. Remove intake filters last, after cleaning is complete.

6. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

3.02 MIXING OF MULTI-COMPONENT PRODUCTS

A. General: Fluid-applied products furnished in two or more components shall be mixed thoroughly, in precise proportions so that an excess of one component will not remain

uncured. The requirements of this section apply to all fluid-applied multi-component products, including but not limited to the following:

1. Multi-component adhesives.

2. Multi-component waterproofing and sealant products.

3. Multi-component paints and coatings

4. Multi-component fluid-applied floorings

B. Requirements:

1. All multi-component mixtures shall be brought to the Project Site in factory-sealed and premeasured containers with precise quantities required for proportional mixing. No bulk materials will be permitted on-site if not packaged in this manner.

2. Mix components in strict accordance with manufacturer's written instructions regarding quantities, mixing method and other conditions.

3. Each container of each component shall be completely mixed with the entire contents of a corresponding container of the second component.

a. No field mixing of partial quantities will be permitted.

b. Properly dispose of mixed components remaining unused at the end of a workday.

3.03 CONTROL OF COMBUSTION PRODUCTS

A. General: Minimize the use of fuel-burning equipment inside and near the building. Where fuel-burning engines are necessary, cycle off equipment when not in use.

B. Vehicle Exhaust: No vehicles shall be left idling near temporary or permanent air intakes. Motorized vehicles used within the building shall be electrically powered.

C. Power Equipment: No internal combustion engines shall be operated within the building. Location of engines outside the building shall be remote from permanent air intakes and operable windows of occupied spaces.

D. Exhaust of Temporary Heating Equipment:

1. No temporary heating equipment that burns kerosene or other liquid fuel will be permitted within the building.

2. Temporary equipment that produces heat by combustion of fuel shall be installed with provisions to ventilate combustion gases to the exterior of the building.

E. Welding: Welding operations shall be properly ventilated.

F. Smoking: No smoking will be permitted within the construction site or adjacent areas at any time.

3.04 DUST CONTROL

A. General: The following provisions do not supersede specific requirements for methods of construction or applicable general conditions set forth elsewhere in the Contract with regard to performance obligations of the Contractor.

1. Maintain the construction site, stockpiles, access, detour, and haul roads, staging, and parking area used for the Work, free of dust that would cause a hazard or a nuisance to those at the site or adjacent sites. Refer to Section 31 00 00 - EARTHWORK, for additional provisions for control of dust on the site.

2. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and use damp cloths and wetting agents or sweeping compounds to prevent air-borne dust from dispersing into the atmosphere.

3. Cutting of concrete and masonry products shall be performed using wet saw methods.

4. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

5. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

6. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces, including paint, coatings, sealants, caulking, and adhesives.

B. Dust Partitions and Coverings:

1. Furnish, erect, and maintain for the duration of the work period, temporary fire-resistant dustproof coverings and solid partitions as required to prevent the spread of dust beyond the immediate area where work is being performed.

2. Temporary partitions for dust control shall extend from floor to bottom of structure above, to provide an air-tight barrier. Provide air-tight coverings for openings required for access through partitions.

3. Cover equipment installed within construction area using canvas, polyethylene tape, or other materials as recommended by manufacturer of equipment for protection from airborne dust and vapors.

4. Refer to Section 01 50 00 – Temporary Facilities and Controls, for additional requirements for temporary partitions and related protective measures.

C. Prevent dust and odors from entering the new HVAC system. Confirm that the HVAC Subcontractor has sealed all diffusers, return side ductwork, and equipment within the Work Area so as to prevent dust from entering. For further requirements, refer to SMACNA Guidelines and DIVISION 23 – Heating, Ventilating, and Air Conditioning.

D. Prevent exterior dust and odors from entering interior space after building is enclosed. Whenever possible, seal window units with plastic as recommended in SMACNA Guidelines.

3.05 WATER DAMAGE

A. General: The General Contractor shall be responsible for protecting the Work from moisture, in order to prevent growth of harmful fungus, mold, and other biological activity.

B. Protection of Existing and New Building Construction:

1. Refer to Section 01 50 00 - Temporary Facilities and Controls, for materials and installation of weatherproof enclosures.

2. Remove and replace construction that becomes wet, or that shows evidence of biological growth due to the presence of moisture.

C. Protection of Stored Construction Materials:

1. Take precautions to prevent porous materials such as gypsum board, insulation, ceiling tile, wood, and similar products from becoming wet.

2. Refer to Section 01 50 00 - Temporary Facilities and Controls, for materials and installation of weatherproof enclosures.

3. Store materials above ground surfaces and provide spacers between the ground and protective covering to allow for ventilation.

4. Discard construction material that becomes wet, or that shows evidence of biological growth due to the presence of moisture.

D. Procedures for drying out wet construction: In the case that an unanticipated event permits the entry of water into new or existing construction, the Contractor shall perform procedures to dry out construction within 24 hours, to a degree that will not support biological growth using restoration drying techniques.

1. Refer to guidelines published by the United States Environmental Protection Agency.

2. Construction that is not adequately dried out, or which shows evidence of biological growth, shall be removed immediately from the construction area and disposed of legally.

3. Wetting by contaminated water and subsequent cleaning and decontamination shall be supervised by a qualified company.

3.06 CLEAN UP

A. Prior to turning over work area to Owner, conduct final cleaning to remove dust to the minimum practicable level.

B. Clean ductwork, registers and grilles within the Work Area, and HVAC equipment servicing the Work Area using professional duct cleaning company.

C. After completion of duct cleaning, vacuum vertical and horizontal surfaces, ledges, trim, tops of light fixtures and other equipment, and other locations where dust has settled. Utilize HEPA-filtered vacuum to capture fine dust.

D. Vacuum carpet tiles and fabric-covered surfaces with a high-efficiency particulate arrestor (HEPA) vacuum prior to Substantial Completion.

E. Do not use solvent-based cleaners in final cleaning of Work Area, unless cleaning occurs at least 14 days prior to Owner’s scheduled Active Use of the area.

F. Coils, air filters, and fans in HVAC system shall be cleaned prior to final testing and balancing. Refer to Division 23 - HVAC, for requirements.

3.07 BUILDING FLUSH-OUT

A. Contractor’s Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:

1. All construction is complete.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.

4. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.

5. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.

1. Obtain concurrence that construction is complete enough before beginning flush-out.

2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.

3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.

4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 3,500 cubic feet per square foot of floor area prior to occupancy, and:

a. Begin ventilation at least three hours prior to daily occupancy.

b. Continue ventilation during all occupied periods until total air volume of 14,000 cubic feet per square foot of floor area has been achieved.

c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.08 AIR CONTAMINANT TESTING

A. Contractor’s Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before starting construction, as baseline for evaluation of postconstruction testing.

C. Perform air contaminant testing before occupancy.

D. Do not start air contaminant testing until:

1. All construction is complete, including interior finishes.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.

4. New HVAC filtration media have been installed.

E. Indoor Air Samples: Collect from spaces representative of occupied areas:

1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.

2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet take samples from areas having the least ventilation and those having the greatest presumed source strength.

3. Collect samples from height from 36 inches to 72 inches above floor.

4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.

5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.

6. When retesting the same building areas, take samples from at least the same locations as in first test.

F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

G. Analyze air samples and submit report.

H. Air Contaminant Concentration Determination and Limits:

1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

2. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.

3. Formaldehyde: Not more than 27 parts per billion.

4. Total Volatile Organic Compounds (TVOC): Not more than 500 micrograms per cubic meter.

5. 4-Phenylcyclohexene (4-PCH): Not more than 6.5 micrograms per cubic meter.

6. Particulates (PM10): Not more than 50 micrograms per cubic meter.

7. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

I. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner, or conduct full building flush-out specified above.

END OF SECTION

SECTION 0 22 00
EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for slabs-on-grade.
   4. Subbase course for concrete walks.
   5. Excavating and backfilling trenches within building lines.
   6. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:
   1. Division 1 Section "Construction Facilities and Temporary Controls."
   2. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
   3. Division 2 Section "Excavation Support and Protection."
   4. Division 15 and 16 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

1.3 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations.
   1. Additional Excavation: Excavation below subgrade elevations as directed by Engineer. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Each type of plastic warning tape.
   2. Drainage fabric.

B. Samples: For the following:
   1. 10-lb samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

A. Comply with applicable requirements of NFPA 495, "Explosive Materials Code."

B. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

C. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups SC, GC, CL, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, GM, SC, SM, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.
E. Sub-base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch sieve and not more than 12 percent passing a No. 200 sieve.
F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
1. Grab Tensile Strength: 110 lbf; ASTM D 4632.
2. Tear Strength: 40 lbf; ASTM D 4533.
3. Puncture Resistance: 50 lbf; ASTM D 4833.
4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D 4491.
5. Apparent Opening Size: No. 50; ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

3.5 EXCAVATION FOR WALKS

A. Excavate surfaces under walks to indicated cross sections, elevations, and grades.

3.6 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.
B. Excavate trenches to uniform widths to provide a working 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 inches on each side of pipe or conduit.
C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
   3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 APPROVAL OF SUBGRADE

A. Notify Architect when excavations have reached required subgrade.
B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
   1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Inspecting and testing underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Place and compact initial backfill of subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

D. Coordinate backfilling with utilities testing.

E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

F. Place and compact final backfill of satisfactory soil material to final subgrade.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and 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.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

D. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

E. Retain applicable subparagraphs below. Percentages of maximum dry unit weight are examples only; revise to suit Project. Delete scarifying and recompacting existing subgrade when proof rolling will suffice.
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 6 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
   3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Walks: Plus or minus 1 inch.
   2. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course on prepared subgrade and as follows:
   1. Place base course material over subbase.
   2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
   3. Shape subbase and base to required crown elevations and cross-slope grades.
   4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
   5. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 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 02200

SECTION 02282
TERMITE CONTROL

GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SUMMARY

Provide soil treatment for termite control, as herein specified, prior to placement of vapor barrier under concrete work.

SUBMITTALS

Product Data: Submit manufacturer's technical data and application instructions.

QUALITY ASSURANCE

In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.

JOB CONDITIONS

Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

SPECIFIC PRODUCT WARRANTY

Furnish written warranty certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean terminate activity is discovered during warranty period, Contractor will retreat soil and repair or replace damage caused by termite infestation. Provide warranty for a period of 1 years from date of treatment, signed by Applicator and Contractor. This contract shall be renewable annually at the option of the Owner.

PRODUCTS

SOIL TREATMENT SOLUTION

Use an emulsible concentrate termiticide for dilution with water, especially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements and concentrations:

Chloropyrifos ("Dursban TC"); 1.0 percent is water emulsion.

Permathrin ("Dragnet", "Torpedo"); 0.5 percent in water emulsion.

Other solutions may be used as recommended by Applicator if also acceptable to Architect and approved for intended application by jurisdictional authorities. Use only soil treatment solutions which are not injurious to planting.

EXECUTION

APPLICATION

Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

Application Rates: Apply soil treatment solutions as follows:

Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following rates of application:

> Apply 4 gallons of chemical solution per 10 lin. ft. to soil in critical areas under slab, including entire inside perimeter inside of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
>
> Apply one gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.
>
> Apply 4 gallons of chemical solution per 10 lin. ft. of trench, for each foot of depth from grade to footing, along outside edge of building. Dig a trench 6" to 8" wide along outside of foundation to a depth of not less than 12". Punch holes to top of footing at not more than 12" o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in trench.

At hollow masonry foundations or grade beams, treat voids at rate of 2 gal. per 10 lin. ft., poured directly into the hollow spaces.

At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gals. per 10 lin. ft. of penetration.

Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

Outside building perimeter in a strip at least 2' wide, 1 gallon per 5 square feet.

END OF SECTION

SECTION 02311
ROUGH GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cutting, grading, filling, rough contouring, compacting, and shaping the site around the area ways.

1.2 RELATED SECTIONS

A. Section 01400 – Quality Requirements.
B. Section 02200 – Earthwork

1.3 REFERENCES

A. ASTM C136 - Method For Sieve Analysis of Fine and Coarse Aggregates.
B. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
C. ASTM D2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
D. ASTM D2434 - Test Method for Permeability of Granular Soils (Constant Head).
E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.
B. Accurately record actual locations of utilities remaining by horizontal dimensions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Subsoil Fill: Common sandy loam typical to the agricultural area.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01039.
B. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.
B. Stake and flag locations of known utilities.
C. Locate, identify, and protect utilities that remain, from damage.
D. Notify utility company to remove and relocate utilities to allow for the improvements to proceed.
E. Protect above and below grade utilities that remain.
F. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
G. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 FILLING

A. Install Work in accordance with designated requirements.
B. Fill areas to contours and elevations with soil materials.
C. Place fill material on continuous layers and compact.
D. Maintain optimum moisture content of fill materials to attain required compaction density.
E. Slope grade away from building minimum 2 inches in 10 ft unless noted otherwise.
F. Make grade changes gradual. Blend slope into level areas.

3.4 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 6 inches from required elevation.

3.5 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Field inspection and testing for compaction. Compact to minimum 95 percent of maximum density.

END OF SECTION

SECTION 02 41 16
STRUCTURE DEMOLITION

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. Demolition and removal of buildings and site improvements.
2. Abandoning in-place and/or removing below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place and/or removing site utilities.
4. Salvaging items for reuse by Owner.

B. Related Sections:

1. Section 02 41 19 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified refrigerant recovery technician.

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

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before the Work begins.

F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

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

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

C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.

5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

F. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS[

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 DEMOLITION CONTRACTOR

A. Demolition Contractor:

1. Insert, in separate subparagraphs, name of Contractor prequalified to perform the Work of this Section.

3.2 EXAMINATION

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

B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations. Comply with Section 01 32 33 "Photographic Documentation."

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

1. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

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

3.3 PREPARATION

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

B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.

2. Arrange to shut off indicated utilities with utility companies.
3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

C. Existing Utilities: See plumbing and electrical Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

E. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 50 00 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least <Insert number> hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

D. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings.

D. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.

E. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.

1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.

F. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.

G. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

H. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials, recycled pulverized concrete according to backfill requirements in Section 312000 "Earth Moving."
2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

I. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.7 DEMOLITION BY EXPLOSIVES

A. Explosives: Perform explosive demolition according to governing regulations.

1. Obtain written permission from authorities having jurisdiction before bringing explosives to, or using explosives on, Project site.
2. Do not damage adjacent structures, property, or site improvements when using explosives.

B. Comply with recommendation in specialty explosives consultant's report.

3.8 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials, recycled pulverized concrete, recycled pulverized masonry according to backfill requirements in Section 312000 "Earth Moving."

C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.9 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.11 CLEANING

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

1. Clean roadways of debris caused by debris transport.

END OF SECTION

SECTION 02 41 19
SELECTIVE DEMOLITION

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

B. Related Requirements:

1. Section 010100 "General Scope of Work" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

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

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Notify Owner for the removal of items.

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

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

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

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

F. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

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

H. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

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

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, preconstruction videotapes, and templates.

1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

1. Comply with requirements for existing services/systems interruptions specified in Section 01 01 00 "General Scope of Work."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner and/or Building Manager will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

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

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

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

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."

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

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Work in Historic Areas: Selective demolition may be performed only in areas of the Project that are not designated as historic. In historic spaces, areas, and rooms or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 013591 "Historic Treatment Procedures."

C. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

D. Removed and Salvaged Items:

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

E. Removed and Reinstalled Items:

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

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

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Existing Items and Construction to be removed to be coordinated with Owner.

B. Existing Items to Be Removed and Salvaged to be coordinated with Owner

C. Existing Items to Be Removed and Reinstalled to be coordinated with Owner.

D. Existing Items to Remain to be coordinated with Owner.

END OF SECTION

SECTION 024200
DEMOLITION OF EXISTING CIVIL SITE IMPROVEMENTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This specification shall provide for the removal and disposal of old structures or portions of old structures, as noted on the plans, and shall include all excavation and backfilling necessary to complete the removal. The work shall be done in accordance with the provisions of these specifications.

PART 2 - EXECUTION

2.01 METHOD OF REMOVAL

A. Culverts or Sewers: Pipe shall be removed by careful excavation of all dirt on top and the sides in such manner that the pipe will not be damaged. Removal of wastewater appurtenances shall be included for removal with the pipe. Those pipes which are deemed unsatisfactory for reuse by the Engineer may be removed in any manner the Contractor may select.

B. Concrete Structures: Concrete structures or concrete portions of structures shall be removed by blasting and/or sledging the concrete into sizes not larger than one cubic foot. Portions of the old structure shall be removed to the lines and dimensions shown on the plans, and these materials shall be disposed of as shown on the plans or as directed by the Engineer. Any portion of the existing structure, outside of the limits designated for removal, damaged during the operations of the Contractor shall be restored to its original condition at his entire expense. Explosives shall not be used in the removal of portions of the existing structure unless approved by the Engineer, in writing.

C. Concrete portions of structures below the permanent ground line, which will not interfere in any manner with the proposed construction, may be left in place, but removal shall be carried at least 2 feet below the permanent ground line and neatly squared off. Reinforcement shall be cut off close to the concrete.

D. Steel Structures: Steel structures or steel portions of structures shall be dismantled in sections as determined by the Engineer. The sections shall be stored. Rivets and bolts connecting steel railing members, steel beams of beam spans and steel stringers of truss spans shall be removed by butting the heads with a "cold cut" and punching or drilling from the hole, or by such other method as will not injure the members for re-use and will meet the approval of the Engineer. The removal of rivets and bolts from connections of truss members, bracing members, and other similar members in the structure will not be required unless specifically called for on the plans or special provisions and the Contractor shall have the option of dismantling these members by flame-cutting the members immediately adjacent to the connections. Flame-Cutting will not be permitted, however, when plans or special provisions call for the structure unit to be salvaged in such manner as to permit re-erection. In such case, all members shall be carefully matchmarked with paint in accordance with diagram furnished by the Engineer prior to dismantling, and all rivets and bolts shall be removed from the connections in the manner specified in the first portion of this paragraph.

1. Timber Structures:
   a. Timber structures or timber portions of structures shall be removed in such manner as to damage the timber for further use as little as possible. All bolts and nails shall be removed from such lumber as deemed salvable by the Engineer.
   b. Unless otherwise specified on the plans, timber piles shall be either pulled or cut off at the point not less than 2 feet below ground line, with the choice between these two methods resting with the Contractor, unless otherwise specified.
2. Brick or Stone Structures:
   a. Brick or stone structures or stone portions of structures shall be removed by blasting and/or sledging the masonry into sizes not larger than one cubic foot.
   b. Portions of such structures below the permanent ground line, which will not in any manner interfere with the proposed construction, may be left in place, but removal

shall be carried at least 2 feet below the permanent ground line and neatly squared off.

3. Salvage:
   a. All material such as pipe, timbers, railings, etc., which the Engineer deems as salvageable for reuse and all structural steel shall be in the property of City unless otherwise specified and delivered to a designated storage area.
   b. All mechanical and electrical lift station material, which the Engineer deems as salvageable for reuse, including pumps and control panels shall be in the property of the City unless otherwise specified and delivered to a designated storage area.
   c. The I-beams, stringers, etc., which are specified to be dismantled without damage for reuse, and all steel members when matchmarked and dismantled for reuse, shall be blocked off the ground in an upright position to protect the members against further damage.
   d. Materials, other than structural steel, which are not deemed salvable by the Engineer, shall become the property of the Contractor and shall be removed to suitable disposal sites off of the right-of-way arranged for by the Contractor, or otherwise disposed of in a manner satisfactory to the Engineer.
   e. Where temporary structures are necessary for a detour adjacent to the present structure, the Contractor will be permitted to use the material in the old structure for the detour structure, but he shall dismantle and stack or dispose of the material as required above as soon as the new structure is opened for traffic.
4. Backfill:
   a. All excavation made in connection with this specification and all openings below the natural ground line caused by the removal of old structures or portions thereof shall be backfilled to the level of the original ground line, unless otherwise provided on the plans.
   b. That portion of the backfill which will support any portion of the roadbed or embankment shall be placed in layers of the same depth as those required for placing embankment. Material in each layer shall be wetted uniformly, if required, and shall be compacted to the density required in the adjoining embankment. In places inaccessible to blading and rolling equipment, mechanical or hand tamps, or rammers shall be used to obtain the required compaction.
   c. That portion of the backfill which will not support any portion of the roadbed or embankment shall be placed as directed by the Engineer in such manner and to such state of compaction as will preclude objectionable amount of settlement.

END OF SECTION

SECTION 03100
CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in place concrete, shoring, bracing and anchorage for the south entrance and ramp and sidewalks.
B. Form accessories.
C. Form stripping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03300 – Cast-In-Place Concrete: Placement of concrete accessories.
B. Section 05500 – Metal Fabrications: Placement of metal fabrications.
C. Division Fifteen: Placement of mechanical items.
D. Division Sixteen: Placement of electrical items.

1.3 RELATED SECTIONS

A. Section 03200 - Concrete Reinforcement.
B. Section 03300 - Cast-In-Place Concrete.
C. Section 03350 - Concrete Finishing.

1.4 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.
B. ACI 318 - Building Code Requirements for Reinforced Concrete.
C. ACI 347 - Recommended Practice For Concrete Formwork.
D. ANSI/ASTM A17.1 - Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks.
E. PS 1 - Construction and Industrial Plywood.

1.5 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and 318.

1.8 REGULATORY REQUIREMENTS

A. Conform to 2000 International Building Code for fabrication, erection and removal of formwork.

1.9 COORDINATION

A. Coordinate work under provisions of section 01300.
B. Coordinate this Section with other Sections of work which require attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Plywood: Douglas Fir species; solid one side sound undamaged sheets with clean, true edges.
B. Lumber: SPF species; #2 grade; with grade stamp clearly visible.

2.2 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gauge matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable snap-off type, metal, fixed length, cone type, with waterproofing washer. 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture.
C. Corners: Chamfer wood strip type; 3/4 x 3/4 inch.
D. Dovetail Anchor Slot: Galvanized steel, 22 gauge thick, foam filled.
E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
F. Waterstops: Rubber, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 6 inches wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION – FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
D. Align joints and make watertight. Keep form joints to a minimum.
E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
F. Provide fillet chamfer strips on external corners of beams and columns.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.
B. Locate and set in place items which will be cast directly into concrete.
C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals specified in Section 04820.
E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
F. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight.
G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.
B. Clean formed cavities of debris prior to placing concrete.
C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.
B. Construct and align formwork for elevator hoistway in accordance with ANSI/ASME A17.1.
C. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric and accessories for cast-in-place.

1.2 RELATED SECTIONS

A. Section 03100 – Concrete Forms and Accessories.
B. Section 03300 – Cast-In-Place Concrete.
C. Section 04230 – Reinforced Concrete Unit Masonry.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.
B. ACI 318 - Building Code Requirements for Reinforced Concrete.
C. ACI SP-66 - American Concrete Institute - Detailing Manual.
D. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
E. ANSI/ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
G. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.
H. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
I. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
J. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.
K. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
L. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330
B. Shop Drawings: Indicate bar sizes, spacings, and locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice ACI 301, ACI SP-66, ACI 318.
B. Maintain one copy of each document on site.
C. Submit certified copies of mill test report of reinforcement materials analysis.
D. Provide Architect/Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

1.6 QUALIFICATIONS

A. Welders' Certificates: Submit under provisions of Section 01400 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.7 COORDINATION

A. Coordinate work under provisions of Section 01300.
B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, unfinished.
B. Reinforcing Steel Plain Bar and Rod Mats: ASTM A704, ASTM A615, Grade 60; steel bars or rods, unfinished.
C. Stirrup Steel: ANSI/ASTM A82, unfinished.
D. Welded Steel Wire Fabric: ASTM A185 in flat sheets ; unfinished.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type.
B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture. Brick batts may be used at slab on grade; 1/2 brick minimum.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice, ACI SP-66, ACI 318, and ANSI/ASTM A184.
B. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
B. Do not displace or damage vapor barrier.
C. Accommodate placement of formed openings.
D. Maintain concrete cover around reinforcing as indicated on structural drawings.
E. Conform to applicable code and plans for concrete cover over reinforcement.
F. Bond and ground all reinforcement to requirements of Division 16.

3.2 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01400.

3.3 SCHEDULES

A. Reinforcement for Foundation Wall, Framing Members and Slab-on-Grad: Deformed bars.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

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. Extent of concrete work is shown on drawings.

1.3 SUBMITTALS

A. Product Data: Submit data for non-proprietary materials and items, including admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

B. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACT 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

1.4 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. ACT 301 "Specifications for Structural Concrete for Buildings".
   2. ACT 318 "Building Code Requirements for Reinforced Concrete".
   3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

B. Materials and installed work may require testing and retesting at anytime during progress of work. Retesting of rejected materials for installed work, shall be done at Contractor's expense.

1.5 PROJECT CONDITIONS

A. Protect adjacent finish materials against spatter during concrete placement.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I, "Alamo Cement" or equal. Use one brand of cement throughout project, unless otherwise acceptable to Architect.

B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
   1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
   2. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

C. Water: Drinkable.

D. Water-reducing Admixture: ASTM C 194, Type A, and containing not more than 0.1 percent chloride ions.
   1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
      a) "WRDA Hycol"; W.R. Grace.
      b) "PSI N"; Gifford-Hill/American Admixtures
      c) "Eucon WR-75"; Euclid Chemical Co.
      d) "Pozzolith Normal"; Master Builders.
      e) "Plastocrete 160"; Sika Chemical Corp.
      f) "Chemtard"; Chem-Masters Corp.
      g) "Pro-Kete-N"; Protex Industries, Inc.

E. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.
   1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
      a) "Accelguard 80"; Euclid Chemical Co.
      b) "Pozzolith High Early"; Master Builders.
      c) "Gilco Accelerator"; Gifford-Hill/America Admixtures

F. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
   a) "Edoco 20006"; Edoco Technical Products.
   b) "Pozzolith Retarder"; Master Builders.
   c) "Eucon Retarder 75"; Euclid Chemical Co.
   d) "Daratard"; W.R. Grace.
   e) "PSI R"; Gifford-Hill/American Admixtures.
   f) "Plastiment"; Sika Chemical Co.
   g) "Protard"; Protex Industries, Inc.

G. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chlorine ions are not permitted.

2.2 RELATED MATERIALS

1. None

2.3 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACT 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

B. Submit written reports to Architect and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

C. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:
   1. 3000 psi 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained). For structural slabs.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

E. Admixtures:
   1. Use water-reducing admixture in concrete as required for placement and workability.
   2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

F. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
   1. Ramps, slabs, and sloping surfaces: Not more than 5".
   2. Reinforced foundation systems: Not less than 3" and not more than 5".
   3. Other concrete: Not less than 3" nor more than 5".

2.4 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

B. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 JOINTS:

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, located so as not to impair strength and appearance of the structure, as acceptable to Architect.

B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.4 CONCRETE PLACEMENT

A. Replacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or casting. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
B. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
C. General: Comply with ACT 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" 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.
F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACT 309.
G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly space locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
J. Bring slab surfaces to correct level within straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
K. Maintain reinforcing in proper position during concrete placement operations.
L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACT 306 and as herein specified.
M. When air temperature has fallen to or is expected to fall below 40 deg F (4deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.
N. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
O. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix design.
P. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACT 305 and as herein specified.
Q. Cool ingredients before mixing to maintain concrete temperature at time of placement below 95º deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
R. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
S. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
T. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.5 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.6 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
C. For exposed-to-view surfaces blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
D. Repair of Formed Surfaces: Removed and replaced concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
G. Correct high area in unformed surfaces by grinding, after concrete has cured at least 4 days.
H. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.
I. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
J. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2" parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
K. Perform structural repairs with prior approval of Architect or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.
L. Repair methods not specified above may be used, subject to acceptance of Architect.

3.7 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Owner’s Agent will employ a testing laboratory to perform test and to submit test reports.
B. Sampling and testing for quality control during placement of concrete shall include the following, as directed by Architect.
C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
D. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
E. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
F. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 deg C) and above; and each time a set of compression test specimens are required.
G. Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
H. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu yds. plus additional sets for each 50 cu yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. When frequency of testing will provide less than 5 strength test for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
I. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

J. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

K. Test results will be reported in writing to Architect, Structural Engineer, and Contractor within 24 hours after tests. Reports of compressive strength test 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.

L. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

M. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

N. See Structural Plans for additional requirements.

END OF SECTION

SECTION 03350
CONCRETE FINISHING

PART 1 GENERAL
1.1 SECTION INCLUDES
A. Finishing of exposed concrete.
1.2 RELATED SECTIONS
A. Section 03100 - Concrete Forms and Accessories.
B. Section 03300 - Cast-In-Place Concrete.
1.3 REFERENCES
A. ACI 302 - Guide for Concrete Floor and Slab Construction.
1.4 SUBMITTALS
A. Submit under provisions of Section 01330.
B. Product Data: Provide data on concrete colorer, sealer, and slip resistant treatment, compatibilities, and limitations.
1.5 MAINTENANCE DATA
A. Submit under provisions of Section 01700.
B. Maintenance Data: Provide data on maintenance renewal of applied coatings.
1.6 QUALITY ASSURANCE
A. Perform Work in accordance with ACI 301 and ACI 302.
B. Maintain one copy of each document on site.
1.7 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products to site under provisions of Section 01600.
B. Deliver materials in manufacturer's packaging including application instructions.
1.8 COORDINATION
A. Coordinate work under provisions of Section 01300.
B. Coordinate the work with concrete placement and curing.

PART 2 PRODUCTS
Not used

PART 3 EXECUTION
3.1 EXAMINATION
A. Verify site conditions under provisions of Section 01300. Verify that surfaces are acceptable to receive the Work of this section.
3.2 MONOLITHIC SLAB FINISHES
A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
C. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating 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 units. Check and level surface plane to tolerances of F 35 - F 25. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin firm finish coating system.
E. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface procedures a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F 35 - F 25. Grind smooth surface defects which would telegraph through applied floor covering system.
F. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
G. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
H. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristly broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

I. See architectural for stained concrete locations.

3.3 TOLERANCES

A. After placing slabs, plane surface to tolerances for floor flatness (F) of 35 and floor levelness (F1) of 25. Slope surfaces uniformly to drains where requires. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

END OF SECTION

SECTION 03390
CONCRETE CURING

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Initial and final curing of horizontal concrete surfaces.

1.2 RELATED SECTIONS
A. Section 03300 – Cast-In-Place Concrete.
B. Section 03350 - Exposed Concrete Finishing.

1.3 REFERENCES
A. ACI 301 - Structural Concrete for Buildings.
B. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.
C. ACI 308 - Standard Practice for Curing Concrete.
D. ASTM C171 - Sheet Materials for Curing Concrete.
E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
F. ASTM D2103 - Polyethylene Film and Sheeting.

1.4 SUBMITTALS
A. Submit under provisions of Section 01300.
B. Product Data: Provide data on curing compounds, product characteristics, compatibility and limitations.
C. Manufacturer's Installation Instructions: Indicate criteria for preparation and application.

1.5 QUALITY ASSURANCE
A. Perform Work in accordance with ACI 301 and ACI 302.
B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products under provisions of Section 01600.
B. Deliver curing materials in manufacturer's packaging including application instructions.

PART 2 PRODUCTS

2.1 MATERIALS
A. Membrane Curing Compound Type A: ASTM C309 Type 1.
B. Polyethylene Film Type B: ASTM C171, 6 mil thick, clear.
C. Water: Potable and not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify substrate conditions under provisions of Section 01039.
B. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES
A. Cure floor surfaces in accordance with ACI 308.
B. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.
C. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
D. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions in two coats with second coat applied at right angles to first.
E. Polyethylene Film: Spread Polyethylene Film over floor slab areas, lapping edges and sides and sealing with pressure sensitive tape; cover with plywood; maintain in place for 7 days.

3.3 PROTECTION OF FINISHED WORK
A. Protect finished Work under provisions of Section 01500.
B. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Perform all work required to complete the Concrete Finishing indicated by the Contract Documents and furnish all supplementary items necessary for its proper execution.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specification sections, apply to work of this section.

1.3 CODES AND STANDARDS

A. Work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the latest editions of the following codes or specifications.
1. ACI 301, "Specifications for Structural Concrete for Buildings".
2. ACI 305, "Hot Weather Concreting".
3. ACI 306, "Cold Weather Concreting".
4. ACI 311, "ACI Manual of Concrete Inspection".
5. ACI 318, "Building Code Requirements for Reinforced Concrete".
6. ASTM C309, Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.4 PROJECT DATA

A. Submit copies of manufacturer's literature for all products.

1.5 FINISHING TOLERANCES

A. Tolerances:
1. Construct formwork to provide concrete surfaces conforming to tolerances of Section 3.3, ACI 347.
2. Establish and maintain, in an undisturbed condition and until final completion of project, sufficient control points and bench marks to be used for reference purposed to check tolerances.
3. Regardless of tolerances specified herein, no portion of building shall extend beyond legal boundary of project.
4. Floor Finished Surface Flatness and Levelness (random traffic areas):
a. Floor slabs shall conform to the following ACI F-number requirements:
Slab on grade: Specified Overall Value: Ff25/fl20
Minimum Local Value: Ff17/Fl15
b. When tested in accordance with the requirements of ASTM E1155, the following percentages of elevation samples on a Test Surface shall fall within a level 3/4" envelope. Percentages apply to the entire Test

Surface.

Slab on grade: 90%

The arithmetic mean of these elevation samples shall not deviate from design grade more than the following amounts:

Slab on grade: 0.25"

PART 2 PRODUCTS

2.1 MATERIALS

A. Liquid Membrane-Forming Curing Compound: Liquid type water-based membrane-forming dissipating curing compound complying with ASTM C 309.

1. "1100 - Clear"; W.R. MEADOWS. Curing Compound must be compatible with floor sealer.

PART 3 EXECUTION

3.1 FORMED SURFACES

A. As-Cast Rough Form Finish: Rough or board form finish surfaces shall be reasonable true to line and plane with no specific requirements for selected facing materials. Defects shall be patched and fins exceeding 1/4" in height shall be rubbed down with wooden blocks. Otherwise, surfaces shall be left with the texture imparted by the forms.

B. As-Cast Smooth Form Finish: Form facing materials shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper or other material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edges, patches, dents or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

3.2 REPAIR OF DEFECTIVE AREAS

A. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary the edges shall be perpendicular to the surface or slightly undercut. No feather edges will be permitted.

B. The area to be patched and an area at least 6 inches wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared, using a mix of approximately one part cement to one part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.

C. The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the course aggregate shall be omitted and the mortar shall consist of not more than one part cement to 2 1/2 parts sand by damp loose volume.

D. White Portland Cement shall be substituted for a part of the gray Portland Cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing.

E. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

F. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface.

G. To permit initial shrinkage, it shall be left undisturbed for at least one hour before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.

H. All high points on the building slab that do not meet the required tolerance will be ground down to tolerance.

3.3 SLAB SURFACES

A. Troweled Finish:

1. The surface shall be finished first with impact power floats, then with power trowels. The first troweling after power floating shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but, which may still contain some trowel marks.
2. Additional trowelings shall be done by power trowel after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the final troweling operations.
3. The finished surface shall be free of any trowel marks and shall be uniform in texture and appearance and shall be plane to a required tolerance. High points of the finished slab, which do not meet tolerance requirements shall be removed by grinding.
4. Slab shall be cured for a minimum of seven (7) days with a spray of concrete curing compound. Curing compound shall be applied per manufacturers recommendations.
5. Slab shall be free of holes, nails, embeds or other objectionable items at completion of construction.

3.4 SCHEDULE OF FINISHES

A. As-Cast Rough Form Finish: All concrete surfaces below grade.

B. As-Cast Smooth Form Finish: All interior and exterior concrete surfaces exposed to view.

C. Troweled Finish: Floor surfaces scheduled as exposed or to receive floor covering.

D. Broom Finish: Exterior horizontal surfaces not scheduled for nonslip finish and interior surfaces scheduled to receive thin set tile.

END OF SECTION

SECTION 04 20 00
UNIT STRUCTURAL MASONRY

PART 1 GENERAL

1.1 WORK INCLUDED

A. Includes furnishing all materials, equipment and services as required in conjunction with or properly incidental to construction of all masonry as described and/or as shown on the Drawings.

B. Comply with Drawings and general Requirements and Referenced Documents.

1.2 CODES AND STANDARDS

A. Concrete masonry unit manufacturer shall certify that masonry units furnished meet or exceed requirements of this Specification.

B. The work in this Section, unless noted on the Drawings, or herein specified shall be governed by the latest edition of the following codes or specifications.

1. ACI 531 "Building Code Requirements for Concrete Masonry Structures."

2. ASTM C-145 "Standard Specification for Solid Load Bearing Concrete Masonry Units."

3. ASTM C-270 "Standard Specification for Mortar for Unit Masonry."

1.3 SUBMITTALS

A. Submit shop drawings showing dimensions necessary for fabrication and placement of reinforcement and accessories.

B. Do not make shop drawings using reproductions of Contract Drawings.

C. Submit in writing any requests for modification to Drawings or Specifications. Submitting shop drawings for review does not constitute "in writing" unless it is brought to the attention of the Architect that specific changes are being suggested.

1.4 STORAGE OF MATERIALS

A. Deliver materials to job site in undamaged condition.

B. Store concrete masonry units on raised platforms. Cover and protect units from inclement weather.

C. Store mortar and grout materials in manner to prevent intrusion of moisture and contaminants.

1.5 JOB CONDITIONS

A. Masonry construction shall be in compliance with "Recommended Practices and Specifications for Cold weather Masonry Construction" adopted February 1975 by International Masonry Industry All-Weather Council and as specified herein.

B. Lay no concrete masonry unit when air temperature is below 40 degrees F unless materials are protected from weather and laid up in shelter. In such instances, maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

C. In temperatures exceeding 100 degrees F, do not lay out mortar beds ahead of placing units. Use a very light fog spray, not sufficient to penetrate masonry, on vertical surface of masonry to aid in mortar curing during first 24 hours after placing units.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete Block:

1. Hollow load-bearing units:

a. ASTM C 90, Grade N general purpose, Type I moisture-controlled. Units shall have a compressive strength of 2,000 psi on net area.

b. Nominal face dimensions: 8" high x 16" long.

c. Provide standard and fire rated units.

2. Provide normal weight aggregate units.

3. Masonry Units shall be manufactured by Feather Lite Building Products, P.O. Box 1029, Austin, Texas 7876, 512/472-2424.

4. Special shapes:

a. 8" Smooth and Split Face Block Hollow Core Units.

b. 12" Smooth and Split Face Block Hollow Core Units.

B. Flashing

1. 20-mil minimum thickness elastomeric impermeable sheet material.

2. Resistant to corrosive effects of masonry mortar.

3. Acceptable product: Nervastral HD, Rubber and Plastics Compound Co., Inc.

C. Horizontal Joint Reinforcing:

1. Continuous open-web welded wire trusses, 9 ga. side rods and diagonal ties, galvanized finish, welded at 16" intervals to continuous side rods forming truss design.

2. Prefabricated corner and "tee" intersecting units.

3. Size for single wythe construction.

4. Acceptable products:

a. Dur-O-Wal, Dur-O-Wal Company.

b. Blok-Trus, AA Wire Products Company.

c. Trus-Mesh, Hohmann and Barnard.

D. Reinforcing Rods: ASTM A 615, Grade 60.

E. Weeps: PVC plastic tubes or sash cord.

F. Portland Cement:

1. ASTM C 150, Type I or Type III, nonstaining.

2. Use of masonry cement will not be permitted.

G. Hydrated Lime: ASTM C 207, Type S.

H. Mortar Aggregates:

1. ASTM C 144, free of clay or organic matter.

2. Gradation:

Sieve Size:	Percent Passing:
No. 4	100
No. 8	95 to 100
No. 16	60 to 100
No. 30	35 to 70
No. 50	15 to 35
No. 100	2 to 15
No. 200	0 to 2

I. Portland Cement Grout Aggregates: ASTM C 33, pea gravel uniformly graded from 3/8" to 1/2".

J. Water: Clean and free of deleterious amounts of acids, alkalies or organic matter.

K. Cleaning Agents:

1. Combination of surface acting acids and wetting agent for general purpose cleaning of new masonry surfaces.

2. Acceptable product: Sure-Klean No. 600 Detergent, Pro/So/Co., Inc.

2.2 MIXES

A. Mortar Proportions:

1. Nonload-bearing walls: ASTM C 270, Type N, 750 psi at 28 days, (1:1:6).

2. Load-bearing walls: ASTM C 270, Type S, 1800 psi at 28 days, (1:1/2:4-1/2).

B. Portland Cement Grout: Portland cement, sand, pea gravel and water proportioned to produce 2,500 psi at 28 days with 9-1/2" slump when placed.

C. Control batching procedure to ensure proper proportions by measuring materials by volume. Measurement by shovel will not be permitted.

D. Mix mortar in accordance with requirements of BIA M 1 and grout in accordance with ASTM C 476.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect foundation to assure surfaces to support masonry are to proper grade and elevation and free from dirt or other deleterious matter.

3.2 PREPARATION

A. Concrete Masonry Units:

1. Lay only dry units, free of paint, oil, efflorescence or foreign matter.

2. Remove laitance, loose aggregate or anything that prevents bonding to foundation.

B. Reinforcement: Before being placed, remove loose coatings from reinforcement.

C. Use masonry saws to cut masonry units.

3.3 INSTALLATION

A. Installation Tolerances:

1. Maximum Variation from Plumb:

a. Vertical lines and surfaces of columns and walls:

(1) 1/4" in 10'-0".

(2) 3/8" in 20'-0" maximum.

(3) 1/2" in maximum.

b. External corners or control joints:

(1) 1/4" in 20'-0"

(2) 1/2" in 40'-0" maximum.

2. Maximum Variation from Level or Grades for Exposed Lintels, Sill, Parapets or Horizontal Grooves:

a. 1/4" on any bay or 20'-0".

b. 1/2" in 40'-0".

3. Maximum Variation from Plan Location of Linear Building Line or Related Portions of Columns, Walls and Partitions:

a. 1/2" in any bay or 20'-0".

b. 3/4" in 40'-0".

4. Maximum Variation in Cross-Sectional Dimensions of Columns and Thickness of Walls: -1/4"; +1/2".

B. Pattern Bond: Running bond with vertical joints located at centerline of masonry units in alternate courses unless noted otherwise on architectural drawings.

C. General:

1. Set units plumb, true to lien and with level courses accurately spaced within allowable tolerances.

2. Do not install cracked, broken or chipped masonry units exceeding ASTM allowables.

3. Adjust masonry unit to final position while mortar is soft and plastic.

4. Where adjustment must be made or if units are displaced after mortar has stiffened, remove units, clean joints and units of mortar and relay with fresh mortar.

5. Do not pound corners and jambs to fit stretcher units after they are set in position.

6. Adjust shelf angles to keep masonry level and at proper elevation.

7. Provide pressure relieving joints by placing continuous 1/8" foam pad under shelf angle.

D. Mortar Beds:

1. Hollow units:

a. Lay with full mortar coverage on horizontal and vertical face shells.

b. Provide full mortar coverage on horizontal and vertical face shells and webs where adjacent to cells or cavities to be filled with grout.

E. Horizontal and Vertical Face Joints:

1. Construct uniform joints, 3/8" nominal thickness.

2. Shove vertical joints tight.

3. Tool concave joints in exposed surfaces when thumb-print hard with round joints slightly larger than width of joint.

4. Flush cut all joints not exposed.

5. Fill horizontal joints between top of non-load bearing masonry partitions and underside of beams or slabs with flexible material.

F. Control Joints:

1. Keep clean of mortar and debris.

2. Install where indicated and at following locations:

a. Changes in thickness, height and direction.

b. Within 8'-0" of corners or offsets.

c. At control or expansion joints in structure.

d. At each side of openings greater than 24" wide.

e. Place control joints at foundation walls, shelf angles, setbacks and materials expanding at different ratios.

3. Concrete masonry units:

a. Space joints at 30'-0" o.c. maximum in uninterrupted walls.

b. Provide continuous vertical control joints through bond beams except at

lintels above openings

c. Offset control joints to ends of lintels.

G. Collar Joints:

1. Keep cavity in cavity walls clean.

2. Remove all protruding mortar fins in cavity to be grouted.

H. Joining of Work:

1. When joining fresh masonry to set or partially set masonry construction, remove loose units and mortar and clean exposed surface of set masonry prior to laying fresh masonry.

2. If necessary to stop off horizontal run of masonry, rack back one-half block length in each course.

3. Do not use toothing to join new masonry to set or partially set masonry.

I. Reinforcing and Ties:

1. Bars:

a. Reinforce each jamb of wall openings with one bar vertical.

b. Place reinforcing bars in hollow cores vertically where indicated.

2. Horizontal joint reinforcing:

a. Fully embed joint truss type reinforcement in each alternate bed joint 16" o.c.

b. Extend joint reinforcement entire length of bed joint.

c. Place reinforcing in course immediately above opening extending at least 16" past each side of opening.

d. Lap reinforcement minimum 6" at ends.

e. Bend or weld at offsets or special conditions.

J. Bond Beams:

1. Provide CMU bond beams at top of CMU walls and lintels above openings.

2. Reinforce bond beams with minimum of two bars and grout.

3. Discontinue bond beams at expansion and control joints.

K. Flashing:

1. General:

a. Clean surface to receive flashing and remove projections which might puncture or damage flashing material.

b. Seal joints with manufacturer's recommended adhesive.

c. Seal top of flashing to ensure moisture cannot infiltrate behind flashing.

d. Continue flashing around corners. Ensure membrane material is not interrupted in horizontal plane at corners.

2. Wall base, opening sills and heads:

a. Place flashing on mortar bed and cover with mortar.

b. Start 1/2" from outside face of wall and turn up in cavity 8" minimum.

c. Lap joints 4" minimum.

d. Place flashing under and behind sills.

e. Place flashing over steel lintels.

f. Extend flashing beyond opening jamb lines.

L. Weep Holes:

1. Provide weep holes in head joints in first course immediately above flashing by either leaving head joint free and clean of mortar or placing and leaving sash cord or plastic weeps in joint.

2. 24" o.c. maximum spacing.

3. Keep weep holes and area above flashing free of mortar waste.

M. Built-In Work:

1. At completion of conventional masonry unit work, fill holes in joints and tool.

2. Cut out and re-point defective joints.

3. Dry brush masonry surface after mortar has set at end of each day's work and after final pointing.

3.4 CLEANING

A. Clean initially with stiff brushes and water. Remove efflorescence in accordance with manufacturer's recommendations.

B. When cleaning agent is required, apply cleaning agent to sample wall area of 20 sq. ft.

1. Do not proceed with cleaning until sample area is reviewed.

2. Scrub with acceptable cleaning agent and immediately rinse with clear water.

3. Do small sections at a time, working from top to bottom.

4. Protect sash, metal lintels and other corrosive parts when masonry is cleaned with acid solution.

C. Leave area and surfaces clean and free of mortar spots, drippings and broken masonry.

END OF SECTION

SECTION 04230
REINFORCED UNIT MASONRY

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.
B. Requirements of Section "Unit Masonry" apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of each type of reinforced unit masonry work is indicated on drawings and in schedules.

1.3 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.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. General: Refer to Section "Unit Masonry" for masonry materials and accessories not included in this section.
B. Reinforcement Bars: Provide deformed bars of following grades complying with ASTM A 615, Except as otherwise indicated.
C. Provide Grade 60 for bars No. 3 to No. 18, except as otherwise indicated.
D. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT:

A. General: Clean reinforcement of loose rust, mill scale, earth, ice, or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement 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).
C. 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.
D. 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 of attaching to dowels, lap ends, place in contact and wire tie.
E. Provide not less than minimum lap indicated, or if not indicated, as required by governing code.
F. 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.
G. 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 fire-proofing, pipe enclosures, and other special conditions.
H. Anchoring: Anchor reinforced masonry work to supporting structure they indicated.
I. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.2 INSTALLATION, GENERAL:

A. Refer to Section "Unit Masonry" for general installation requirements of unit masonry.
B. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
C. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any).
D. Brace, tie, and support as required to maintain position and shape during
E. Construction and curing of reinforced masonry.
F. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.
G. 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.

b. 7 days for slabs.
c. 7 days for reinforced masonry soffits.

3.3 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY:

A. General:
1. Do not wet concrete masonry units (CMU).
2. 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.

B. 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 dimension 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. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

C. Low-Lift Grouting:
1. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.
2. 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 or 10 ft.
3. Lay CMU to maximum pour height. Do not exceed 4' height, or if bond beam occurs below 4' height stop pour at course below bond beam.
4. 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.
5. Bond Beams: Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcement in bond beam; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

D. High-Lift Grouting:
1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 3" and 10 sq. in., respectively.
2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units
4. above, or use header units with concrete brick supports, or cut openings in one face shell.

E. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
F. Limit grout lifts to a maximum height of 4' and grout pour to a full height of wall, unless otherwise indicated.
G. Place vertical reinforcement before grouting. 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 or 10'.
H. 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 reinforcement bar, pull loops and bar to proper position and tie free ends.
I. Place horizontal beam reinforcement as the masonry units are laid.
J. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement 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.
K. Do not place grout until entire height of masonry to be grouted 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.
L. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.

M. 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 4'. 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.
N. Place grout in lintels or beams over openings in one continuous pour.
O. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.
P. 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 before grouting. Repeat sequence if more pours are required.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

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. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
B. Structural steel is that work defined in America Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.
D. Refer to Division 3 for anchor bolt installation in concrete; Division 4 for masonry.
E. Source Quality Control: 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.
F. Promptly remove and replace materials or fabricated components which do not comply.
G. Design of Members and Connections: 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. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.
B. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.
C. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of others sections.

1.4 QUALITY ASSURANCE

A. Code and Standards: Comply with provisions of following, except as otherwise indicated:
B. AISC "Code of Standard Practice for Steel Buildings and Bridges".
C. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings".
D. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
E. AISC "Specifications for Architecturally Exposed Structural Steel".
F. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
G. American Welding Society (AWS) D1. "Structural Welding Code - Steel".
H. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
I. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
J. Provide certification that welders to be employed in work have satisfactory passed AWS qualification tests.
K. If recertification of welders is required, retesting will be Contractor's responsibility.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to insure 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, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free or surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes.
B. Structural Steel Shapes, ASTM A572
C. Plates and Bars: ASTM A36.
D. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
E. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020, cold finished carbon steel; with dimensions complying with AISC Specifications.
F. Anchor Bolts: ASTM A 307, nonheaded type unless otherwise indicated.
G. Adhesive Anchors: Simpson “SET” Adhesive Anchor System
H. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
I. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.
J. Direct tension indicator washers may be used at Contractor's option.
K. Electrodes for Welding: Comply with AWS Code.
L. Structural Steel Primer Paint: GPA - 313.
M. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621.
N. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
   1. Euco N.S.; Euclid Chemical Co.
   2. Crystex; L & M Construction Chemicals
   3. Masterflow 713; Master Builders
   4. Five Star Grout; U.S. Grout Corp.
   5. Upcon; Upco Chem. Div., USM Corp.
   6. Propak; Protex Industries, Inc.
   7. Set Non-Shrink; Set Products, Inc.

2.2 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
C. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
D. Connections: Weld or bolt shop connections, as indicated.
E. Bold field connections, except where welded connections or other connections are indicated.
F. Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.
G. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.
H. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or ASTM A325 or A490 bolts” (RCRBSJ).
I. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
J. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
K. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
L. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.3 SHOP PAINTING

A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.

B. Do not paint surfaces which are to be welded.
C. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
D. Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
E. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods which result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 EXECUTION

3.1 ERECTION

A. Surveys. Employ a land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.
B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
C. Temporary Planking: “OSHA approved” temporary planking and working platforms as necessary to effectively complete work.
D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
E. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
F. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
G. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
H. Field Assembly: Set structural frames accurately to lines and elevation indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
I. Level and plumb individual members of structure within specified AISC tolerances.
J. Splice members only where indicated.
K. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
L. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
M. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
N. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
O. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
P. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.2 QUALITY CONTROL

A. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports. Contractor shall pay for such services from the testing allowance specified in Division 1.
B. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
C. Provide access for testing agency to places where structural work is being fabricated or produced so that required inspection and testing can be accomplished.
D. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

E. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

END OF SECTION

SECTION 05210 - STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Open-web K-series steel joists.
   2. Joist accessories.

B. Related Sections include the following:

   1. Division 4 Section "Unit Masonry Assemblies" for installing bearing plates in unit masonry.
   2. Division 5 Section "Metal Fabrications" for furnishing steel bearing plates.
   3. Division 9 Section "Painting" for prime painting.

C. Structural Performance: Provide special joists and connections capable of withstanding the design loads within limits and under conditions required by the Steel Joist Institute. Special loading requirements are indicated on the structural drawings.

D. Design joists to withstand design loads with total load deflections no greater than the following:
   1. Roof Joists: Vertical deflection of 1/360 of the span.

1.3 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.
   1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Mill certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.
   1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.

B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel.", and SJI exceptions

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.6 SEQUENCING

A. Deliver steel bearing plates and other devices to be built into concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for chord and web members.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

D. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements in FS TT-P-664.

2.3 OPEN-WEB K-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications 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; of joist type indicated.

1. Joist Type: K-series steel joists.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

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."

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.

2.4 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.
B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications."
   1. Furnish additional erection bridging if required.
C. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
D. Supply 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.
E. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING
A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2.
B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
C. Apply one shop coat of 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, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
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 recommendations, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
D. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.
E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL
A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections.

B. Field welds will be visually inspected according to AWS D1.1.

C. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as applicable:

1. Liquid Penetrant Inspection: ASTM E 165.

D. Bolted connections will be visually inspected.

E. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.

F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories**,** bearing plates and abutting structural steel.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2.
2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.

C. 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 05210

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Noncomposite vented form deck.

B. Related Sections include the following:
   1. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
   1. Mechanical fasteners.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck 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. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

C. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

1.5 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.

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. Steel Deck:

    a. Roof Deck, Inc.
    b. United Steel Deck, Inc.
    c. Verco Manufacturing Co.
    d. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: per plan.
3. Profile Depth: per plan.
4. Design Uncoated-Steel Thickness: per plan
5. Span condition: As indicated.
6. Side Laps: per plan.

2.3 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. 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.
E. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

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.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.
B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
C. Locate decking bundles to prevent overloading of supporting members.
D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF DECK INSTALLATION

A. 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, but not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 18 inches apart, maximum 12 inches apart in the field of the roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions of FM Loss Prevention Data Sheet 1-28.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling No. 12 diameter or larger carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. 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.

D. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.4 REPAIRS AND PROTECTION

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

END OF SECTION 05310

SECTION 05500
METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

B. Extent of metal fabrications is indicated on drawings.

C. Types of work in this section include metal fabrications for:

1. Rough hardware.
2. Loose steel lintels
3. Miscellaneous framing and supports.
4. Structural steel is specified in another section within Division 5.

1.3 SYSTEM PERFORMANCES

A. Structural Performances: Engineer and provide assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated:

1. Handrails and Toprails: Capable of withstanding the following loads applied as indicated when tested per ASTM E 935.
2. Concentrated loads of 250 lbs. applied at any point in any direction.
3. Uniform load of 50 lbs. per linear ft. applied simultaneously in both vertical and horizontal directions.
4. Concentrated and uniform loads above need not be assumed to act
5. concurrently.
6. Guards: Intermediate rails, capable of withstanding a uniform load of 25 lb. per sq. ft. of gross areas of guard, including any open areas, of which they are a part.

B. Above load need not be assumed to be acting concurrently with uniform horizontal loads on toprails of railing assembly in determining stress on guard supporting members.

1.4 QUALITY ASSURANCE

A. Shop Assembly: Preassemble items 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.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, anchor details, and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

C. Where materials or fabrications are indicated to comply with certain requirements for design loadings, include structural computations and letter certifying compliance.

PART 2 PRODUCTS

2.1 MATERIALS

A. Ferrous Metals:

1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
2. Steel Plates, Shapes, and Bars: ASTM A36.
3. Steel Tubing: Cold-formed, ASTM A500; or hot-rolled, ASTM A50.
4. Steel Pipe: ASTM A53; Type and grade (if applicable) as selected by fabricator and as required for design loading; galvanized; standard weight (schedule 40), unless otherwise indicated.
5. Brackets, Flanges, and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
6. Concrete Inserts; Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized, ASTM A 153.

B. Grout:

1. Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CE CRD-C621. Provide grout specifically recommended by manufacturer for interior and

exterior applications of type specified in this section.

C. Fasteners:
   1. As recommended by fabricator's engineer.
D. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, complying with the Military Specifications MIL-P-21035 (Ships) or SSPC-Paint-20.
E. Concrete Fill:
   1. Concrete Materials and Properties: Comply with requirements of Division-3 section "Concrete Work" for normal weight, ready-mix concrete.
F. Non-Slip Aggregate Finish: Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rust-proof and non-glazing; unaffected by freezing, moisture or cleaning materials.

2.2 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.
B. For Exposed Work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/8". Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grid exposed welds smooth and flush to match and blend with adjoining surfaces.
D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts.
E. Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
F. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
G. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized, as follows:
   1. ASTM A 123 for galvanized rolled, pressed and forged steel shapes, plates, bars, and strip 1/8" thick and heavier.
   2. ASTM A 386 for galvanizing assembled steel products.
H. Fabricate joints which will be exposed to weather in a manner to exclude water or provide week holes where water may accumulated.

2.3 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items as specified in Division-6 sections.
B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.4 LOOSE STEEL LINTELS

A. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit were indicated. Provide not less than 8" bearing at each side of openings, unless otherwise indicated.
B. Galvanize loose steel lintels to be installed in exterior walls.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.
B. Fabricate miscellaneous units to sizes, shapes, and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricated from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware and similar items.
C. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish insets if units must be installed after concrete is placed.

PART 3 EXECUTION

3.1 PREPARATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.
B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors,

which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

A. General:
   1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrication to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts wood screws, and other connectors as required.
   2. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation, of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plus, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in form work for items which are to be built into concrete masonry or similar construction.

B. Fit exposes connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposes joint, but cannot be shop welded because of shipping size limitations. Grind exposes joints smooth and touch-up shop paint coat. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication.

C. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

D. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUST AND CLEAN

A. For galvanize surfaces: Clean field welds, bolted connections and abraded areas and apply of galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 05 50 00
MISCELLANEOUS METAL WORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials, equipment, apparatus, tools, transportation, protection, and services necessary for Miscellaneous Metal Work indicated on the Drawings and specified herein.

B. Examination: Carefully examine the Drawings and Specifications and include all Miscellaneous Metal Work not distinctly specified in other sections, or noted on the Drawings as being provided by other Trades.

C. Miscellaneous Metal Products: No attempt is made to enumerate or describe each item of the Work, but simply to describe major items, certain special items, and general construction requirements for all items. Work includes, but is not necessarily limited to the following:

1. Anchors.

2. Anchor Bolts and Pipe Sleeves.

3. Lintels.

4. Miscellaneous Steel Frames and Curbs.

5. Steel Ladders - furnish and install.

D. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Concrete Reinforcing - Sections 03 200 and 03 30 00.

2. Reinforced Unit Masonry Assemblies - Section 04820.

3. Structural Steel (including Roof Opening Curb Steel) - Section 05120.

4. Steel Roof Deck - Section 05312.

5. Cold-Formed Metal Framing - Section 05 40 00.

6. Rough Carpentry - Section 06 10 00.

7. Roof and Wall Specialties and Accessories - Section 07 70 00.

8. Hollow Metal Doors and Frames - Section 08 11 13.

9. Door Hardware - Section 08 71 00.

10. Gypsum Wallboard - Section 09 29 00.

11. Acoustical Panel Ceilings - Section 09 51 13.

12. Paints and Coatings - Section 09 90 01.

E. Work Furnished but not installed:

1. Items anchored (not bolted) to Concrete and Masonry Work.

2. Items as specified herein for installation by others.

1.02 DESIGN REQUIREMENTS

A. Structural Performance of Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to comply with requirements for ASTM Standard E985 for structural performance, based on testing performed in accordance with ASTM Standards E894 and E935.

B. Accessibility Guidelines: Handrails required to be accessible to persons with disabilities shall comply with Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

1.03 QUALITY ASSURANCE

A. Reference Specifications: Except as otherwise specified herein, materials and workmanship shall conform to the following current specifications as amended to date.

1. All applicable Local Building Codes and Ordinances.

2. “Specifications for Structural Steel Buildings”, and “Commentary” thereon, as adopted by the American Institute of Steel Construction, Inc. (AISC), March 9, 2005.

3. American Welding Society (AWS), D1.1, Structural Welding Code - Steel.

4. "Standard Specifications for Open Web Steel Joists" as adopted by the Steel Joist Institute (SJI) and the American Institute of Steel Construction, Inc., (AISC).

1.04 CERTIFICATION OF WELDERS

A. Current and valid certification qualified by a recognized, Independent Laboratory shall be furnished to Architect for all welders working on fabrication and/or erection PRIOR to starting Work. All welding shall be performed by welders who have qualified by tests in accordance with AWS "Standard Qualification Procedure", to perform the type of Work required.

1.05 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. Shop Drawings:

1. Prepare completely detailed Shop Drawings showing all items to be provided, and submit reproducibles to the Architect for review.

2. Prepare completely detailed Shop Drawings showing details for cutting, fabricating, and connecting all pieces. Do not duplicate Design Drawings for use as Shop Drawings. Duplication of Design Drawings shall be grounds for rejection.

3. Where connections are not shown on the Drawings, connections shall be designed and detailed on the Shop Drawings, and sealed by a Registered Professional Structural Engineer in the State of the proposed Project, retained and paid by the steel fabricator.

4. Provide separate Shop Drawings for erection.

5. Prepare Shop Drawings in accordance with "AISC - Detailing for Structural Steel", latest edition, using a marking system compatible with, and referenced to, the marking system used on the Design Drawings.

6. Indicate welding by using AWS symbols, showing type, size and location of all welds. Provide auxiliary views of welds as required to clarify the welded connections.

7. Formally check all Shop Drawings before forwarding to Architect.

C. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

1.06 QUALITY CONTROL

A. Testing Agency Services: Contractor may engage at his expense, a separate testing agency for information and guidance, to ascertain that all new materials are furnished, fabricated and installed in accordance with all requirements of the Contract Documents. The testing agency shall send reports of all inspections to the Architect, Owner, and General Contractor.

1.07 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 Substitution

A. Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Steel Rolled Plates and Shapes: Fabricated from new open hearth structural steel conforming to ASTM A36 - Standard Specification for Carbon Structural Steel.

B. Steel Pipe: ASTM Standard A53, Type S, Grade A, Schedule 40, unless otherwise noted.

C. Steel Tubing: Cold rolled, electric resistance welded, carbon steel, hollow, structural steel tubing, fabricated from steel having properties complying with ASTM A500 - Standard Specification for Cold- Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

D. Hi-Tensile Bolts: Heavy hex type structural bolts conforming with ASTM Standard A325, with matching heavy hex type nuts, 3/4" minimum diameter, of lengths required for connections, with hardened steel washers.

E. Standard Bolts and Anchor Bolts: Unfinished bolts conforming to ASTM Standard A307, Grade A, with hexagon heads and nuts where exposed in the finish Work.

F. Expansion Bolts: Hilti® Kwik Bolt 3 Expansion Anchor as manufactured by Hilti, Inc., 5400 South 122nd. East Avenue, Tulsa, OK 74146, (866)445-8827, (800)879-8000 or (918)252-6000; www.us.hilti.com.

1. Comparable Products: Expansion bolts by the following manufacturer with comparable products of equivalent capacity may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review.

a. Power-StudÔ as manufactured by Powers Fasteners, Inc., 2 Powers Lane, Brewster, NY 10509, (800)524-3244 or (914)235-6300; www.powers.com.

G. Welding Electrodes: Series E-60 or E-70, AWS A5.1 or A5.5.

H. Galvanizing: Provide zinc coating where indicated on the Drawings. Galvanizing shall be in accordance with ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products and/or ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, not less than 1.25 oz./sq. ft.

I. Priming Paints: Provide one (1) of the following manufacturers and products, "lead and zinc chromate free" rust inhibiting priming paint, subject to review by the Architect. Substitutions will not be permitted.

1. Manufacturers:

a. ICI Paints, Devoe® High Performance Coatings, Strongsville, OH, (800)654-2616; www.devoecoatings.com.

b. PPG Architectural Finishes, 400 S. 13th Street, Louisville, KY 40203, (800)441-9695; www.ppghpc.com.

c. Tnemec, Inc., 6800 Corporate Drive, Kansas City, MO 64120, (800)863-6321; www.tnemec.com.

2. Ferrous Metal Paint Product:

   a. ICI Paints, Devoe® High Performance Coatings, DEVSHIELD™ 4130 Rust Penetrating Metal Primer, Light Gray.

   b. PPG Architectural Finishes, PPG High Performance Coatings™ (HPC), SPEEDHIDE® Int/Ext Rust Inhibitive Steel Primer 6-208 Red.

   c. Tnemec, Inc., Tnemec Primer Series 10, 99 Red.

3. Galvanized Steel Paint Product:

   a. ICI Paints, Devoe® High Performance Coatings, DEVGUARD™ 4160 Multi-Purpose Tank & Structural Primer, White.

   b. PPG Architectural Finishes, PPG High Performance Coatings™ (HPC), SPEEDHIDE® Int/Ext Galvanized Steel Primer 6-209, White.

   c. Tnemec, Inc., Hi-Build Epoxoline Series 66, White.

2.02 CONNECTIONS AND WORKMANSHIP

A. General: Weld all shop connections, bolt or weld all field connections unless otherwise noted or specified. Provide all clips, lugs, brackets, straps, plates, bolts, nuts, washers, required for complete fabrication and erection. Use connections of type and design required by forces to be resisted, and to provide secure fastening. Shop welded steel bolts shall be welded to sides and bottom of steel members, not at top of member.

B. Bolting: In bolting, draw-up bolts or nuts tight, and deform threads where possible. Use bolts of lengths required so that bolts do not project more than 1/4" beyond face of nut. Do not use washers unless specified.

C. Welding:

1. Perform all welding by the electric arc method, in accordance with the recommendations of the American Welding Society (AWS). Welds shall be solid and homogeneously a part of the metals joined, free from pits or incorporated slag or scale. Surfaces of weld shall be smooth and regular, and shall be of full area indicated or required to develop the required strength of the joint.

2. Only welders and welding operators who have been tested and certified in accordance with Appendix A, AWS D1.0, and the applicable provisions of AWS D1.0 will be permitted. All operators shall pass all applicable qualification tests

while in the current and continuous employment of the fabricator or erector regardless of previous qualifications and certifications.

3. Perform all shop and field welding by the shielded metal-electric arc process. Use qualified welders. Provide all necessary jigs and holding devices for shop welding. Dog or clamp down all Work to prevent distortion during welding.

4. Design weld details and procedures so as much shop Work as possible is performed in the flat and horizontal position. Avoid undercutting, insufficient throat or leg, lack of fusion and splattering. Prepare welding procedure specifications and diagrams for each weld joint, and use in the Work. Assign each joint a procedure designation number or code. Show the number or code in the tail or each welding symbol in the Shop Drawings. Qualify non-prequalified welds in accordance with Appendix A, AWS D1.0. Where a standard weld type is repeated throughout the Work, the procedure designation or code may be indicated by general note or reference on each Shop Drawing where that weld type appears.

5. Make fillet welds larger than 5/16" in not less than two (2) passes. After each pass, remove the slag coating entirely before starting next pass. Do not use fillet welds smaller than 1/4" unless the thickness of the connected material requires the use of 3/16" weld. Add approximately 3/4" to the theoretical length of all intermittent welds as an allowance for craters. Fill all craters.

6. Structural welds shall not be less than 3" in length unless otherwise approved on Shop Drawings.

7. Welds of all metal fabrications exposed in the finish Work shall be ground smooth, flush with adjacent surfaces, filleted at angular connections, and suitably prepared for final finish painting, unless otherwise specified.

D. Galvanized Steel Products: Field touch-up all damaged areas of galvanized coating, damaged during erection including field abrasions and welds, with zinc-rich galvanized coating repair paint according to ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. Provide nylon/polyester or natural bristle brush application of paint product in accordance with the manufacturer's recommendations and instructions. Surfaces shall be dry, free from oil, dirt, dust, mill scale or other contaminants to ensure adequate adhesion.

1. Galvanized Coating Repair Paint: Zinc Clad® VI Water Based Organic Zinc-Rich Epoxy (VOC content of less than 105 grams/liter), as manufactured by The Sherwin-Williams® Company, Cleveland, OH, (800)321-8194; www.sherwin-williams.com

2. Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

E. Holes for Connections of Work by Others: Provide all holes required for the connection of the Work of other Trades where noted on the Drawings, or determined prior to fabrication of the steel.

F. Finished Work: Any Work not presenting a finished appearance will be rejected. Furnish all members true to length so assembling may be done without fillers, except where required as detailed. Trim projecting edges or corners flush where different members are assembled. All items shall be free from twists, bends, and joints. Cope, block, and miter joints carefully and neatly. Clip projecting corners. Trim all filler pieces flush.

2.03 PAINTING (SHOP AND FIELD)

A. Miscellaneous (steel) metal shall be shop prime painted and field touched-up using paint specified herein.

B. Before shop painting, thoroughly clean all surfaces of all dirt, grease, scale and rust. All surfaces not in contact but inaccessible after assembling shall have two (2) coats before assembling. Surfaces in contact after assembling need have no paint. All finished pieces shall have one (1) coat before leaving the shop.

C. After erection, clean all foreign material off the steel, and if paint is removed, repaint to meet requirements of original prime coatings.

D. After all miscellaneous (steel) metal Work has been installed and accepted, touch-up all abraded surfaces, including field bolts and welded areas.

1. Volatile Organic Compounds (VOC) Content: Field touch-up paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

E. Furnish the General Contractor with copies of invoice for paint, and allow manufacturer’s representatives and General Contractor full access to the paint shop to inspect the paint.

2.04 ANCHORS

A. Provide anchors for miscellaneous iron members anchored into concrete or masonry. Fabricate anchors from strap iron, bent to shape, welded to backs of members, extended with bent end for building-in as conditions require, of sizes and spacing as noted. Where size and spacing are not noted, furnish 1-1/2" x 1/4" size anchors for concrete and 1-1/2" x 1/8" size anchors for masonry. Space masonry anchors properly to fit the pointing of the

adjacent masonry Work. Unless otherwise noted on the Drawings, space anchors 3'-0" or less on centers.

B. Where anchors and plates or clips are to be built-in for attachment of later Work, provide bolts in the plates or clips, welded to back, with threaded ends extended as required.

C. For attaching Work to masonry or concrete, where anchors or inserts cannot be built-in, provide approved type of cinch anchors and machine bolts or screws.

2.05 ANCHOR BOLTS AND PIPE SLEEVES

A. Furnish to Masonry Contractor for installation, miscellaneous anchor bolts and pipe sleeves as indicated and required, including all markings, setting diagrams, templates. Steel Contractor shall drill all holes required for anchor bolts and through-bolts detailed not to be built-in.

B. Furnish to Concrete Contractor for installation, pipe sleeves as indicated and required, including all markings, setting diagrams, and templates.

2.06 LINTELS

A. Furnish to the Masonry Contractor for setting, all steel lintels for masonry veneers, including those required for items such as grilles, doors, ducts, wall recesses and other locations shown or required.

B. Lintels shall be rolled structural shapes of sizes noted, selected for straightness and trueness of section. Camber shall not exceed 1/8" in 10'-0".

C. Unless otherwise shown, lintels shall have a bearing of not less than 8" each side of opening.

D. Galvanize all lintels in exterior walls.

2.07 MISCELLANEOUS STEEL FRAMES AND CURBS

A. General: Furnish steel frames and curbs in accordance with the Drawings and as specified herein, to Masonry or Concrete Contractor for setting.

B. Fabrication: Steel frames for door and other miscellaneous openings, and steel curbs throughout shall be built-up of rolled steel plate or structural sections as noted, with connections to adjoining Work, and anchors for building into masonry and/or concrete. All sections shall be selected for trueness of web and flange, straightened as required so that the finished frames are uniform, square and true throughout the length and depth of the assembled units and that curbs are straight and true.

C. Assembly: Frames shall be assembled by riveting or welding, but rivets may not be used on exposed surfaces. Built-up members of frames shall be connected by means of plug welding or continuous welding. Exposed edges of member shall be welded continuously. Frames and lintel members shall be welded together where so noted and shown. All exposed welding shall be ground smooth.

D. Door Frame Jambs in Concrete or Masonry: Provide 1-1/4" x 3/16" steel strap anchors on back, vertically adjusted, 2'-0" on centers maximum for building into concrete or masonry, and clip angle at bottom for bolting into concrete; and shall be fitted with temporary spreader bars at bottom to hold frame in shape during shipping and erection.

E. Steel Frames and Curbs in Concrete Work: Provide 1-1/2" x 1/4" steel strap anchors on back, extended for building-in, spaced not over 3 ft. on centers, but not less than two (2) per side.

2.08 STEEL LADDERS

A. General: Interior steel ladders shall be Occupational Safety and Health Administration (OSHA) approved ladders complete as detailed on Drawings. Fabricate steel ladders, as detailed with parallel side rails, of structural steel shapes indicated, and 3/4" diameter, solid, cold-rolled steel bar stock rungs spaced as shown on Drawings. Drill side rails for rungs, set rungs into rails, weld rungs solidly into rails, and grind rails smooth. Provide all steel plate brackets, washers, and fasteners, including steel angle braces, as required and detailed to install ladders in place securely.

2.09 MISCELLANEOUS

A. Anchoring Cements: Products specified herein shall be as manufactured by CGM, Incorporated, 1445 Ford Road, Bensalem, PA 19020, (800)523-6570, (215)638-4400; www.cgmbuildingproducts.com, or comparable equivalent products subject to review by the Architect.

1. Exterior Use - Anchoring Cement: Super Por-Rok® Exterior Anchoring Cement, quality controlled hydraulic cement, quick-setting, pourable, non-metallic, non-shrink grout, in accordance with the following ASTM International Standard Specifications.

a. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

b. ASTM C900 - Standard Test Method for Pullout Strength of Hardened Concrete.

2. Interior Use - Anchoring Cement: Por-Rok® Anchoring Cement, non-shrink, hydraulic controlled expansion cement.

3. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

B. Isolation Coatings: Paint products specified herein shall be as manufactured by The Sherwin Williams® Company, Cleveland, OH, (800)321-8194, (800)474-3794, or comparable manufacturer's equivalent products subject to review by the Architect.

1. Aluminum Contact with Steel: Wherever aluminum items are to be secured to, or in contact with steel supporting members, paint the contact surface of the steel with the following paint system for both the surfaces of the steel supporting members and the aluminum.

a. One (1) Prime Coat: Kem Kromik® Universal Metal Primer, B50WZ1 Off-White (VOC content of less than 420 grams/liter).

1) Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

b. One (1) Topcoat: TarGuard® Coal Tar Epoxy, B69B60 Black (VOC content of less than 250 grams/liter).

1) Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Aluminum Contact with Masonry or Concrete: Wherever aluminum items are to be secured to or in contact with masonry or concrete, shop paint the aluminum contact surface with the following paint product.

a. One (1) Topcoat: TarGuard® Coal Tar Epoxy, B69B60 Black (VOC content of less than 250 grams/liter).

1) Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

3. Brass or Bronze Contact With Steel: Wherever brass or bronze items are to be in contact with steel members, paint the contact surfaces of the steel with one (1) coat of TarGuard® Coal Tar Epoxy, B69B60 Black, (VOC content of less than 250 grams/liter).

a. Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

4. Condition of Painted Products: Paint coats shall be thoroughly dry prior to installation of the steel, aluminum, brass and/or bronze products. Exposed to view surfaces shall be clean and free of isolation coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 SETTING AND ERECTING MISCELLANEOUS METAL

A. Fabricate all items as required to be built into concrete or masonry completely, and deliver to site for installation by others. Furnish all parts complete with bolts, anchors, and clips, ready to set. Deliver items to the general location of the Work. Where Work is composed of several parts, only those parts, upon which anchors occur, will be set and built-in by the other Trades, ready to receive further field assembly by this Trade.

1. All Work required to be anchored entirely in concrete shall be set by the Concrete Contractor.

2. All Work required to be anchored entirely to masonry shall be set by the Mason Contractor.

3. All Work required to be anchored partially to masonry shall be set by the Mason Contractor.

B. Where necessary to secure Work to the structure by means of expansion bolts, cinch anchors, and similar connections, lay-out and install connections, install the Work and bolt up. Drill holes in Concrete and Masonry Work with rotary twist drills only.

C. Furnish, connect, and completely install all other items. Erect all items to proper lines and levels, plumb and true, and in correct relation to adjoining Work. Secure all parts in a rigid and substantial manner using concealed connections whenever practicable.

3.03 FIRE PREVENTION

A. Precautions: When welding or cutting with burning torches is required, take all precautions to prevent damage to the building(s) from fire, weld spatter, dripping molten metal, smoke and fumes, or other causes arising from the operations. Provide fireproof tarpaulins or enclosures around the areas of welding or burning.

B. Trained Personnel and Equipment: Furnish a worker trained and experienced in fire-fighting, whose sole duty shall be to prevent damage and fire at each location where welding or burning is to be done. Furnish adequate and sufficient fire-fighting equipment and extinguishers at each location.

3.04 FIELD FINISH PAINTING

A. Finish field painting of miscellaneous metal items as indicated on the Drawings and specified herein shall be by the Painting Contractor.

3.05 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials, equipment, and services necessary for Rough Carpentry Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Wood Nailers, Blocking, and Plywood - furnish and install.

2. Rough Hardware - furnish and install.

B. Related Sections: The following items of related Work will be performed under other sections of the Specifications:

1. Indoor Air Quality Requirements - Section 01 81 19. AIR BORNE PRODUCTS

2. Concrete Formwork and Cast-In-Place Concrete- Sections 03 10 0 and 03 30 00.

3. Unit Structural Masonry - Section 04 23 0.

4. Structural Steel - Section 05 12 00.

5. Metal Roof Deck - Section 05 31 0.

6. Cold-Formed Metal Framing - Section 05 40 00.

7. Board Insulation - Section 07 21 2.

8. Sheet Metal Work - Section 07 60 00.

9. Aluminum Framed Entrances and Storefronts- Section 08 41 13.

10. Gypsum Wallboard - Section 09 29 00.

11. Thin-Set Tile Work - Section 09 31 00.

12. Resilient Tile Flooring - Section 09 65 19

13. Paints and Coatings - Sections 09 90 00.

14. Toilet Compartments - Section 10 21 13.

15. Plumbing Fixtures - Division 22.

1.02 QUALITY ASSURANCE

A. Wood Treatment Plants: The treatment plant shall be franchised or licensed by the specified preservative and/or retardant manufacturers as specified herein.

B. Requirements of Regulatory Agencies:

1. Grades of Lumber and Plywood: Lumber and plywood shall be as defined by the rules of the recognized association of manufacturers producing the kind or species of lumber and plywood specified herein. All lumber and plywood shall be grade stamped by the inspecting authorities.

C. Environmental Requirements: Paint products shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC).

D. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.03 MEASUREMENTS

A. Field Measurements: Contractor shall obtain field measurements of adjoining Work as required to locate and fit the Work of this section. Contractor shall be responsible for the accurate fitting of materials together and to the building.

1.04 SUBMITTALS

A. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

C. Shop Drawings: Prepare complete Shop Drawings, showing dimensions, sections, details of materials, fabrication, and installation of materials and products. Special attention shall be given to, but not necessarily limited to the following:

D. Product Data: Include the following for review.

1. Wood Treatment Certificates for Lumber and Plywood.

2. Products specified herein under Article heading MISCELLANEOUS".

1.05 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Protection: Protect all materials from the weather during transit and during storage at the site. Store materials above the ground, in sheds if possible. If outdoor storage is required, house materials under waterproof coverings. Do not deliver materials to the job site until required for installation. Take all precautions to avoid absorption of moisture by wood and plywood.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 WOOD FOR ROUGH CARPENTRY

A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

B. Lumber: Wood shall conform to American Softwood Lumber Standard, current edition of "Voluntary Product Standard PS20", as published by the National Institute for Standards and Technology (NIST). Grades shall conform with current grading rules of the Lumber Manufacturers Association, under whose rules the lumber is manufactured.

C. Dimension and Board Lumber: Douglas Fir. All lumber shall be "seasoned dry" (S-DRY), 19% or less moisture content.

D. Lumber Grades:

1. Boards: Douglas Fir, S4S, Standard Grade or better.

E. Wood Treatments: All dimension lumber except wood blocking and nailers at roof, shall be fire retardant treated. Wood blocking and nailers at roof and in contact with masonry shall be preservative treated.

2.02 PLYWOOD

A. Standards, Thicknesses and Grades: Plywood shall be in accordance with the National Institute of Standards and Technology (NIST) current DOC VPS Standard PS 1-95, and the quality standards of the APA-The Engineered Wood Association (formerly American Plywood Association). Thicknesses shall be as indicated on the Drawings. Grades of plywood shall be as follows for various uses, as indicated by the registered grade-trademarks of APA:

1. Plywood Sheathing: C-D EXT-APA or APA Standard with exterior glue.

2. A-C Plywood: A-C EXT-APA.

3. A-D Plywood: A-D Exposure 1 (interior exposed, such as backboards for electrical and telephone panels).

4. B-C Plywood: B-C EXT-APA (water heater platforms).

5. C-D Plywood: C-D Plugged (interior concealed).

B. Engineered Wood Products: Products shall contain no urea formaldehyde.

C. Fire Retardant Treatment: All plywood and plywood sheathing shall receive “Fire Retardant Treatment” as specified herein.

2.03 WOOD TREATMENTS

A. Manufacturer: Wood treatments required and as specified herein shall be products Equal to: Arch Wood Protection, Inc., Arch Treatment Technologies, Inc., 5660 New Northside Drive, Suite 1100, Atlanta, GA 30328, (678)627-2000; www.archchemicals.com. Manufacturers with equivalent products and treatments shall be subject to review by the Architect.

B. Wood Preservative Treatment: All wood nailers at roof parapets, and/or in contact with masonry, and elsewhere as indicated on the Drawings, shall be pressure impregnated in accordance with the specifications for treatment by Arch Wood Protection, Inc., with Wolman® CCA (Chromated Copper Arsenate) wood preservative and shall bear the Wolmanized® trademark. Treated wood shall conform to AWPA Standard P5, and have a mark certifying conformance. The treating process shall meet requirements of Fed. Spec. TT-W-571 and AWPA Commodity Standards as applicable.

C. Fire Retardant Treatment: Fire retardant treat all wood lumber, plywood and plywood sheathing by pressure treating with Dricon® fire retardant chemicals, by Arch Wood Protection, Inc. Kiln dry all pieces after treatment. Identify all treated pieces with an Underwriters Laboratories, Inc., label or marking, prior to shipment to site. Treatment shall be in accordance with the impregnating salt manufacturer's U.L. approved, specifications, and shall render the wood fire retardant to the extent that
the flame spread does not exceed 25 per ASTM Standard E84 modified to require a 30 minute test period. The treating process shall conform to the requirements of the applicable AWPA Standard C1, C2, C3, C4, C9, C14, C15, C16, C22, C23, C24, C28, C31, C33 and M4, for the species, product, preservative and end use. Preservatives shall conform to AWPA P1/P13, P2, P5, P8 and P9. Include certification by treatment plant that the treatment will not bleed through finished surfaces.

D. Certification: Submit certificates of wood treatments. Stamp or brand lumber before delivery, indicating treatment applied.

E. Exposed Wood/Field-Cuts: Surfaces of treated wood exposed by cutting or drilling at the job site shall be treated with heavy brush coat of same preservative or fire-retardant treatment used in treatment.

1. Volatile Organic Compounds (VOC) Content: Field applied preservative and fire-retardant product specified herein shall have a VOC content of 350 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2.04 ROUGH HARDWARE

A. General: Furnish all items of rough hardware such as spikes, nails, screws, bolts, anchors, brackets, etc., necessary for the installation of this Work.

B. Bolts, Nuts, and Expansion Shields: Use galvanized steel bolts for all bolting Work. Use carriage bolts and nuts, or welded stud bolts and nuts for securing wood members to steel framing. Use metallic expansion shields for securing bolts to concrete. Use similar shields or toggle bolts for securing to masonry. Select length of bolts to suit thickness of material being joined.

C. Nails: Use nails conforming with Federal Spec. FF-N-105a, except as otherwise specified. Use galvanized steel nails for all Work. Zinc coating on galvanized nails shall conform with Article 3.2.1 of the Fed. Spec. Do not use aluminum nails. Except as otherwise specified, use common nails for securing of rough carpentry, use casing or finish nails, counter-set, for securing of finish carpentry.

D. Corrosion Rates: Rough hardware in contact with fire retardant treated wood shall exhibit corrosion rates less than one mil per year when tested in accordance with Fed. Spec. MIL-L-19140E, Paragraph 4.6.5.2.

2.05 MISCELLANEOUS

A. Isolation Coatings: Paint product specified herein shall be as manufactured by The Sherwin Williams® Company, McAllen, TX, or comparable manufacturer's products subject to review by the Architect.

1. Paint Product: TarGuard™ Coal Tar Epoxy, B69B60 Black.

2. Condition of Painted Products: Paint coats shall be thoroughly dry prior to installation of the steel/metal products. Exposed to view surfaces shall be clean and free of isolation coatings.

3. Volatile Organic Compounds (VOC) Content: Field applied preservative and fire-retardant product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 - Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 ROUGH CARPENTRY

A. Wood Nailers, and Blocking:

1. Neatly and accurately fit together with all necessary bolts and spikes, all wood where indicated on Drawings, such as blocking, nailers, as required to make secure.

2. Where wood blocking is required in metal stud framed walls, e.g., for support of Tenant's or Owner's fixturing, securely fasten the wood blocking to the metal stud framing at positions required, as detailed and/or noted on the Drawings. Coordinate Work with Tenant's or Owner's Representative.

3. Where wood members are to be secured to masonry, secure with 1/2" bolts with 3" hooked ends, not less that two (2) to each block, continuous nailers shall be spaced approximately 32" O.C. Bore lumber for bolts and countersink for heads. Provide washers under all bolt heads and nuts. All nailers and cants shall be furnished in long lengths to minimize number of end joints. When joints are required, they shall be made without projecting edges.

4. Miscellaneous wood items which are built into concrete or masonry shall be delivered to the respective contractors for installation.

5. Metal roof deck flutes shall be provided with wood blocking where and as indicated on the Drawings.

B. Rough Hardware: Install all items of rough hardware as necessary for the execution of the Work.

C. Preservative Treated Wood: Install wood treated with approved preservative for wood nailers at roof parapets, and in contact with masonry. Surfaces of treated wood exposed by cutting or drilling at the job site shall be treated with heavy brush coat of same preservative as applied at the treatment plant.

D. Fire Retardant Treated Wood: Install wood that has been fire retardant treated, and in all wood blocking.

E. Plywood: Install plywood, including plywood sheathing, of thickness noted and where indicated on Drawings. All Work and nailing shall be in accordance with the recommendations of APA-The Engineered Wood Association, and with the governing code requirements.

3.03 CLEAN-UP

A. Work Required: Clean-up or repair adjacent finish Work which is soiled, marred, or damaged by the Work of this section, at Contractor's expense.

B. Debris and Waste Materials: During progress of the Work, the premises shall be kept free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site and dispose of legally. Upon completion and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

END OF SECTION

SECTION 06 11 40
WOOD BLOCKING AND CURBING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes roof curbs, and perimeter nailers; blocking in roof openings; telephone and electrical panel back boards; and preservative treatment of wood.

B. Related Sections:

1. Section 05312: Metal roof decking to receive wood curbs.

1.2 REFERENCES

A. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.

B. APA/EWA (APA/Engineered Wood Association) - Certification.

C. AWPA (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.

D. SPIB (Southern Pine Inspection Bureau) - Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and provide application instructions where required.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:
1. Lumber Grading Agency: Certified by ALSC.
2. Plywood Grading Agency: Certified by APA/EWA.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: SPIB.

B. Miscellaneous Framing: Stress Group D, No. 2 or better grade 19 percent maximum moisture content after treatment, pressure preservative treat.

C. Plywood: APA/EWA Rated Sheathing, Grade C-D; Exposure Durability 1; unsanded.

2.2 ACCESSORIES

A. Fasteners and Anchors:
1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

2.3 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA Treatment C1 using water borne preservative with 0.25 percent retainage.

PART 3 EXECUTION

3.1 FRAMING

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. Space framing and furring 16 inches oc.

E. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

F. Coordinate curb installation with installation of decking and support of deck openings.

3.2 SHEATHING

A. Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board by 12 inches beyond size of electrical and telephone panel.

3.3 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment.

B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.4 SCHEDULES

A. Roof Blocking: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.

B. Telephone and Electrical Panel Boards: ¾ inch thick, square edges, site brush applied preservative treated.

C. Storefront Blocking and shim: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.

END OF SECTION

SECTION 06 16 43
GYPSUM SHEATHING

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications

PART1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture and mold-resistant gypsum sheathing.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Section 05 40 00 Cold-Formed Metal Framing.

2. Section 06 10 00 Rough Carpentry.

3. Section 09 21 16 Gypsum Board Assemblies.

1.02 REFERENCES

A. ASTM International (ASTM):

1. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products.

2. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

3. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

4. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

5. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.

6. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

7. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.

8. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.

B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

1.03 QUALITY ASSURANCE

A. Environmental Requirements: Paint products shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC).

B. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.04 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each product specified.

1.05 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay).

B. Manufacturer's Warranty:

1. Five years against manufacturing defects.

2. Ten years against manufacturing defects when used as a substrate in architecturally specified EIFS.

1.06 MATERIAL DELIVERY, STORAGE & HANDLING

A. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

PART2 PRODUCTS

2.01 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC:

1. Fiberglass-Mat-Faced Gypsum Sheathing, Type X for Fire-Rated Designs: DensGlass Fireguard Sheathing.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X:

1. Thickness: 5/8 inch.

2. Width: 4 feet.

3. Length: [8 feet] [9 feet] [10 feet].

4. Weight: 2.5 lb/sq. ft.

5. Edges: Square.

6. Surfacing: Fiberglass mat on face, back, and long edges.

7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 pounds per square foot, dry.

8. Flexural Strength, Parallel (ASTM C1177): 100 lbf, parallel.

9. Humidified Deflection (ASTM C1177): Not more than 1/8 inch.

10. Permeance (ASTM E96): Not more than 17 perms.

11. R-Value (ASTM C518): 0.67.

12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.

13. Microbial Resistance (ASTM D6329, GREENGUARD 3-week protocol): Will not support microbial growth.

14. Acceptable Products:

a. 5/8 inch DensGlass Fireguard Sheathing, Georgia-Pacific Gypsum.

2.03 ACCESSORIES

A. Screws: ASTM C1002, corrosion resistant treated.

PART3 EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

C. Verification of Conditions:

1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

3.02 INSTALLATION

A. General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.

1. Manufacturer's Recommendations:

a. Current "Product Catalog", Georgia-Pacific Gypsum.

3.03 PROTECTION

A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

3.04 CLEAN-UP

A. Waste Management: Collect field-generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials, equipment, and services necessary for Carpentry Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Counter Supports - furnish and install.

2. Hollow Metal Door and Frames - install.

3. Finish Hardware - install.

4. TV Wall Mount Bracket - install.

B. Color Selections: Refer to Color Legend on Drawings.

C. Door Schedule and Colors: Refer to the Drawings.

D. Related Sections: The following items of related Work will be performed under other sections of the Specifications:

1. Unit Structural Masonry - Section 04 23 0.

2. Rough Carpentry - Section 06 10 00.

3. Hollow Metal Doors and Frames - Section 08 11 13.

4. Aluminum Storefronts - Section 08 41 10.

5. Door Hardware - Section 08 71 00.

6. Gypsum Wallboard - Section 09 29 00.

7. Thin-set Tile Work - Section 09 31 00.

8. Paints and Coatings - Section 09 90 00.

9. Toilet Compartments - Section 10 21 13.

10. Signage - Section 10 14 00.

11. Toilet Accessories - Section 10 28 13.

12. Fire Protection Specialties - Section 10 44 00.

13. Plastic Laminate - Clad Countertops - Section 12 36 23.13.

14. Plumbing Fixtures - Division 22.

1.02 QUALITY ASSURANCE

A. Wood Treatment Plants: The treatment plant shall be franchised or licensed by the specified preservative and/or retardant manufacturers as specified herein.

B. Requirements of Regulatory Agencies:

1. Grades of Lumber and Plywood: Lumber and plywood shall be as defined by the rules of the recognized association of manufacturers producing the kind or species of lumber and plywood specified herein. All lumber and plywood shall be grade stamped by the inspecting authorities.

1.03 MEASUREMENTS

A. Field Measurements: Contractor shall obtain field measurements of adjoining Work as required to locate and fit the Work of this section. Contractor shall be responsible for the accurate fitting of materials together and to the building.

1.04 SUBMITTALS

A. Shop Drawings: Prepare complete Shop Drawings, showing dimensions, sections, details of materials, fabrication, and installation of materials and products. Special attention shall be given to, but not necessarily limited to the following:

1. Counter Supports.

B. Product Data: Include the following for review.

1. Wood Treatment Certificates for Lumber and Plywood.

2. Products specified herein under Article heading “MISCELLANEOUS”.

1.05 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Protection: Protect all materials from the weather during transit and during storage at the site. Store materials above the ground, in sheds if possible. If outdoor storage is required, house materials under waterproof coverings. Do not deliver materials to the job site until required for installation. Take all precautions to avoid absorption of moisture by wood and plywood.

B. Finish Hardware: The Finish Hardware Contractor will furnish all finish hardware not included in other trades, and deliver to Carpenter for storage and installation. Carpentry Contractor shall be responsible for safekeeping, furnishing templates to proper contractors, proper installation, receiving shipments and delivery of keys for hardware.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 WOOD FOR FINISH CARPENTRY

A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

B. Lumber Grades: All lumber shall conform to, and be graded in accordance with American Lumber Standard PS-20.

1. Grading Authority Stamp: All lumber shall bear stamp of grading authority indicating compliance with specified species, grade and moisture content. Finish lumber shall be stamped on back or end where not exposed to view.

2. Dimension and Board Lumber: Douglas Fir or Pine. Maximum allowable moisture content shall be 12%.

a. Appearance Framing: 2" to 4" thick, 2" and wider shall be Douglas Fir, S4S, No. 1/Appearance.
b. Boards: 1" thick, 2" and wider shall be Douglas Fir or Pine, S4S, Superior or better.

C. Millwork and Trim: “Custom Grade” as defined in the Architectural Woodwork Quality Standards Guide Specifications, and Quality Certification Standards of the Architectural Woodwork Institute (AWI).

D. Wood Species: Unless otherwise noted on the Drawings, wood specie shall be as follows (Provide sample for approval):

1. Paint Grade Trim: Natural Birch or Poplar.

2. Stain Grade Trim: Red Oak.

3. Hardwood: Natural Birch or Poplar.

E. Engineered Wood Products: Products shall contain no urea formaldehyde.

2.02 WOOD TREATMENTS

A. Manufacturer: Wood treatments required and as specified herein shall be products Equal to: Arch Wood Protection, Inc., 1955 Lake Park Drive, Suite 100, Smyrna, GA 30080, (770) 801-6600 or (866) 873-3789. Manufacturers with equivalent products and treatments shall be subject to review by the Architect.

B. Wood Preservative Treatment: All wood nailers at roof parapets, and/or in contact with masonry, and elsewhere as indicated on the Drawings, shall be pressure impregnated in accordance with the specifications for treatment by Arch Wood Protection, Inc., with Wolman® CCA (Chromated Copper Arsenate) wood preservative and shall bear the Wolmanized® trademark. Treated wood shall conform to AWPA Standard P5, and have a mark certifying conformance. The treating process shall meet requirements of Fed. Spec. TT-W-571 and AWPA Commodity Standards as applicable.

C. Fire Retardant Treatment: Fire retardant treat all wood framing, plywood and plywood sheathing by pressure treating with Dricon® fire retardant chemicals, by Arch Wood Protection, Inc. Kiln dry all pieces after treatment. Identify all treated pieces with an Underwriters Laboratories, Inc., label or marking, prior to shipment to site. Treatment shall be in accordance with the impregnating salt manufacturer’s U.L. approved, specifications, and shall render the wood fire retardant to the extent that the flame spread does not exceed 25 per ASTM Standard E84 modified to require a 30 minute test period. The treating process shall conform to the requirements of the applicable AWPA Standard C1, C2, C3, C4, C9, C14, C15, C16, C22, C23, C24, C28, C31, C33 and M4, for the species, product, preservative and end use. Preservatives shall conform to AWPA P1/P13, P2, P5, P8 and P9. Include certification by treatment plant that the treatment will not bleed through finished surfaces.

D. Certification: Submit certificates of wood treatments. Stamp or brand lumber before delivery, indicating treatment applied.

E. Exposed Wood/ Field-Cuts: Surfaces of treated wood exposed by cutting or drilling at the job site shall be treated with heavy brush coat of same preservative or fire-retardant treatment used in treatment.

2.03 ROUGH HARDWARE

A. General: Furnish all items of rough hardware such as spikes, nails, screws, bolts, anchors, brackets, etc., necessary for the installation of this Work.

B. Bolts, Nuts, and Expansion Shields: Use galvanized steel bolts for all bolting Work. Use carriage bolts and nuts, or welded stud bolts and nuts for securing wood members to steel framing. Use metallic expansion shields for securing bolts to concrete. Use similar shields or toggle bolts for securing to masonry. Select length of bolts to suit thickness of material being joined.

C. Nails: Use galvanized steel nails for all Work. Do not use aluminum nails. Except as otherwise specified, use common nails for securing of rough carpentry, use casing or finish nails, counter-set, for securing of finish carpentry.

D. Corrosion Rates: Rough hardware in contact with fire retardant treated wood shall exhibit corrosion rates less than one mil per year when tested.

2.04 MISCELLANEOUS

A. General: Miscellaneous materials specified herein represent products from the McMaster-Carr Supply Company, P.O. Box 94930, Cleveland, OH 44101-4930, (330)995-5500, and illustrate the type, material, quality, required. Comparable products may be acceptable, subject to the Architect's review.

1. Fastening Hardware: Provide materials such as screws, bolts, nuts, washers, nails, anchors, and miscellaneous other fastening products as required by the Drawings and/or field conditions.

B. Counter Supports:

1. Support bracket to be fully recessed 2" x 2" x 0.25" aluminum "T" extrusion, 12" x 14", as manufactured Equal to: Rangine Corp., 330 Reservoir Street, Needham, MA 02494, (800)826-6006, www.rakks.com.

2. Support angle to be 1-1/4" x 1-1/4" x 3/16" aluminum angle as supplied Equal to: McMaster-Carr Supply Co., P.O. Box 94930, Cleveland, OH 44101, (330)995-5500, www.mcmaster.com.

C. TV Wall Mount Bracket: Provide TV Mounting Bracket Anchor Kit, Part PAC-115, as recommended by Bracket Manufacturer. Bracket Manufacturer is Equal to: Chief Manufacturing. Anchor kit can be purchased online through www.Amazon.com or www.Clubmac.com.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 FINISH CARPENTRY WORK

A. General:

1. All Finish Carpentry Work shall be executed by skilled mechanics in a workmanlike manner. All joints shall be neatly and accurately made, closely fitted and assembled to remain tight and conceal any shrinkage.

2. All wood shall be well sanded to perfectly smooth surfaces, touched-up by hand and made suitable to receive paint or stain finish Work by Painting Contractor.

3. Protect all wood finishes from damage due to traffic or other construction Work, by covering with building paper and boards. Protection shall be particularly required for the jambs of openings through which material is being transported.

B. Finish Hardware: All finish hardware for wood doors and for hollow metal doors will be furnished by the Finish Hardware Contractor to Carpentry Contractor for installation. Prepare all doors to receive the hardware. Install and adjust all hardware properly, in accordance with the manufacturer's instructions. Attach and secure the hardware so that no parts are damaged or injured. Install weather stripping, door sweeps, and overhead rain drip at exterior doors.

C. Architectural Millwork: Install at locations indicated on the Drawings, all wood products as specified herein.

D. Corner Guards:

1. Project Conditions and Temperature: Materials must be acclimated in an enclosed environment of 65°-75°F for at least 24 hours prior to beginning the installation. Temperature at the time of installation must be between 65°-75°F and be maintained for at least 48 hours after the installation.

2. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

3. Surface Preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.

4. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

5. Installation: Install and clean corner guards in strict accordance with the manufacturer's installation and cleaning method recommendations. Use only contact cement recommended by manufacturer, and locate all components firmly into position, level and plumb.

3.03 CLEAN-UP

A. Work Required: Clean-up or repair adjacent finish Work which is soiled, marred, or damaged by the Work of this section, at Contractor's expense.

B. Debris and Waste Materials: During progress of the Work, the premises shall be kept free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site and dispose of legally. Upon completion and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

END OF SECTION

SECTION 06 83 00
COMPOSITE PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Paneling materials to create sculptured wall surface.
   1. Soelberg Industries, Texture, Muto Acuto pattern.

1.2 REFERENCES

A. Abbreviations and Acronyms:
   1. ANSI: American National Standards Institute
   2. ASTM: American Society for Testing and Materials
   3. CPA: Composite Panel Association
   4. LEED: Leadership in Energy and Environmental Design
   5. MDF: Medium Density Fiberboard
   6. USGBC: US Green Building Council
   7. SFI: Sustainable Forestry Initiative

1.3 Submittals

A. General: Submit the following in accordance with conditions of contract and Division 1 specifications section 01 33 00 “Submittal Procedures”.

B. Product data and detailed specifications for each system component and installation accessory required, including installation methods.

C. Shop drawings showing locations, seam locations, pattern orientation, installation method, corner conditions and installation details of panel products.

D. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern and thickness:

E. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.

F. Maintenance data for wall system components for inclusion in the operating and maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an installer who has no less than 3 years experience in installation of panels similar in complexity to those required for this project.

B. Product quality standard. Quality grade to be premium.

C. Code compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA, and Life Safety.

D. Fire performance characteristics: Provided wall panel fabricated from fire rated materials tested in accordance with ASRM-E84 (CAN/ULC S 102.2) for Class 1 characteristics listed below:
   1. Flame spread 25 or less
   2. Smoke developed: 150

1.5 DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery, contractor must open crate and inspect goods prior to signing the bill of lading. This must occur regardless of any visible signs of external damage to the crating material. Freight Damage is not responsibility of Seolberg Industries. If Damage is found, contractor is signing for damaged freight. It is the responsibility of the contractor to file any and all freight claims resulting from this process. Soelberg Industries has no liability after the goods are shipped from Seller's address. Store materials in original, undamaged packaging in a clean, dry place out of direct sunlight and exposure to the elements. A room temperature of 40-100°F (38°C) should be maintained.

B. Materials must be stored flat.

1.6 PROJECT CONDITIONS

A. HVAC: Operate HVAC system to maintain occupancy level temperature and relative humidity conditions (25-55 percent) in the area of installation from 48 hours prior to delivery of panels to the installation area through remainder of construction period.

B. Materials must be acclimated in a n environment of 65-75°F (18-24°C) with maintained relative humidity levels of 25-55% for at least 48 hours prior to beginning the installation.

C. Lighting: Permanent project lighting, including any special lighting used to highlight the panels, must be operational during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Interior wall panel product specified shall be manufactured by:
Soelberg Industries
248 South Mountain Way Drive
Orem, UT 84058 (801) 434 9450

www.soelbergi.com/textur3d

2.2 MATERIALS
A. Wall Panels to be pattern MUTO Acuto refer to drawings for length and width. Thickness ½".
B. Core Material Firerated MDF

2.3 INSTALLATION COMPONENTS: VERTICAL
A. Zclip
B. Construction Adhesive
C. Stand Off's
D. Other

2.4 FABRICATION

A. General: Fabricate wall panels to comply with requirements indicated for design, dimensions, detail, finish and sizes. All based upon required field verified dimensions.

2.5 FINISHES

A. COLOR: GRAPHITE

B. COLOR: MIDNIGHT

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

B. Verify that permanent project lighting is in place and operational prior to start of install.

C. Coordinate with responsibly entity to correct unsatisfactory conditions.

D. Commencement of work by installer is acceptance of conditions.

3.2 PREPARATION

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles.

B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacture's installation instructions. Store flat and in HVAC controlled area at all times.

3.3 INSTALLATION

A. Install in accordance with the Manufacturer's recommendations and the required field verified dimensions.

3.4 CLEANING

A. General: Immediately upon completion of installation, clean wall panels and accessories in accordance with manufacturer's recommended cleaning method.

3.5 PROTECTION

A. Protect installed materials to prevent damage during remainder of construction period. Store flat and in HVAC controlled area at all times.

END OF SECTION

SECTION 07191
VAPOR RETARDANT

1.1 SCOPE

A. The Conditions of The Contract (Division 0), and General Requirements (Division 1), are applicable to and a part of this Section.

B. Related Work Specified Elsewhere:

1. Termite Treatment: Section 02281.

1.2 DESCRIPTION

A. Vapor Barrier (Under Slab): Shall conform to ASTM E1745, Class C or better and shall have a minimum water vapor permeance of .044 perms when tested in accordance with ASTM E96. Vapor barrier shall be no less than 15 mils thick.

PART 2: PRODUCTS

2.1 APPROVED PRODUCTS

A. Stego Wrap (15 mil).by Stego Industies LLC. (887) 464-7834.

B. Griffolyn T-65 by Reef Industries (800) 231-6074.

C. Rufco D16WB by Raven Ind. At Texas Environmental Plastic:
(281) 821-7320.

PART 3: EXECUTION

3.1 INSTALLATION

A. Lay sheets smoothly, stretch and weight edges, lap joints twelve (12) inches and seal with tape as specified by vapor barrier manufacturer. Turn barrier up six 6 inches at walls and at all pipes, abutments, etc. Tape and seal at penetrations and at edges.

B. At grade beams, extend vapor barrier down sides of beam trenches (and footing excavations).

3.2 PATCHING:

A. Patch all punctures with a minimum overlap of 6” in all directions and tape around entire perimeter of repair.

END OF SECTION

SECTION 07 19 10
VAPOR BARRIER

1.1 SCOPE

A. The Conditions of The Contract (Division 0), and General Requirements (Division 1), are applicable to and a part of this Section.
B. Related Work Specified Elsewhere:

1. Termite Control: Section 02 28 20.

1.2 DESCRIPTION

A. Vapor Barrier (Under Slab): Shall conform to ASTM E1745, Class C or better and shall have a minimum water vapor permeance of .044 perms when tested in accordance with ASTM E96. Vapor barrier shall be no less than 8 mils thick.

PART 2: PRODUCTS

2.1 APPROVED PRODUCTS
Griffolyn T-65 by Reef Industries (800) 231-6074.

PART 3: EXECUTION

3.1 INSTALLATION

A. Lay sheets smoothly, stretch and weight edges, lap joints twelve (12) inches and seal with tape as specified by vapor barrier manufacturer. Turn barrier up six 6 inches at walls and at all pipes, abutments, etc. Tape and seal at penetrations and at edges.

B. At grade beams, extend vapor barrier down sides of beam trenches (and footing excavations) to within 4” of trench bottom and secure to sides of trench. Do not extend barrier across bottom of beam trench.

3.2 PATCHING**:**

A. Patch all punctures with a minimum overlap of 6” in all directions and tape around entire perimeter of repair.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, and services necessary for Insulation Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Furnish and Install:

a. Blanket/Batt Insulation.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Concrete Work - Section 03 30 00.

2. Masonry - Section 04 20 00.

3. Steel Roof Decking - Section 05 31 23.

4. Cold-Formed Metal Framing - Section 05 40 00.

5. Rough Carpentry - Section 06 10 00.

6. Sheet Metal Work - Section 07 60 00.

7. Joint Protection - Section 07 90 00.

8. Aluminum Window Framing - Section 08 41 00.

9. Gypsum Sheathing Panels and Gypsum Wallboard - Section 09 29 00.

1.02 QUALITY ASSURANCE

A. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.03 SUBMITTALS

A. Product Data: Submit three (3) sets of manufacturer's Product Data for each type of insulation specified herein.

1.04 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Store materials at the site off the ground and in properly protected dry storage facilities, until ready for use. Provide a tarpaulin covering over the materials, securely tied down. Wet, damp, or damaged materials shall not be used.

C. Waste Management: Collect field generated construction waste created during construction or final.

1.05 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and ladders in accordance with applicable code requirements. Erect at times and locations so as not to delay any part of the Work, and promptly remove when no longer required.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 BLANKET/BATT INSULATION

A. Manufacturer: Insulation specified herein shall be as manufactured by Thermafiber, Inc., 3711 Mill Street, Wabash, IN 46992, (888)834-2371 or (260)563-2111; www.thermafiber.com.

1. Insulation: Commercial quality, inorganic and noncombustible Thermafiber® Fire Safety Blankets, open-faced with vapor barrier (foil-faced vapor retarder), unless otherwise noted on the Drawings, flame-resistant, mineral wool fiber insulation.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

C. Blanket/Batt Widths: Provide as required by framing member spacings indicated on Drawings.

D. Surface Burning Characteristics: Class A fire hazard classification in accordance with ASTM Standard E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1. With Vapor Barrier: Thermafiber® FS-25 (with foil-faced vapor retarder attached), Type III, Flame Spread maximum 25, and Smoke Developed 0.

2. Without Vapor Barrier: Thermafiber® FS-15 (unfaced), Type I, Flame Spread 0, and Smoke Developed 0.

E. Vapor Retarder Facing: Foil-scrim (FSP) laminate vapor retarder shall be applied with a flameresistant adhesive. Class A flame-spread rating. Vapor retarder facing, shall have 0.02 perm rating, or better, when tested in accordance with ASTM Standard E96, Procedure A.

F. Type and Quality: Rated non-combustible as defined by National Fire Protection Association NFPA Standard 220, when tested in accordance with ASTM Standard E136. Insulation shall be nonasbestos, moisture-resistant, noncorrosive, nondeteriorating, mildew-proof and vermin-proof.

G. Thermal Resistance Values: Provide not less than R19 as unless otherwise indicated on Drawings. Thicknesses shall be as determined by manufacturer for “R” value specified. More than one layer of insulation may be used to achieve the specified “R” value.

H. Vapor Retarder Tape: Compatible with specified facer and comparable perm rating. For taping insulation joints and repairing tears.

I. Exposed Insulation: Where exposed, insulation shall meet the requirements of Factory Mutual (FM).

PART 3 - EXECUTION

3.01 BLANKET/BATT INSULATION INSTALLATION

A. General: Install blanket/batt insulation at metal stud framed exterior building walls, and other locations as indicated on Drawings.

1. Install insulation between studs, from interior side of wall recessed slightly from stud faces. Secure to studs to prevent sagging, in accordance with manufacturer's recommendations.

2. Fill voids in building construction with blanket insulation, at locations indicated on the Drawings, such as between top of concrete walls and underside of metal deck; between top of structural steel members and underside of deck, between exterior face of structural steel member and exterior construction.

3. Foil-faced batt insulation shall be furnished to the Sheet Metal Contractor for utility enclosures.

B. Vapor Retarder Installation: Seal all joints in exterior wall insulation with vapor retarder tape. Apply vapor retarder tape at intersection of insulation with framing, adjacent pieces and similar intersections to insure a vapor tight seal. Repair all tears in insulation foil facing with vapor retarder tape.

3.02 EXAMINATION

A. Refer to Section 01 31 00 - Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.03 CLEAN-UP

A. Work Required: Clean-up any Work soiled in the performance of the Work under this section.

B. Debris and Waste Materials: During progress of the Work, upon completion of Work, and before final acceptance of the Work, keep the premises free of debris and waste materials resulting from Work of this section. Remove all debris and rubbish to central area designated by the General Contractor, for general clean-up by the General

Contractor, or if directed by the General Contractor to remove from the site and legally dispose.

C. Unused Materials, Tools, and Equipment: Upon completion of Work and before final acceptance of the Work, remove all unused materials, tools, and equipment from the site.

D. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 07 21 20
BOARD INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes board insulation above metal deck.

B. Related Sections:
1. Section 0719 00 - Vapor Barrier: Vapor barrier materials to adjacent insulation.

1.2 REFERENCES

A. ASTM C1177 – Values for Sheathing.

B. ASTM C79- Values for paper faced gypsum sheathing.

C. Gypsum Association-GA252.

D. ASTM C240 - Testing Cellular Glass Insulation Block.

E. ASTM C552 - Cellular Glass Thermal Insulation.

F. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.

G. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation Board.

H. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

J. NFPA 255 (National Fire Protection Association) - Test of Surface Burning Characteristics of Building Materials.

K. UL 723 (Underwriters Laboratories, Inc.) - Tests for Surface Burning Characteristics of Building Materials.

L. ASTM C510 – Test Methods for heat flow meter.

1.3 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements.

B. Materials of This Section: Provide thermal protection to vapor retarder in conjunction with vapor retarder materials in Section 07260.

C. Materials of This Section: Provide thermal protection to air seal materials at building enclosure elements.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance criteria, limitations, adhesives and warranties.

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.

1.5 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 – General Scope of Work: Work sequence.

B. Sequence Work to ensure firestopping, vapor retarder, and air barrier materials are in place before beginning Work of this section.

1.7 COORDINATION

A. Coordinate Work with Section 07 26 00 for installation of vapor barrier and Section 07270 for air seal materials.

PART 2 PRODUCTS

2.1 BOARD INSULATION

A. Manufacturers:

1. Rigid Board Insulation Compatible with TPO roof. Comply with R-value requirements as stated on the drawings.

2. Substitutions: Section 01 60 00 - Product Requirements Not Permitted.

2.2 ACCESSORIES

A. Joint tape: 2” wide, 10x10 glass mesh tape.

B. Joint Compound: G-P Gypsum Corporation GyProc 90 setting type joint compound.

C. Nails, Wood Framing: Hot dip, 11-gauge galvanized nails with 7/16” head, 1 ½” min. length.

D. Screws, metal framing:

1. Type S-12, bugle head, self tapping, rust resistant, fine thread for heavy steel gauge(12 to 22).

2. Type S, bugle head, rust resistant sharp point, fine thread for light gauge metal framing or furring.

E. Screws, metal or wood framing:

1. Wafer head, rust resistant, Type S-12 drill or Hi Lo, min. 1 ¼ length. Or Type W rust- resistant, bugle head, coarse thread, sharp point for wood.

F. Sealant: Dow Corning 795 or equivalent.

G. Cellular Glass Insulation: ASTM C552 Type IV, cellular glass board; with the following characteristics.

1. Board Size: 4’x0” inch 8’x0”.

2. Board Thickness: ½ inches.

3. Thermal Resistance: R of 0.56.

4. Compressive Strength: Minimum 40 psi.

5. Water Absorption: In accordance with ASTM C240, 0.2 percent by volume maximum.

6. Facing: Factory applied No. 15 non-perforated asphalt saturated felt complying with ASTM D226, Type 1 or equal.

7. Board Edges: square.

8. Flame/Smoke Properties in accordance with ASTM E84, UL 723, NFPA 255.

9. Facing: [Unfaced] [Faced on one side with asphalt treated mesh reinforced Kraft paper] [Faced one side with mesh reinforced aluminum foil] [Faced one side with asphalt treated mesh reinforced Kraft paper and other side with mesh reinforced aluminum foil]

10. Board Edges, square.

11. Flame/Smoke Properties in accordance with ASTM E84, UL 723, NFPA 255.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

C. Verify substrate surface is flat, free of honeycomb, fins, irregularities, materials or substances affecting adhesive bond.

D. Preparation: Examine subframing, verify that surface of framing and furring members to receive sheathing does not vary more than ¼ " from the place of faces of adjacent members.

3.2 INSTALLATION - FOUNDATION PERIMETER

A. Adhere 4 inch wide strip of polyethylene sheet over construction joints with double beads of Type 1 adhesive each side of joint.

1. Tape seal joints.

2. Extend sheet full height of joint.

B. Apply Type 1 adhesive in three continuous beads per board length to full bed 1/8 inch thick.

C. Install boards on foundation wall, grade beam perimeter, vertically horizontally.

1. Place boards in method to maximize contact bedding.

2. Stagger [side] [end] joints.

3. Butt edges and ends tight to adjacent board and to protrusions.

D. Extend boards over control and unbonded to foundation on one side of joint.

E. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

F. Sheathing: Provide Dens-Glass Gold sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's, instructions and applicable instructions in GA-253 and ASTM C 1280.

G. Install Dens-Glass Gold Sheathing with gold side out.

H. Use maximum lengths possible to minimize number of joints.

I. Wood Framing: Attach Dens-Glass Gold sheathing to wood framing with nails spaced 4" o.c. at perimeter for racking shear resistance, 8" o.c. at perimeter where there are framing supports and where racking shear resistance is not required; and 8" o.c. along intermediate framing in field for both conditions.

J. Metal Framing: Attach Dens-Glass Gold sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.

K. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.

L. Locate fasteners minimum 3/8" from edges and ends of sheathing panels.

M. Joint treatment and finish preparation:

1. Painted ceilings and soffits

a. Apply joint tape over joints and embed in setting type joint compound specified.

b. Skim coat surface with setting type joint compound for smooth finish.

c. Prime and paint with exterior grade, good quality paints.

N. Building paper: 1.If required install building paper or equal with flashing around openings.

3.3 INSTALLATION - EXTERIOR WALLS

A. Adhere 6 inch wide strip of polyethylene sheet over joint with double beads of Type 1 adhesive each side of joint.

1. Tape seal joints between sheets.

2. Extend sheet full height of joint.

B. Apply Type 1 adhesive in three continuous beads per board length to full bed 1/8 inch thick. Daub adhesive tight to protrusions.

C. Install boards on wall surface, studs, horizontally. Place membrane surface of insulation against adhesive.

D. Place boards in method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.

E. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

F. Place 12 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and doors frame. Tape seal in place to ensure continuity of vapor retarder and air seal.

G. Tape insulation board joints.

3.4 SCHEDULES

A. Perimeter Insulation: Type B, extruded polystyrene, bead adhesive application, 1/2 inch (13 mm) thick protection board.

B. Cavity Wall Insulation: Type F, semi-rigid glass fiber board, full bed vapor retarder adhesive, secured with impaling fasteners.

END OF SECTION

SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, equipment, and materials to install rigid insulation, tapered insulation and ½" asphalt coated wood fiber over deck substrates indicated on the drawings. Install cants, crickets and saddles where indicated on drawings.

1.02 RELATED SECTIONS

A. Division 6 "Rough Carpentry"

B. Division 7 "Modified Bituminous Sheet Roofing"

1.03 SUBMITTALS

A. Samples and product literature for all products listed.

B. Design Loads: Submit copy of minimum design load calculations according to ASCE 7-10 for Components and Cladding. In no case shall the design loads be taken to be less than those detailed in article 1.06 of this specification.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original unopened packages, dry, undamaged, seals and labels intact.

B. Store all insulation delivered to the site in enclosed trailers.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Apply insulation only when the weather conditions are in compliance with the roof system limitations.

B. Protect the installed insulation from water penetration at the end of each day's work.

C. Application of the roof system shall immediately follow the installation of the roof insulation as it is installed.

1.06 DESIGN AND PERFORMANCE CRITERIA

A. Uniform Wind Uplift Load Capacity

1. Installed roof system over 22 ga. <u>steel decks</u>, shall withstand negative (uplift) design wind loading pressures complying with the structural drawings. Attachment shall be installed exactly as given in article 3.03.

a. Design Code: ASCE 7-10 for Components and Cladding.

Roof Area	Design Uplift Pressure
Zone 1 - Field of roof	- 27.5 psf
Zone 2 – Eaves and rakes	- 46.1 psf
Zone 3 - Corners	- 69.3 psf

Edge Zone width for 2 & 3 = 6 feet - 10 inches.

PART 2 - PRODUCTS

2.01 GENERAL

A. When a particular make or trade name is specified, it shall be indicative of a standard required.

2.02 MATERIALS

A. Polyisocyanurate Insulation Board: ASTM C 1289 Type II, Class 1, Grade 2,
1. 5-inch minimum, Average R-value, 20 LTTR. Provide in 4 ft. by 4 ft. sizes. ACFoam-II, Atlas Roofing Corporation.

B. 1/2” Wood fiber recovery board, asphalt impregnated all six sides.

C. USG Securock® Gypsum-Fiber Roof Board, 1/2-inch.

2.03 RELATED MATERIALS

A. As indicated on plans.
Fasteners & Plates:
1. Steel Deck: Trufast #14 HD fasteners with 3” steel plates, Altenloh, Brinck & Co. Group.

C. Tapered Crickets: 1/2” slope minimum, Polyisocyanurate Insulation Board: ASTM C 1289 Type II. ACFoam-II, Atlas Roofing Corporation.
D. Cant Strips: Fiberglass, Glass Cant. The Garland Company
E. Type IV Steep Asphalt.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate surfaces to receive roof and deck insulation and associated work and conditions under which insulation will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Verify deck and surfaces are clean, smooth, dry, free of depressions or irregularities prior to beginning installation of materials.

C. Verify roof openings, curbs, pipes, sleeves, ducts, penetrations or vents through roof are solidly set, wood nailing strips are in place.

D. Verify all specifications related to Carpentry, have been followed prior to beginning installation of insulation. Beginning installation means acceptance of substrate.

3.02 PROTECTION

A. During execution of work covered by this Section, the Contractor shall provide protection for roof insulation from water and wind penetration at the end of each day's work.

B. Protect the roof insulation in areas that will receive excessive traffic with a surface protection such as plywood.

C. All workmen shall wear clean, soft rubber-soled shoes for any application work where they may be walking on the in-place insulation.

3.03 GENERAL INSTALLATION

A. Insulation board shall be fully attached with specified fastening system as listed below.

1. STEEL DECKS

a. Fasteners in FIELD, Zone 1 of the roof are placed 12 fasteners per board.

b. Fasteners at PERIMETERS, Zone 2 of the roof are placed 18 fasteners per board.

c. Fasteners at CORNERS, Zone 3 of the roof are placed 24 fasteners per board.

d. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six (6) inches.

e. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one (1) inch minimum for metal. .

B. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.

C. Install the ½" wood fiber board using Type IV Steep asphalt. Offset joints with those of the Insulation.

D. All boards shall be cut and fitted where the roof deck intersects a vertical surface. The boards shall be cut to fit a minimum of 1/4" away from the vertical surface.

E. Sump all roof insulation at all scuppers.

F. Cant Strips/Tapered Edge/Crickets: Install preformed 45-degree cant strips at junctures of vertical surface. Install crickets where indicated on the plans.

END OF SECTION

SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEM

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART I GENERAL

1.01 SUMMARY

A. This document is to be used in preparing specifications for projects utilizing the Dryvit Outsulation Plus MD System. For complete product description and usage refer to:

1. Dryvit Outsulation Plus MD System Data Sheet, DS445.
2. Dryvit Outsulation Plus MD System Application Instructions, DS218.
3. Dryvit Outsulation Plus MD System Installation Details, DS110.
4. Dryvit Backstop DMS Data Sheet DS 704

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Indoor Air Quality Requirements - Section 01 81 19. AIR BORNE PRODUCTS
2. Unit Masonry – Section 04200
3. Concrete – Sections 03300 and 03400
4. Light Gauge Cold Formed Steel Framing – Section 05400
5. Wood Framing – Section 06100
6. Sealant – Section 07900
7. Flashing – Section 07600

1.02 REFERENCES

A. Section Includes

1. ASTM B 117 (Federal Test Standard 141A Method 6061) Standard Practice for Operating Salt Spray (Fog) Apparatus
2. ASTM C 150 Standard Specification for Portland Cement
3. ASTM C 297 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
4. ASTM C 1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

5. ASTM C 1396 (formerly C 79) Standard Specification for Gypsum Board

6. ASTM D 968 (Federal Test Standard 141A Method 6191) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

7. ASTM D 2247 (Federal Test Standard 141A Method 6201) Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity

8. ASTM D 2898 Standard Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

9. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

10. ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

11. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

12. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials

13. ASTM E 119 Standard Method for Fire Tests of Building Construction and Materials

14. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

15. ASTM E 330 Test Method for Structural Performance of Exterior Windows, Doors and Curtain Walls by Uniform Static Air Pressure Difference

16. ASTM E 331 Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference

17. ASTM E 2098 Test Method for Determining the Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to Sodium Hydroxide Solution

18. ASTM E 2134 Test Method for Evaluating the Tensile-Adhesion Performance of Exterior Insulation and Finish Systems (EIFS)

19. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials

20. ASTM E 2273 Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies

21. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

22. ASTM E 2430 Standard Specification for Expanded Polystyrene (EPS) Thermal Insulation Boards for use in Exterior Insulation and Finish Systems (EIFS)

23. ASTM E 2485 (formerly EIMA Std. 101.01) Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water-Resistive Barrier Coatings

24. ASTM E 2486 (formerly EIMA Std. 101.86) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)

25. ASTM G 155 (Federal Test Standard 141A Method 6151) Standard Practice for Operating-Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials

26. DS131, Dryvit Expanded Polystyrene Insulation Board Specification

27. DS151, Custom Brick™ Polymer System Specifications for Use On Vertical Walls

28. DS152, Dryvit Cleaning and Recoating

29. DS153, Dryvit Expansion Joints and Sealants

30. DS159, Dryvit Water Vapor Transmission

31. DS456, Rapidry DM™ 35-50 or DS457, Rapidry DM™ 50-75 Data Sheets

32. DS494, Dryvit AquaFlash® System

33. DS704, Backstop® DMS

34. DS705, Reflectit™

35. DS706, Mojave E™ Finish

36. Mil Std E5272 Environmental Testing

37. Mil Std 810B Environmental Test Methods

38. NFPA 268 Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.

39. NFPA 285 Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.

40. ANSI FM 4880 Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems

1.03 DEFINITIONS

A. Base Coat: Material used to encapsulate one or more layers of reinforcing mesh fully embedded that is applied to the outside surface of the EPS.

B. Building Expansion Joint: A joint through the entire building structure designed to accommodate structural movement.

C. Contractor: The contractor that installs the Outsulation Plus MD System to the substrate.

D. Dryvit: Dryvit Systems, Inc., the manufacturer of the Outsulation Plus MD System, a Rhode Island corporation.

E. Expansion Joint: A structural discontinuity in the Outsulation Plus MD System.

F. Finish: An acrylic-based coating, available in a variety of textures and colors that is applied over the base coat.

G. Insulation Board: Expanded polystyrene (EPS) insulation board, which is affixed to the substrate.

H. Panel Erector: The contractor who installs the panelized Outsulation Plus MD System.

I. Panel Fabricator: The contractor who fabricates the panelized Outsulation Plus MD System.

J. Reinforcing Mesh: Glass fiber mesh(es) used to reinforce the base coat and to provide impact resistance.

K. Sheathing: A substrate in sheet form.

L. Substrate: The material to which the Outsulation Plus MD System is affixed.

M. Substrate System: The total wall assembly including the attached substrate to which the Outsulation Plus MD System is affixed.

1.04 SYSTEM DESCRIPTION

A. General: The Dryvit Outsulation Plus MD System is an Exterior Insulation and Finish System (EIFS), Class PB, consisting of a water-resistive barrier coating (air/water-resistive barrier), an adhesive, expanded polystyrene insulation board, base coat, reinforcing mesh(es) and finish.

B. Methods of Installation:

1. Field Applied: The Outsulation Plus MD System is applied to the substrate system in place.

2. Panelized: The Outsulation Plus MD System is shop-applied to the prefabricated wall panels.

C. Design Requirements:

1. Acceptable substrates for the Outsulation Plus MD System shall be:

b. Exterior sheathing having a water-resistant core with fiberglass mat facers meeting ASTM C 1177.

2. Deflection of the substrate systems shall not exceed 1/240 times the span.

3. The substrate shall be flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.

4. The slope of inclined surfaces shall not be less than 6:12, and the length shall not exceed 305 mm (12 in).

5. All areas requiring an impact resistance classification higher than "standard", as defined by ASTM E 2486 (formerly EIMA Standard 101.86), shall be as detailed in the drawings and described in the contract documents. Refer to Section 1.04.D.1.d of this specification.

6. Expansion Joints:

   a. Design and location of expansion joints in the Outsulation Plus MD System is the responsibility of the project designer and shall be noted on the project drawings. As a minimum, expansion joints shall be placed at the following locations:

      1) Where expansion joints occur in the substrate system.

      2) Where building expansion joints occur.

      3) At floor lines in wood frame construction.

      4) At floor lines of non-wood framed buildings where significant movement is expected.

      5) Where the Outsulation Plus MD System abuts dissimilar materials.

      6) Where the substrate type changes.

      7) Where prefabricated panels abut one another.

      8) In continuous elevations at intervals not exceeding 23 m (75 ft).

      9) Where significant structural movement occurs, such as changes in roofline, building shape or structural system.

7. Terminations:

   a. Prior to applying the Dryvit Outsulation Plus MD System, wall openings shall be treated with Dryvit AquaFlash System or Flashing Tape. Refer to Dryvit Outsulation Plus MD Installation Details (DS110).

   b. The Outsulation Plus MD System shall be held back from adjoining materials around openings and penetrations such as windows, doors, and mechanical equipment a minimum of 19 mm (3/4 in) for sealant application. See Dryvit's Outsulation Plus MD System Installation Details, DS110.

   c. The system shall be terminated a minimum of 203 mm (8 in) above finished grade.

   d. Sealants

      1) Shall be manufactured and supplied by others.

2) Shall be compatible with the Outsulation Plus MD System materials. Refer to current Dryvit Publication DS153 for listing of sealants tested by sealant manufacturer for compatibility.
3) The sealant backer rod shall be closed cell.

8. Vapor Retarders: The use and location of vapor retarders within a wall assembly is the responsibility of the project designer and shall comply with local building code requirements. The type and location shall be noted on the project drawings and specifications. Vapor retarders may be inappropriate in certain climates and can result in condensation within the wall assembly. Refer to Dryvit Publication DS159 for additional information.

9. Dark Colors: The use of dark colors must be considered in relation to wall surface temperature as a function of local climatic conditions. Use of dark colors in high temperature climates can affect the performance of the system.

10. Flashing: Shall be provided at all roof-wall intersections, windows, doors, chimneys, decks, balconies and other areas as necessary to prevent water from entering behind the Outsulation Plus MD System.

D. Performance Requirements:

1. The Outsulation Plus MD System shall have been tested as follows:

a. Air/Water-Resistive Barrier Coating

TEST	TEST METHOD	CRITERIA	RESULTS
Tensile Bond	ASTM C 297/E 2134 ICC ES (AC 212)*	Minimum 104 kPa (15 psi)	Substrate: Minimum 131 kPa (19 psi) (Backstop NT) Minimum 166 kPa (24.1 psi) (Backstop DMS) Flashing Minimum 2970 kPa (431 psi) (Backstop NT) Minimum 967 kPa (140 psi) (Backstop DMS)
Freeze-thaw	ASTM E 2485/ICC-ES Proc. ICC ES (AC 212)*	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
Water Resistance	ASTM D 2247 ICC ES (AC 212)*	No deleterious effects after 14 days exposure[1]	No deleterious effects after 14 days exposure
Water Vapor Transmission	ASTM E 96 Proc. B ICC ES (AC 212)*	Vapor Permeable	7 perms (Backstop NT)[2] 30 perms (Backstop DMS)
Air Leakage	ASTM E 283	No ICC or ANSI/EIMA Criteria	0.01 l/sec/m^2 (0.002 cfm/ft^2) (Backstop NT)
Air Permeance	ASTM E 2178	No ICC or ANSI/EIMA Criteria	0.0006 l/s/m^2 @ 75Pa (1.2x10^{-4} cfm/ft^2 @ 1.6 psf) (Backstop NT)
Air Barrier Assembly	ASTM E 2357	No ICC or ANSI/EIMA Criteria	0.05 l/sec m^2 @300 Pa (<0.001 cfm/ft^2 @ 6.24 psf) (Backstop NT)
Structural Performance	ASTM E 1233 Proc. A ICC ES (AC 212)*	Minimum 10 positive cycles at 1/240 deflection; No cracking in field, at joints or interface with flashing	Passed
Racking	ASTM E 72	No cracking in field, at	Passed

	ICC ES (AC 212)*	joints or interface with flashing at net deflection of 3.2 mm (1/8 inch)	
Restrained Environmental	ICC-ES Procedure ICC ES (AC 212)*	5 cycles; No cracking in field, at joints or interface with flashing	Passed
Water Penetration	ASTM E331 ICC ES (AC 212)*	No water penetration beyond the inner-most plane of the wall after 15 minutes at 137 Pa (2.86 psf)	Passed
Weathering **UV Exposure**	ICC ES Proc. ICC ES (AC212)*	210 hours of exposure	Passed
Acceleratred Aging	ICC ES Proc. ICC ES (AC212)*	25 cycles of wetting and drying	Passed
Hydrostatic Pressure Test	AATCC 127 ICC ES (AC212)*	ICC: 549 mm (21.6 in) water column for 5 hours	Passed
Surface Burning Characteristics	ASTM E 84	Flame Spread < 25 Smoke Developed < 450	Passed

* (AC212 – Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing, also referred to as ASTM E 2570
1. No cracking, checking, rusting, crazing, erosion, blistering, peeling, or delamination when viewed under 5x magnification
2. Defined as a Class III vapor retarder per the 2009 IBC and IRC

b. Durability

TEST	TEST METHOD	CRITERIA	RESULTS
Abrasion Resistance	ASTM D 968	No deleterious effects after 500 liters (528 quarts)	No deleterious effects after 1000 liters (1056 quarts)
Accelerated Weathering	ASTM G 155 Cycle 1	No deleterious effects after 2000 hours	No deleterious effects after 5000 hours
	ASTM G 154 Cycle 1 (QUV)		No deleterious effects after 5000 hours
Freeze-Thaw	ASTM E 2485 (formerly EIMA 101.01)	No deleterious effects after 60 cycles	Passed - No deleterious effects after 90 cycles
	ASTM C 67 modified	No deleterious effects after 60 cycles	Passed - No deleterious effects after 60 cycles
	ASTM E 2485/ICC-ES Proc. ICC ES (AC235)***	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
Mildew Resistance	ASTM D 3273	No growth during 28 day exposure period	No growth during 60 day exposure period
Water Resistance	ASTM D 2247	No deleterious effects after 14 days exposure	No deleterious effects after 42 days exposure
Taber Abrasion	ASTM D 4060	N/A	Passed 1000 cycles
Salt Spray Resistance	ASTM B 117	No deleterious effects after 300 hours exposure	No deleterious effects after 1000 hours exposure
Water Penetration	ASTM E 331 ICC ES (AC 235)***	No water penetration beyond the inner-most plane of the wall after 15 minutes at 137 Pa (2.86 psf)	Passed 15 minutes at 137 Pa (2.86 psf)
Water Vapor	ASTM E 96 Procedure B	Vapor permeable	EPS 5 perm-

Transmission			inch Base Coat* 40 Perms Finish** 40 Perms
Drainage Efficiency	ASTM E 2273 ICC ES (AC 235)***	Minimum Drainage Efficiency of 90%	Passed
* Base Coat perm value based on Dryvit Genesis® ** Finish perm value based on Dryvit Quarzputz *** AC 235 – Acceptance Criteria for EIFS Clad Drainage Wall Assemblies			

c. Structural

TEST	TEST METHOD	CRITERIA	RESULTS
Tensile Bond	ASTM C 297/E 2134	Minimum 104 kPa (15 psi) – substrate or insulation failure	Minimum 213.6 kPa (31 psi)
Transverse Wind Load	ASTM E 330	Withstand positive and negative wind loads as specified by the building code	Minimum 4.3 kPa (90 psf)***** 16 inch o.c. framing, ½ in sheathing screw attached at 203 mm (8 inch) o.c.
* All Dryvit components remain intact – for higher wind loads contact Dryvit Systems, Inc.			

d. Impact Resistance: In accordance with ASTM E 2486 (formerly EIMA Standard 101.86):

Reinforcing Mesh[1]/Weight g/m² (oz/yd²)	Minimum Tensile Strengths	EIMA Impact Classification	EIMA Impact Range Joules	(in-lbs)	Impact Test Results Joules	(in-lbs)
Standard - 146 (4.3)	27 g/cm (150 lbs/in)	Standard	3-6	(25-49)	4	(36)
Standard Plus™ - 203 (6)	36 g/cm (200 lbs/in).	Medium	6-10	(50-89)	6	(56)
Intermediate® - 407 (12)	54 g/cm (300 lbs/in).	High	10-17	(90-150)	12	(108)
Panzer® 15* - 509 (15)	71 g/cm (400 lbs/in).	Ultra High	>17	(>150)	18	(162)
Panzer 20* - 695 (20.5)	98 g/cm (550 lbs/in).	Ultra High	>17	(>150)	40	(352)
Detail® Short Rolls - 146 (4.3)	27 g/cm (150 lbs/in).	n/a	n/a	n/a	n/a	n/a
Corner Mesh™ - 244 (7.2)	49 g/cm (274 lbs/in).	n/a	n/a	n/a	n/a	n/a

*Shall be used in conjunction with Standard Mesh (recommended for areas exposed to high traffic).
1. It shall be colored blue for product identification bearing the Dryvit logo.

e. Fire performance

TEST	TEST METHOD	CRITERIA	RESULTS
Fire Resistance	ASTM E 119	No effect on the fire resistance of a rated wall assembly	Passed 1 hour
Ignitability	NFPA 268	No ignition at 12.5 kw/m^2 at 20 minutes	Passed
Intermediate Multi-Story Fire Test	NFPA 285 (UBC 26-9)	1. Resist flame propagation over the exterior surface 2. Resist vertical spread of flame within combustible core/component of panel from one story to the next 3. Resist vertical spread of flame over the interior surface from one story to the next 4. Resist lateral spread of flame from the compartment of fire origin	Passed

		to adjacent spaces	
Full Scale Multi-Story* (corner test)	ANSI FM 4880	Resist flame propagation over the exterior surface	Passed; No height restrictions*
* Dryvit FM Products must be specified			

2. The Outsulation Plus MD components shall be tested for:

a. Fire

TEST	TEST METHOD	CRITERIA	RESULTS
Surface Burning Characteristics	ASTM E 84	All components shall have a: Flame Spread ≤ 25 Smoke Developed ≤ 450	Passed

b. Durability

TEST	TEST METHOD	CRITERIA	RESULTS
Reinforcing Mesh **Alkali Resistance of Reinforcing Mesh**	ASTM E 2098 (formerly EIMA 105.01)	> 21dN/cm (120 pli) retained tensile strength after exposure	Passed
EPS (Physical Properties) **Density** **Thermal Resistance** **Water Absorption** **Oxygen Index** **Compressive Strength** **Flexural Strength** **Flame Spread** **Smoke Developed**	 ASTM C 303, D 1622 ASTM C 177, C 518 ASTM C 272 ASTM D 2863 ASTM D 1621 Proc. A ASTM C 203 ASTM E 84	 15.2-20.0 kg/m^3 (0.95-1.25 lb/ft^3) 4.0 @ 4.4 °C (40 °F) 3.6 @ 23.9 °C (75 °F) 2.5 % max. by volume 24% min. by volume 69 kPa (10 psi) min. 172 kPa (25 psi) min. 25 max. 450 max.	 Pass Pass Pass Pass Pass Pass Pass Pass Pass

1.05 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Product Data: The contractor shall submit to the owner/architect the manufacturer's product data sheets describing products, which will be used on this project.

C. Shop Drawings for Panelized Construction: The panel fabricator shall prepare and submit to the owner/architect complete drawings showing: wall layout, connections, details, expansion joints, and installation sequence.

D. Samples: The contractor shall submit to the owner/architect two (2) samples of the Outsulation Plus MD System for each finish, texture and color to be used on the project. The same tools and techniques proposed for the actual installation shall be used.

Samples shall be of sufficient size to accurately represent each color and texture being utilized on the project.

E. Test Reports: When requested, the contractor shall submit to the owner/architect copies of selected test reports verifying the performance of the Outsulation Plus MD System.

F. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

1.06 QUALITY ASSURANCE

A. Environmental Requirements: Paint products shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC).

B. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

D. Qualifications

1. System Manufacturer: Shall be Dryvit Systems, Inc. All materials shall be manufactured or sold by Dryvit and shall be purchased from Dryvit or its authorized distributors.

a. Materials shall be manufactured at a facility covered by a current ISO 9001:2008 and ISO 14000:2004 certification. Certification of the facility shall be done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).

2. Contractor: Shall be knowledgeable in the proper installation of the Dryvit Outsulation Plus MD System and shall be experienced and competent in the installation of Exterior Insulation and Finish Systems. Additionally, the contractor shall possess a current Outsulation Plus MD System Trained Contractor Certificate* issued by Dryvit Systems, Inc.

3. Insulation Board Manufacturer: Shall be listed by Dryvit Systems, Inc., shall be capable of producing the Expanded Polystyrene (EPS) in accordance with the current Dryvit Specification for Insulation Board, DS131, and shall subscribe to the Dryvit Third Party Certification and Quality Assurance Program.

4. Panel Fabricator: Shall be a contractor experienced and competent in the fabrication of architectural wall panels and shall possess a current Outsulation Plus MD System Trained Contractor Certificate* issued by Dryvit Systems, Inc.

5. Panel Erector: Shall be experienced and competent in the installation of architectural wall panel systems and shall be:

a. The panel fabricator or

b. An erector approved by the panel fabricator or

c. An erector under the direct supervision of the panel fabricator

E. Regulatory Requirements:

1. The EPS shall be separated from the interior of the building by a minimum 15-minute thermal barrier.

2. The use and maximum thickness of EPS shall be in accordance with the applicable building code(s).

F. Certification

1. The Outsulation Plus MD System shall be recognized for the intended use by the applicable building code(s).

G. Mock-Up

1. The contractor shall, before the project commences, provide the owner/architect with a mock-up for approval.

2. The mock-up shall be of suitable size as required to accurately represent the products being installed, as well as each color and texture to be utilized on the project.

3. The mock-up shall be prepared with the same products, tools, equipment and techniques required for the actual applications. The finish used shall be from the same batch that is being used on the project.

4. The approved mock-up shall be available and maintained at the jobsite.
For panelized construction, the mock-up shall be available and maintained at the panel fabrication location.

1.07 DELIVERY, STORAGE AND HANDLING

A. All Dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact.

B. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.

1. Materials shall be stored at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Minimum storage temperature shall be as follows:

a. Demandit®, and Revyvit®: 7 °C (45 °F)
b. Ameristone™, TerraNeo®, Lymestone™, and Reflectit: 10 °C (50 °F)
c. DPR, PMR™ and **E™** Finishes, Color Prime™, Primus®, Genesis and NCB™: 4 °C (40 °F)
d. Custom Brick™ Finish: refer to Custom Brick Polymer Specification, DS151.
e. For other products, refer to specific product data sheets.

2. Maximum storage temperature shall not exceed 38 °C (100 °F). **NOTE: Minimize exposure of materials to temperatures over 32 °C (90 °F). Finishes exposed to temperatures over 43 °C (110 °F) for even short periods may exhibit skinning, increased viscosity and should be inspected prior to use.**

C. Protect all products from inclement weather and direct sunlight.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.08 PROJECT CONDITIONS

A. Environmental Requirements

1. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.

2. At the time of application, the minimum air and wall surface temperatures shall be as follows:

a. Demandit®, and Revyvit®: 7 °C (45 °F)

b. Ameristone™, TerraNeo®, Lymestone™, and Reflectit: 10 °C (50 °F)

c. DPR, PMR and **E** Finishes, Color Prime, Primus Genesis and NCB: 4 °C (40 °F)

d. Custom Brick Finish: refer to Custom Brick Polymer Specification, DS151.

e. For other products, refer to specific product data sheets.

3. These temperatures shall be maintained with adequate air ventilation and circulation for a minimum of 24 hours (48 hours for Ameristone, TerraNeo and Lymestone) thereafter, or until the products are completely dry. Refer to published product data sheets for more specific information.

B. Existing Conditions: The contractor shall have access to electric power, clean water and a clean work area at the location where the Dryvit materials are to be applied.

1.09 SEQUENCING AND SCHEDULING

A. Installation of the Outsulation Plus MD System shall be coordinated with other construction trades.

B. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.10 WARRANTY

A. Dryvit Systems, Inc. shall provide a written moisture drainage and limited materials warranty against defective material upon written request. Dryvit shall make no other

warranties, expressed or implied. Dryvit does not warrant workmanship. Full details are available from Dryvit Systems, Inc.

B. The applicator shall warrant workmanship separately. Dryvit shall not be responsible for workmanship associated with installation of the Outsulation Plus MD System.

1.11 DESIGN RESPONSIBILITY

A. It is the responsibility of both the specifier and the purchaser to determine if a product is suitable for its intended use. The designer selected by the purchaser shall be responsible for all decisions pertaining to design, detail, structural capability, attachment details, shop drawings and the like. Dryvit has prepared guidelines in the form of specifications, installation details, and product sheets to facilitate the design process only. Dryvit is not liable for any errors or omissions in design, detail, structural capability, attachment details, shop drawings, or the like, whether based upon the information prepared by Dryvit or otherwise, or for any changes which purchasers, specifiers, designers, or their appointed representatives may make to Dryvit's published comments.

1.12 MAINTENANCE

A. Maintenance and repair shall follow the procedures noted in the Dryvit Outsulation Plus MD System Application Instructions, DS218.

B. All Dryvit products are designed to require minimal maintenance. However, as with all building products, depending on location, some cleaning may be required. See Dryvit publication DS152 on Cleaning and Recoating.

C. Sealants and Flashings shall be inspected on a regular basis and repairs made as necessary.

PART II PRODUCTS

2.01 MANUFACTURER

A. All components of the Outsulation Plus MD System shall be supplied or obtained from Dryvit or its authorized distributors. Substitutions or additions of materials other than specified will void the warranty.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Portland Cement: Shall be Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.

B. Water: Shall be clean and free of foreign matter.

2.03 COMPONENTS

A. Air/Water-Resistive Barrier Components:

1. Dryvit Backstop® NT: A flexible, polymer-based noncementitious water-resistive coating and air barrier available in Texture and Smooth.

2. Dryvit Grid Tape™: An open weave fiberglass mesh tape with pressure sensitive adhesive available in rolls 102 mm (4 in) wide by 91 m (100 yds) long.

3. Dryvit Backstop DMS: A sprayable single step water-resistive membrane/air barrier and adhesive.
NOTE: Backstop DMS is not approved for use over wood based substrates.

B. Flashing Materials: Used to protect substrate edges at terminations.

1. Liquid Applied: An extremely flexible water-based polymer material, ready for use.

a. Shall be AquaFlash and AquaFlash Mesh

C. Dryvit AP Adhesive™: A moisture cure, urethane-based adhesive used to adhere the Dryvit Drainage Strip and Drainage Track.

D. Drainage Track: UV treated PVC "J" channel perforated with weep holes, complying with ASTM D 1784 and ASTM C 1063. Drainage track usage is limited to the base of the system at finished grade level. All other horizontal terminations shall utilize the Dryvit Drainage Strip as shown in Outsulation Plus MD Installation Details, DS110. Shall be one of the following:

1. Starter Trac STWP – without drip edge by Plastic Components, Inc.

E. Dryvit Drainage Strip™: A corrugated plastic sheet material, which provides drainage.

F. Adhesives: Used to adhere the EPS to the air/water-resistive barrier, shall be compatible with the water-resistive barrier and the EPS.

1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.

a. Shall be Primus, Genesis or Genesis® FM

2. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water.

a. Shall be Primus® DM, Genesis® DM, Genesis® DMS, Backstop DMS, Rapidry DM 35-50 or Rapidry DM 50-75

G. Insulation Board: Expanded Polystyrene meeting Dryvit Specification for Insulation Board, DS131.

1. Thickness of insulation board shall be 1 1/2 in.

2. The insulation board shall be manufactured by a board supplier listed by Dryvit Systems, Inc.

H. Base Coat: Shall be compatible with the EPS insulation board and reinforcing mesh(es).

1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.

a. Shall be Primus, Genesis or Genesis FM

3. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water.

a. Shall be Primus DM, Genesis DM, Genesis DMS, Rapidry DM 35-50 or Rapidry DM 50-75.

I. Reinforcing Mesh: A balanced, open weave, glass fiber fabric treated for compatibility with other system materials

1. Shall be Standard~~,~~ Panzer 20, Detail and Corner Mesh

2. Shall be colored blue for product identification bearing the Dryvit logo.

J. Finish: Shall be the type, color and texture as selected by the architect/owner and shall be one or more of the following:

6. Elastomeric DPR (Dirt Pickup Resistance): Water- based, elastomeric acrylic coating with integral color and texture and formulated with DPR chemistry:

8. Coatings, Primers and Sealers:

a. Demandit

PART III EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

C. Prior to installation of the Outsulation Plus MD System, the contractor shall verify that the substrate:

1. Is of a type listed in Section 1.04.C.1.
2. Is flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.

3. Is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the Outsulation Plus MD System installation or performance.

D. Prior to installation of the Outsulation Plus MD System, the architect or general contractor shall insure that all needed flashings and other waterproofing details have been completed, if such completion is required prior to the Outsulation Plus MD application. Additionally the Contractor shall ensure that:

1. Metal roof flashing has been installed in accordance with Asphalt Roofing Manufacturers Association (ARMA) Standards.

2. Openings are flashed in accordance with the Outsulation Plus MD System Installation Details, DS110, or as otherwise necessary to prevent water penetration.

3. Chimneys, Balconies and Decks have been properly flashed.

4. Windows, Doors, etc. are installed and flashed per manufacturer's requirements and the Outsulation Plus MD System Installation Details, DS110.

E. Prior to the installation of the Outsulation Plus MD System, the contractor shall notify the general contractor, and/or architect, and/or owner of all discrepancies.

3.02 PREPARATION

A. The Outsulation Plus MD materials shall be protected by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.

B. Protect adjoining work and property during Outsulation Plus MD installation.

C. The substrate shall be prepared as to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

3.03 INSTALLATION

A. The system shall be installed in accordance with the Dryvit Outsulation Plus MD System Application Instructions, DS218.

B. The overall minimum base coat thickness shall be sufficient to fully embed the mesh. The recommended method is to apply the base coat in two (2) passes.

C. Sealant shall not be applied directly to textured finishes or base coat surfaces. Dryvit Outsulation Plus MD System surfaces in contact with sealant shall be coated with Demandit or Color Prime.

D. High impact meshes shall be installed as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage.

3.04 FIELD QUALITY CONTROL

A. The contractor shall be responsible for the proper application of the Outsulation Plus MD materials.

B. Dryvit assumes no responsibility for on-site inspections or application of its products.

C. If required, the contractor shall certify in writing the quality of work performed relative to the substrate system, details, installation procedures, workmanship and as to the specific products used.

D. If required, the EPS supplier shall certify in writing that the EPS meets Dryvit's specifications.

E. If required, the sealant contractor shall certify in writing that the sealant application is in accordance with the sealant manufacturer's and Dryvit's recommendations.

3.05 CLEAN-UP

A. All excess Outsulation Plus MD System materials shall be removed from the job site by the contractor in accordance with contract provisions and as required by applicable law.

B. All surrounding areas, where the Dryvit Outsulation Plus MD System has been applied, shall be left free of debris and foreign substances resulting from the contractor’s work.

C. Waste Management: Collect field generated construction waste created during construction or final cleaning.

3.06 PROTECTION

A. The Outsulation Plus MD System shall be protected from inclement weather and other sources of damage until dry and permanent protection in the form of flashings, sealants, etc. are installed.

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS
DuPont ™ Tyvek® CommercialWrap® D

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Weather barrier membrane - DuPont™ Tyvek® CommercialWrap® D

B. Seam Tape - DuPont™ Tyvek® Tape

C. Flashing - DuPont™ FlexWrap™, DuPont™ FlexWrap™ NF, DuPont™ StraightFlash™, DuPont™ StraightFlash™ VF, and DuPont™ Thru-Wall Flashing

D. Fasteners - DuPont™ Tyvek® Wrap Caps

1.2 REFERENCES

A. ASTM International

1. ASTM C 920; Standard Specification for Elastomeric Joint Sealants
2. ASTM C 1193; Standard Guide for Use of Joint Sealants
3. ASTM D 882; Test Method for Tensile Properties of Thin Plastic Sheeting
4. ASTM D 1117; Standard Guide for Evaluating Non-woven Fabrics
5. ASTM E 84; Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E 96; Test Method for Water Vapor Transmission of Materials
7. ASTM E 1677; Specification for Air Retarder Material or System for Framed Building Walls
8. ASTM E2178; Test Method for Air Permeance of Building Materials
9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

B. AATCC – American Association of Textile Chemists & Colorists

1. Test Method 127 Water Resistance: Hydrostatic Pressure Test

C. TAPPI

1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
2. Test Method T-460; Air Resistance of Paper (Gurley Hill Method)

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures.

B. Product Data: Submit manufacturer current technical literature for each component.

C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.

D. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

E. Closeout Submittals

1. Refer to Section 01 70 00 Project Closeout.
2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Installer shall have experience with installation of DuPont ™ Tyvek® weather barrier assemblies under similar conditions.
2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

B. Mock-up

1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.

   a. Mock-up size: 8 feet by 8 feet.
   b. Mock-up Substrate: Match wall assembly construction, including window opening.
   c. Mock-up may remain as part of the work.

2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting

1. Refer to Section 01 31 00 Project management and Coordination.
2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, installer, Owner's Representative, and weather barrier manufacturer's designated representative.
3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 60 00 Product Requirements.

B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store weather barrier materials as recommended by weather barrier manufacturer.

1.6 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.

B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.7 WARRANTY

A. Special Warranty

1. Weather barrier manufacturer's warranty for weather barrier for a period of ten (10) years from date of purchase.

2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty is required prior to assembly installation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. DuPont; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 1-800-44-TYVEK (8-9835); http://www.construction.tyvek.com

2.2 MATERIALS

A. Basis of Design: High-performance, spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® CommercialWrap® and related assembly components.

B. Performance Characteristics:

1. Air Penetration: 0.001 cfm/ft^2 at 75 Pa when tested in accordance with ASTME2178. Type 1 when tested in accordance with ASTM E 1677. ≤0.04 cfm/ft @ 75 Pa when tested in accordance with ASTM E2357.
2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E 96, Method B.
3. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: 2.7 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.
5. Air Infiltration Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D 822 , Method A.
7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84 . Flame Spread: 10, Smoke Developed: 10.

2.3 ACCESSORIES

A. Seam Tape: 3 inch wide DuPont™ Tyvek® Tape for commercial applications.

B. Fasteners:

1. Steel Frame Construction: DuPont™ Tyvek® Wrap Cap Screws,as manufactured by DuPont Building Innovations: 1-5/8 inch rust resistant screw with 2-inch diameter plastic cap fasteners.

2. Wood Frame Construction: #4 nails with large 1-inch plastic cap fasteners or 1-inch minimum plastic cap staple with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud.

C. Sealants

1. Provide sealants that comply with ASTM C 920, elastomeric polymer sealant to maintain watertight conditions.

2. Products:

a. DuPont™ Commercial Sealant.
b. Sealants recommended by the weather barrier manufacturer.

D. Adhesives:

1. Provide adhesive recommended by weather barrier manufacturer.

2. Products:

a. DuPont™ Adhesive/Primer
b. Adhesives recommend by the weather barrier manufacturer.

E. Primers:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

2. Products:

a. DuPont™ Adhesive/Primer
b. Primers recommended by the flashing manufacturer

F. Flashing

1. DuPont™ FlexWrap™: Flexible membrane flashing materials for window openings and penetrations.

2. DuPont™ FlexWrap™ NF: Flexible membrane flashing materials for window openings and penetrations.

3. DuPont™ StraightFlash™: Straight flashing membrane materials for flashing windows and doors and sealing penetrations such as masonry ties, etc.

4. DuPont™ StraightFlash™ VF: Dual-sided flashing membrane materials for brick mold and non-flanged windows and doors.

5. DuPont™ Thru-Wall Surface Adhered Membrane with Integrated Drip Edge: Thru-Wall flashing membrane materials for flashing at changes in direction or elevation (shelf angles, foundations, etc.) and at transitions between different assembly materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 INSTALLATION - WEATHER BARRIER

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations

B. Install weather barrier prior to installation of windows and doors.

C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level

E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.

F. Window and Door Openings: Extend weather barrier completely over openings.

G. Overlap weather barrier

1. Exterior corners: minimum 12 inches.

2. Seams: minimum 6 inches.

H. Weather Barrier Attachment:

1. Steel or Wood Frame Construction: Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommend fasteners, space 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

2. Masonry Construction: Attach weather barrier to masonry. Secure using weather barrier manufacturer recommend fasteners, space 6-18 inches vertically on center and 24 inches maximum horizontally. Weather barrier may be temporarily attached to masonry using recommended adhesive, placed in vertical strips spaced 24 inches on center, when coordinated on the project site.

I. Apply 4 inch by 7 inch piece of DuPont ™ StraightFlash™ or weather barrier manufacturer approved alternate to weather barrier membrane prior to the installation cladding anchors.

3.3 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 OPENING PREPARATION (for use with non-flanged windows - all cladding types0

A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.5 FLASHING (for use with non-flanged windows - all cladding types)

A. Cut 6 inch or 9 inch wide DuPont™ FlexWrap™ a minimum of 12 inches longer than width of sill rough opening. Apply primer as required by manufacturer.

B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. Apply 9-inch wide strips of DuPont™ StraightFlash™ at jambs. Align flashing with interior edge of jamb framing. Start StraightFlash™ at head of opening and lap sill flashing down to the sill.

E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.

F. Install DuPont™ FlexWrap™ at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.

G. Coordinate flashing with window installation.

H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer’s instructions and ASTM C 1193.

I. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont™ StraightFlash™ over the 45-degree seams.

J. Tape top of window in accordance with manufacturer recommendations.

K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer’s instructions and ASTM C 1193.

3.6 OPENING PREPARATION (for use with flanged windows)

A. Cut weather barrier in an "I-cut" pattern. A modified "I-cut" is also acceptable

1. Cut weather barrier horizontally along the bottom of the header.
2. Cut weather barrier vertically 2/3 of the way down from top center of window opening.
3. Cut weather barrier diagonally from bottom of center vertical cut to the left and right corners of the opening.
4. Fold side and bottom weather barrier flaps into window opening and fasten.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.7 FLASHING (for use with flanged windows)

A. Cut 6 inch or 9 inch wide DuPont™ FlexWrap™ a minimum of 12 inches longer than width of sill rough opening.

B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.

E. Install window according to manufacturer's instructions.

F. Apply 4-inch wide strips of DuPont™ StraightFlash™ at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.

G. Apply 4-inch wide strip of DuPont™ StraightFlash™ as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.

H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont™ StraightFlash™ over the 45-degree seams.

I. Tape head flap in accordance with manufacturer recommendations

J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.8 FIELD QUALITY CONTROL

A. Notify manufacturer's designated representative to obtain required periodic observations of weather barrier assembly installation.

3.9 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION

SECTION 07 27 26
FLUID-APPLIED WEATHER BARRIERS
DuPont ™ Tyvek® Fluid Applied WB System

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied, vapor permeable weather barrier membrane. (DuPont™ Tyvek® Fluid Applied WB System.)

B. Joint Treatment:

1. Joint Tape.
2. Joint Compound. (DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound, trowel grade)

C. Flashing:

1. Vapor Permeable Fluid-Applied Elastomeric Flashing. (DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound)
2. Flexible Flashing.(DuPont™ FlexWrap™NF)
3. Sheet Flashing. (DuPont™ StraightFlash™)
4. Thru Wall Flashing. (Hyload™)

D. Sealant. (DuPont™ Sealant for Tyvek® Fluid Applied Systems)

E. Primers for flexible flashing and sheet flashing.

1.2 REFERENCES

A. ASTM International

1. ASTM C 1250 – Standard Test Method for Nonvolatile Content of Cold Liquid-Applied Elastomeric Waterproofing Membranes.
2. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
3. ASTM D 2240 – Standard Test Method for Rubber Property – Durometer Hardness.
4. ASTM D 4541 – Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
5. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
6. ASTM E 96 - Test Method for Water Vapor Transmission of Materials
7. ASTM E 283 – Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.
8. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Skylight, Doors and Curtain Walls by Uniform Static Air Pressure Differences.
9. ASTM E 779 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
10. ASTM E 783 – Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.

11. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
12. ASTM E 1186 – Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
13. ASTM E 1677 - Specification for Air Retarder Material or System for Framed Building Walls.
14. ASTM E 2178 – Standard Test Method for Air Permeance of Building Materials
15. ASTM E 2357 – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
16. ASTM G155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
17. ASTM C 1305 - Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane.

B. AATCC – American Association of Textile Chemists & Colorists

1. Test Method 127 Water Resistance: Hydrostatic Pressure Test.

C. TAPPI

1. Test Method T-460; Air Resistance of Paper (Gurley Hill Method).

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures.

B. Product Data: Submit manufacturer's current technical literature for each component.

C. Quality Assurance Submittals:

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier system installation.

D. Closeout Submittals:

1. Refer to Section 01 70 00 Project Closeout.
2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installer shall have experience with installation of commercial fluid-applied weather barrier assemblies under similar conditions.
2. Installer shall be trained and certified for installation by manufacturer.

B. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

C. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

D. Mock-up:

1. Install mock-up using approved weather barrier system including membrane, flashing, joint and detailing compound and related weather barrier accessories according to weather barrier manufacturer's current printed instructions and recommendations.

   a. Mock-up size: 8 feet by 8 feet.
   b. Mock-up Substrate: Match wall assembly construction, including window opening.
   c. Mock-up may remain as part of the work.

2. Contact manufacturer's Tyvek® Specialist prior to weather barrier system installation, to perform required mock-up visual inspection and analysis as required for warranty.

E. Pre-installation Meeting

1. Refer to Section 01 31 00 Project Management and Coordination.
2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, certified installer, Owner's Representative, and weather barrier manufacturer's designated field representative.
3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier system materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 60 00 Product Requirements.

B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store weather barrier materials as recommended by manufacturer.

1.6 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier system with installation of windows, doors, louvers and flashings to provide a weather-tight barrier system.

B. Schedule installation of exterior cladding within nine months of weather barrier system installation.

1.7 WARRANTY

A. Limited Warranty

1. Manufacturer's warranty for weather barrier for a period of ten (10) years from date of Purchase.
2. Pre-installation meeting and jobsite observations by weather barrier manufacturer for warranty is required prior to assembly installation.

PART 2 - PRODUCTS

2.1 WEATHER BARRIER

A. Manufacturer: DuPont Building Innovations; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 1.800.44TYVEK (8-9835); http://weatherization.tyvek.com

1. Description: A single-component, low VOC, 25 mil thick synthetic polymer fluid-applied product with superior elasticity and flexibility providing resistance to air flow, bulk water and wind driven rain yet allows moisture vapor to escape.
2. Basis of Design: DuPont™ Tyvek® Fluid Applied WB System; including DuPont™ Tyvek® Fluid Applied WB, DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound, DuPont™ Tyvek® Fluid Applied Flashing – Brush Grade and DuPont™ Sealant for Tyvek® Fluid Applied Systems.

B. Performance Characteristics:

1. Air Penetration Resistance (Material):
   a. 0.0002 cfm/ft2 at 75 Pa, when tested in accordance with ASTM E 2178.
   b. Air infiltration greater than 10,000 seconds per 100cc, when tested in accordance with TAPPI Test Method T-460.
2. Air Penetration Resistance (System / Assembly):
   a. ≤ 0.01 cfm/ft2 at 75 Pa, when tested in accordance with ASTM E 2357.
   b. ≤ 0.01 cfm/ft2 at 75 Pa, Type I Air Barrier, when tested in accordance with ASTM E 1677.
3. Water Vapor Transmission: 25 perms, when tested in accordance with ASTM E 96, Method B at 25 mils DFT (Dry Film Thickness).
4. Water Penetration Resistance: Greater than 1000 cm when tested in accordance with AATCC Test Method 127. No leakage at 15 psf when tested in accordance with ASTM E 331.
5. Tensile Strength: Minimum 169 lbs/in^2, when tested in accordance with ASTM D 412.
6. Estimated Elongation: 420% in accordance with ASTM D 412.
7. Hardness: Passes at a Shore A hardness of 71, when tested in accordance with ASTM D 2240.
8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 25, Smoke Developed: 25.
9. UV Resistance: 9 months
10. Volatile Organic Content (VOC): Less than 2% (25-30 g/L) when measured in accordance with ASTM C 1250.
11. Adhesion Strength (Concrete): Greater than 33 psi when measured in accordance with ASTM D 4541.
12. Low Temperature Crack Bridging: Pass, when tested in accordance with ASTM C 1305.

2.2 ACCESSORIES

A. Joint Treatment:

1. Joint Tape:
   a. Product: Self-adhered fiberglass mesh tape as recommended by weather barrier manufacturer.
2. Joint Compound: Fluid-applied, vapor permeable, elastomeric flashing material; trowel applied.
   a. Product: DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound

B. Flashing:

1. Vapor permeable fluid-applied elastomeric flashing:
   a. Product: DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound
2. Flexible flashing with butyl adhesive layer.
   a. Product: DuPont™ FlexWrap™ NF.
3. Sheet flashing with butyl adhesive layer.
   a. Product: DuPont™ StraightFlash™.
4. Thru-Wall flashing, with butyl adhesive layer.
   a. Product: Hyload™ Thru Wall flashing, cloaks, and accessories.

C. Primers for flexible flashing and sheet flashing:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
2. Products:
   a. DuPont™ Adhesive/Primer
   b. Hyload Hyprime Primer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 PREPARATION

A. Complete surface preparation, priming, flashing and detailing of openings, cracks, and material transitions prior to beginning installation of fluid-applied weather barrier system.

B. Surfaces shall be clean and free of frost, oil, grease, mold and efflorescence prior to application of fluid-applied weather barrier system.

3.3 INSTALLATION - DETAILING

A. Corners: Apply 1/2 inch fillet bead of joint compound applied to full-height of inside corners.

B. Joint treatment:

1. Sheathing:
   a. Joints shall be prepared per manufacturer's approved joint treatment details.
   b. Apply joint tape as recommended by fluid-applied weather barrier manufacturer.
      1) No joint treatment required for joints up to 1/16 inch.
      2) Joints 1/16 to 1/4 inch: Fluid-applied joint compound applied to form a 1 inch width on each side of sheathing joint; smooth joint compound across sheathing joint. Thickness shall be 15 to 25 mils.
      3) Joints 1/16 to 1/2 inch: Apply joint tape to bridge both sides of joint equally. Apply fluid-applied joint compound and trowel smooth embedding joint compound uniformly into joint tape to form a 1 inch width on each side of sheathing joint at a consistent thickness of 15 to 25 mils.
      4) Joints 1/2 to 1 inch: Apply sheet flashing primer above and below sheathing joint. Center sheet flashing over sheathing joint and press firmly in place per manufacturer's recommendations.

2. Non-movement joints in masonry and transitions to columns and beams:

a. Joints 1/4 inch wide or less: Apply fluid-applied joint compound a minimum of 2 inches wide by 60 mils thick to each side of joint or crack.
b. Joints 1/4 to 1/2 inch: Apply joint tape to joint, then apply joint compound to joint 2 inches wide by 60 mils thick.

C. Apply fluid-applied joint compound to cladding anchors prior to installation of weather barrier membrane per manufacturer's instructions.

D. Apply fluid-applied joint compound around penetrations in exterior walls forming a fillet bead minimum ½ inch onto each surface.

E. Installation – Vapor permeable fluid-applied elastomeric flashing at openings:

1. At jambs and head of rough opening: Apply 25 mil thickness of fluid-applied flashing to full depth of opening and 2 inches onto outside face of opening.

F. Installation – Self-adhered flexible and sheet flashing at openings:

1. Prime substrates as recommended by self-adhered sheet membrane flashing manufacturer. Cut flexible flashing a minimum of 12 inches longer than length of sill rough opening.
2. Cover horizontal sill by aligning flexible flashing so that 2 inches will extend onto the face of the wall. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure sheet membrane tightly into corners by working in along the sill before adhering up the jambs.
3. Fan flexible flashing at bottom corners onto face of wall. Firmly press in place.
4. Apply 9-inch wide strips of sheet flashing at jambs. Align sheet flashing so that 2 inches will extend onto the face of the wall. Start sheet flashing at head of opening and lap sheet membrane at sill.
5. Coordinate flashing with fluid-applied weather barrier and window installation.

G. Allow Fluid-Applied Flashing, Joint Compound and Sealant to cure for minimum 24 hours before coating with Fluid-applied Weather Barrier.

3.4 INSTALLATION - FLUID-APPLIED WEATHER BARRIER

A. Install fluid-applied weather barrier prior to installation of windows, doors, and louvers.

B. Mask and protect any adjacent finished surfaces from fluid-applied weather barrier material.

C. Install fluid-applied weather barrier over exterior face of required exterior wall substrates in accordance with weather barrier manufacturer recommendations and instructions.

D. Install fluid-applied weather barrier by power-rolling method to achieve 25 mils providing a consistent and uniform thickness.

E. Repair any voids, holidays, or non-uniform installations or damage by other trades to proper mil thickness prior to installation of final cladding assemblies.

3.5 FIELD QUALITY CONTROL

A. Notify weather barrier manufacturer's designated representative to obtain required periodic observations of weather barrier system installation.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections as required in Contract Documents.

C. Inspections: Weather barrier materials, accessories, and installation are subject to inspection for compliance with performance requirements.

D. Tests: As determined by Owner's testing agency from among the following tests:

1. Quantitative Air-Leakage Testing: Weather barrier assemblies will be tested for air infiltration according to ASTM E 783.
2. Quantitative Air-Leakage Testing: Whole building air leakage will be tested in accordance with ASTM E 779, ASTM E 1827 or equivalent.
3. Qualitative Air-Leakage Testing: Weather barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186.
4. Qualitative Water-Leakage Testing: Weather barrier assemblies will be tested for water leakage according to ASTM E 1105.

E. Weather barriers assemblies will be considered defective upon failure of inspections and specific project testing required.

1. Apply additional fluid-applied weather barrier material, in accordance with manufacturer's instructions, where inspection results indicate insufficient thickness, voids, skips, pinholes or other defects as recommended by weather barrier manufacturer.
2. Remove and replace deficient weather barrier system components for retesting as specified above.

F. Repair damage to weather barriers caused by destructive testing; follow manufacturer's written instructions.

3.6 PROTECTION AND CLEANING

A. Protect weather barrier from contact with incompatible materials and sealants not approved per weather barrier manufacturer’s recommendation.

B. Protect installed weather barrier system from damage during construction prior to cladding installation.

1. If damaged or exposed to UV beyond nine (9) months, clean and prepare surfaces and install additional, full-thickness, fluid-applied weather barrier application in accordance with weather barrier manufacturer's instructions.

C. Remove masking materials and adjacent protection after weather barrier installation.

END OF SECTION

SECTION 07 41 13
METAL ROOF PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanically-seamed, standing seam metal roof panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for structural steel framing supporting metal panels.

B. Division 05 Section "Steel Decking" for continuous metal decking supporting metal panels.

C. Division 05 Section "Cold-Formed Metal Trusses" for cold-formed metal trusses supporting metal panels.

D. Division 07 Section Roof Insulation for thermal insulation installed under metal panels.

E. Division 07 Section "Air Barriers" for air barriers within roof assembly and adjacent to roof assembly.

F. Division 07 Section "Sheet Metal Flashing and Trim" for formed sheet metal copings, flashings, reglets, and roof drainage items in addition to items specified in this Section.

G. Division 07 Section "Manufactured Roof Specialties" for manufactured copings, reglets, and roof drainage items in addition to items specified in this Section.

H. Division 07 Section Joint Protection for field-applied Joint Sealants.

1.3 REFERENCES

A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:

1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
2. AAMA 809.2 - Voluntary Specification Non-Drying Sealants.

B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM): www.astm.org:

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM A 980 - Standard Specification for Steel, Sheet, Carbon, Ultra High Strength Cold Rolled.
5. ASTM C 645 - Specification for Nonstructural Steel Framing Members.
6. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
7. ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
8. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
9. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
10. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
11. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
12. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
13. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

D. International Accreditation Service (IAS):

1. IAS AC 472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

E. Underwriters Laboratories, Inc. (UL): www.ul.com:

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.
3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.5 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal roof panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under IAS AC 472 Part B.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

a. Product data, including certified independent test data indicating compliance with requirements.
b. Samples of each component.
c. Sample submittal from similar project.
d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
e. Sample warranty.
f. IAS AC 472 certificate.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
3. Approved manufacturers must meet separate requirements of Submittals Article.

C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

1.6 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, roof accessories, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.

1. Indicate points of supporting structure that must coordinate with metal panel system installation.
2. Include data indicating compliance with performance requirements.
3. Include structural data indicating compliance with requirements of authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch long section of each metal panel profile. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements, witnessed by a professional engineer.

B. Qualification Information: For Installer firm and Installer's field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC 472.

D. Manufacturer's Warranty: Sample copy of manufacturer's standard warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instructions. Provide wood collars for stacking and handling in the field.

1.10 COORDINATION

A. Coordinate sizes, profiles, and locations of roof curbs and other roof-mounted equipment and roof penetrations, based upon sizes of actual selected equipment.

1.11 WARRANTY

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.; Houston TX. Tel: (877)713-6224; Email: info@mbci.com; Web: www.mbci.com.

1. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.

a. Wind Uplift Testing: Certify capacity of metal panels by actual testing of proposed assembly per ASTM E 1592.

2. Snow Loads: N/A
3. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/180 of the span with no evidence of failure.
4. Seismic Performance: Comply with ASCE 7, Chapter 11 Seismic Design Criteria.

C. Wind Uplift Resistance: Refer to sheet S1.03 of the Construction Documents for wind uplift requirements.

D. Air Infiltration, ASTM E 1680: Maximum 0.006 cfm/sq. ft. at static-air-pressure difference of 6.24 lbf/sq. ft.

E. Water Penetration Static Pressure, ASTM E 1646: No uncontrolled water penetration at a static pressure of 25 lbf/sq. ft.

F. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.3 METAL ROOF PANELS

A. Mechanically-seamed, Concealed Fastener, Metal Roof Panels: Structural metal roof panel consisting of formed metal sheet with vertical ribs at panel edges, installed by lapping and mechanically interlocking edges of adjacent panels, and attaching panels to supports using concealed clips and fasteners in a weathertight installation.

1. Basis of Design: MBCI, Curved BattenLok, www.mbci.com/curvedbattenlok.html.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 prepainted by the coil-coating process per ASTM A 755/A 755M.

3. Nominal Coated Thickness: 24 gauge.
4. Panel Surface: Smooth with striations in pan.
5. Exterior Finish: Fluoropolymer two-coat system
6. Color: Natural Patina

7. Panel Width: 16 inches
8. Panel Seam Height: 2 inch
9. Joint Type: Mechanically seamed.

2.4 METAL ROOF PANEL ACCESSORIES

A. General: Provide complete metal roof panel assembly incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings, in manufacturer's standard profiles. Provide required fasteners, closure strips, thermal spacers, splice plates, support plates, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Clips: Provide panel clip of type specified, at spacing indicated on approved shop drawings.

1. Two-piece Floating: ASTM C 645, with ASTM A 653/A 653M, G90 hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
2. Single-Piece Fixed: ASTM A 653/A 653M, G90 hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

D. Panel Fasteners: Self-tapping screws and other acceptable corrosion-resistant fasteners recommended by roof panel manufacturer. Where exposed fasteners cannot be avoided, supply fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.

E. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:

1. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.

F. Steel Sheet Miscellaneous Framing Components: ASTM C 645, with ASTM A 653/A 653M, G60 hot-dip galvanized zinc coating.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Fabricate metal panel joints configured to accept factory-applied sealant providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.

C. Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

A. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, meeting solar reflectance index requirements.

1. Basis of Design: MBCI, Signature 300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.

1. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable supports at recommended spacing to match installation requirements of metal panels.
2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to metal panel system manufacturer but not greater than the following:

a. 1/4 inch in 20 foot in any direction.
b. 3/8 inch over any single roof plane.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal roof panel system installation.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, girts, furring, and other miscellaneous panel support members according to ASTM C 754 and manufacturer's written instructions.

B. Flashings: Provide flashings as required to complete metal roof panel system. Install in accordance with Section 07 62 00 "Sheet Metal Flashing and Trim" and approved shop drawings.

3.3 METAL PANEL INSTALLATION

A. Mechanically-Seamed, Standing Seam Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to supports using clips, screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.

1. Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
3. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

3.4 ACCESSORY INSTALLATION

A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Provide concealed fasteners except where noted on approved shop drawings.
4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.

1. Seal panels in accordance with insulated panel manufacturer's instructions, and project design drawings.
2. Prepare joints and apply sealants per requirements of Division 07 Section Joint Protection.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal roof panel manufacturer's instructions. Clean finished surfaces as recommended by metal roof panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Composite Metal panels.

1. Applications of composite metal panels include:

a. Exterior installation of composite metal panels.

b. Interior installation of composite metal panels.

B. Related Sections: Section(s) related to this section include:

1. Cold-Formed Metal Framing: Division 05 Cold-Formed Metal Framing Sections.
2. Sheet Metal Flashing and Trim: Division 07 Flashing and Sheet Metal Sections.
3. Joint Sealers: Division 07 Joint Sealers Sections.
4. Aluminum Windows: Division 08 Windows Sections.
5. Glazing: Division 08 Glass and Glazing Section.
6. Metal Framed Curtain Wall: Division 08 Glazed Curtain Wall Sections.

1.02 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International (ASTM):

1. ASTM D1781 Standard Test Method for Climbing Drum Peel for Adhesives.
2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E108 (Modified) Standard Test Methods for Fire Tests of Roof Coverings.
4. 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.
5. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Pressure Difference.
6. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Pressure Difference.

C. American Architectural Manufacturers Association (AAMA):

1. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

D. Underwriters Laboratories Inc. (UL):

1. UL 94 Standard for Flammability of Plastic Materials for Parts in Devices and Appliances.

E. International Organization for Standardization (ISO):

1. ISO 9001-2000 Quality Management Systems - Requirements.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide composite metal panels which have been manufactured, fabricated and installed to withstand loads from deflection and thermal movement and to maintain performance criteria stated by manufacturer without defects, damage or failure.

B. Deflection and Thermal Movement: Provide systems that have been tested and certified to conform to the following criteria under wind loading of:

1. Normal Deflection: Deflection of perimeter framing member not to exceed L/175 normal to plane of the wall; deflection of individual panels not to exceed L/60.

2. Anchor Deflection: At connection points of framing members to anchors, anchor deflection in any direction not to exceed 1/16 inch (1.6 mm).

C. Water and Air Leakage: Provide systems that have been tested and certified to conform to the following criteria:

1. Air Leakage (ASTM E283): Not more than 0.06 (cfm)/sf of wall area (0.003 (L/s) m^2), when tested at 1.57 psf (0.075 kPa).

2. Water Penetration (ASTM E331): No water infiltration under static pressure at a differential of 10% of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.

a. Water penetration is defined as the appearance of uncontrolled water in the wall.

b. Wall design shall feature provisions to drain to the exterior face of the wall any leakage of water at joints and any condensation that may occur within the construction.

D. Structural: Provide systems that have been tested in accordance with ASTM E330 at a design pressure to meet code and have been certified to be without permanent deformation or failures of structural members.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.

1. Include details showing thickness and dimensions of the various system parts, fastening and anchoring methods, locations of joints and gaskets and location and configuration of joints necessary to accommodate thermal movement.

D. Samples: Submit selection and verification samples for finishes, colors and textures.

1. Selected Samples: Manufacturer's color charts or chips illustrating full range of colors, finishes and patterns available for composite metal panels with factory-applied finishes.

2. Verification Samples:

a. Structural: 12 inch × 12 inch (305 × 305 mm) sample composite panels in thickness specified, from an available stock color, including clips, anchors, supports, fasteners, closures and other panel accessories, for assembly approval. Include panel assembly samples not less than 24 inches × 24 inches (610 × 610 mm), showing 4-way joint.

b. Include separate sets of draw down samples on aluminum substrate, not less than 3 inches × 5 inches (76 × 127 mm), of each color and finish selected, for color approval. Larger samples of standard colors are available with production applied coatings.

E. Quality Assurance Submittals: Submit the following:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.
3. Manufacturer's Instructions: Manufacturer's installation instructions.
4. Manufacturer's Field Reports: Manufacturer's field reports.

F. Closeout Submittals: Submit the following:

1. Warranty: Warranty documents specified herein.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.
   a. Certificate: When requested, submit certificate indicating qualification.
2. Manufacturer Qualifications: Company with a minimum of 5 years of continuous experience manufacturing panel material of the type specified:
   a. Able to provide specified warranty on finish.
   b. Able to provide a list of 5 other projects of similar size, including approximate date of installation and the name of the Architect for each.
   c. Able to produce the composite material without outsourcing of coating or lamination process.
   d. Able to provide certificate of registration of ISO 9001-2000.
3. Fabricator Qualifications: Company with at least 3 years of experience on similar sized metal panel projects and qualified by the panel material manufacturer. Capable of providing field service representation during construction.

B. Mock-Ups: Install at project site a job mock-up using acceptable products and approved installation methods. Obtain Owner's and Architect's acceptance of finish color (draw down samples to be used for color approval of nonstandard coil coated colors), texture and pattern and workmanship standard. Comply with Division 01 Quality Control, Mock-Up Requirements Section.

1. Mock-up Size: 4' x 4'.
2. Maintenance: Maintain mock–up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, substrate conditions, installation instructions and warranty requirements. Comply with Division 01 Project Management and Coordination, Project Meetings Section.

D. Field Quality Control: Comply with panel system manufacturer's recommendations and guidelines for field forming of panels.

1.06 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Protection: Protect finish of panels by applying heavy duty removable plastic film during production.

2. Delivery: Package composite wall panels for protection against transportation damage. Provide markings to identify components consistently with drawings.

3. Handling: Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1. Storage: Store panels in well-ventilated space out of direct sunlight.

a. Protect panels from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.

b. Slope panels to ensure positive drainage of any accumulated water.

c. Do not store panels in any enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).

2. Damage: Avoid contact with any other materials that might cause staining, denting or other surface damage.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights Owner may have under the Contract Documents.

1. Warranty Period:

a. Panel Integrity: 10 years commencing on Date of Substantial Completion.

b. Finish: [Specify number of years] commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 COMPOSITE METAL PANELS

A. Manufacturer: Mitsubishi Plastics Composites America, Inc.

1. Contact: 401 Volvo Parkway, Chesapeake, VA 23320; Telephone (800) 422-7270; Fax: (757) 436-1896; E-mail: info@alpolic.com; website: www.alpolic-northamerica.com.

B. Proprietary Product: ALPOLIC Composite Metal Panels.

1. Standard ALPOLIC composite metal panels.

2.02 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted.

2.03 COMPOSITE METAL PANEL MATERIALS

A. Composite Metal Panels:

1. Core: Thermoplastic material that meets performance characteristics specified when fabricated into composite assembly.

2. Face Sheets: Aluminum alloy 3105 H14, 0.020 inch (0.51 mm) thick and as follows: [Choose coil or spray as applicable to quantity].

a. Coil coated with a fluoropolymer paint finish that meets or exceeds values expressed in AAMA 2605 where relevant to coil coatings.

B. Production Tolerances:

1. Width: +/- 2 mm.

2. Length: +/- 4 mm.

3. Thickness (4 mm Panel): +/- 0.008 inch (0.2 mm).

4. Thickness (6 mm Panel): +/- 0.012 inch (0.3 mm).

5. Bow: Maximum 0.5% length or width.

6. Squareness: Maximum 0.2 inch (5 mm).

7. Edges of sheets shall be square and trimmed.

C. Panel Thickness: [4 mm].

2.04 ACCESSORIES

A. General: Provide fabricator’s standard accessories, including fasteners, clips, anchorage devices and attachments.

2.05 RELATED MATERIALS

A. General: Refer to other related sections for related materials, including cold-formed metal framing, flashing and trim, joint sealers, aluminum windows, glass and glazing and curtain walls.

2.06 FABRICATION

A. General: Shop fabricate to sizes and joint configurations indicated on the drawings.

1. Where final dimensions cannot be established by field measurements, provide allowance for field adjustment as recommended by the fabricator.

2. Form panel lines, breaks and angles to be sharp and true, with surfaces that are free from warp or buckle.
3. Fabricate with sharply cut edges, with no displacement of aluminum sheet or protrusion of core.

2.07 FINISHES

A. Factory Finish: A fluoropolymer paint finish that meets or exceeds values expressed in AAMA 2605 where relevant to coil coatings.

2.08 SOURCE QUALITY

A. Source Quality: Obtain composite panel products from a single manufacturer.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions are acceptable for product installation.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

A. General:
1. Install panels plumb, level and true, in compliance with fabricator's recommendations.
2. Anchor panels securely in place, in accordance with fabricator's approved shop drawings.
3. Comply with fabricator's instructions for installation of concealed fasteners and with provisions of Section 07 90 00 for installation of joint sealers.
4. Installation Tolerances: Maximum deviation from horizontal and vertical alignment of installed panels: 0.25 inch (6.4 mm) in 20 feet (6.1 m), non-cumulative.

3.05 FIELD QUALITY REQUIREMENTS

A. Fabricator's Field Services: Upon Owner's request, provide fabricator's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with fabricator's instructions.

3.06 ADJUSTING

A. Adjusting:
1. Repair panels with minor damage such that repairs are not discernible at a distance of 10 feet (3.1 m).
2. Remove and replace panels damaged beyond repair.
3. Remove protective film immediately after installation of joint sealers and immediately prior to completion of composite metal panel work.
4. Remove from project site damaged panels, protective film and other debris attributable to work of this section.

3.07 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.08 PROTECTION

A. Protection: Protect installed product's finish surfaces from damage during construction.

1. Institute protective measures as required to ensure that installed panels will not be damaged by work of other trades.

END OF SECTION

SECTION 07 42 93
SOFFIT PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flush-profile, concealed fastener, lap-seam metal soffit panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.

B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.

C. Division 07 Section "Thermal Insulation" for thermal insulation installed under metal panels.

D. Division 07 Section "Air Barriers" for air barriers within metal panel assembly and adjacent to metal panel assembly.

E. Division 07 Section "Metal Roof Panels" for metal roof panels installed with metal soffit and liner panels.

F. Division 07 Section "Metal Wall Panels" for metal wall panels installed with metal soffit and liner panels.

G. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.

H. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.3 REFERENCES

A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:

1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
2. AAMA 809.2 Voluntary Specification Non-Drying Sealants.

B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM): www.astm.org:

1. ASTM A755 - 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 A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
3. ASTM C920 - Specification for Elastomeric Joint Sealants.
4. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
5. ASTM D4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
6. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

D. International Accreditation Service (IAS):

1. IAS AC472 Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

1.4 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer accredited under IAS AC472, Part B.

B. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

C. **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 provisions of Section 1605 of the American Recovery and Reinvestment Act of 2009 (ARRA).

D. Steel Construction Publications: Comply with published recommendations in the following, unless more stringent requirements are indicated.

1. American Institute of Steel Construction (AISC): "Steel Construction Manual."
2. American Iron and Steel Institute (AISI): "Cold Formed Steel Design Manual."

1.5 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Prior to erection of framing, conduct pre-installation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.

3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.6 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products. Include data indicating compliance with performance requirements.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Indicate points of supporting structure that must coordinate with metal panel system installation.
2. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch- (305 mm-) long section of each metal panel profile. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements.

B. Qualification Information: For Installer firm and Installer’s field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472 Part B.

D. **Buy American Certification**: Manufacturers' letters of compliance acceptable to authorities having jurisdiction, indicating that products comply with requirements.

E. Manufacturer's warranty: Unexecuted sample copy of manufacturer's warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
3. Shield foam insulated metal panels from direct sunlight until installation.

1.10 WARRANTY

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.

B. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:

1. **Fluoropolymer** Two-Coat System:

a. Basis of Design System: **MBCI, Signature 300**.
b. Color fading in excess of 5 Hunter units per ASTM D2244.
c. Chalking in excess of No. 8 rating per ASTM D4214.
d. Failure of adhesion, peeling, checking, or cracking.
e. Warranty Period: [40] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: **MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.**; Houston TX. Tel: (877)713-6224; Email: info@ecoficientseries.com; Web: www.mbci.com.

1. Provide basis of design product.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E1592:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.

a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.

2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 of the span with no evidence of failure.
3. Seismic Performance: Comply with ASCE 7 Sections 9, "Earthquake Loads."

C. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.3 FORMED METAL SOFFIT PANELS

A. Flush-Profile, Concealed Fastener Metal Soffit Panels: Metal panels consisting of formed metal sheet with vertical panel edges, with flush joints between panels, field assembled with nested lapped edges, and attached to supports using concealed fasteners.

1. Basis of Design: **MBCI, Artisan Panel.**
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A755/A755M.

a. Nominal Thickness: 24 gage coated thickness, with smooth surface.

1) Exterior Finish: Fluoropolymer two-coat system

2) Color: As indicated in the drawings.

3. Panel Width: 12 inches (305 mm).
4. Panel Thickness: 1 inch (25 mm).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide complete metal panel assemblies incorporating trim, fasciae, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panels.

C. Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621[, meeting solar reflectance index requirements].

1. Basis of Design: **MBCI, Signature 300**.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

A. Concealed-Fastener Formed Metal Soffit Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading panel flange. Fit back flange of subsequent panel into secured flange of previous panel.

1. Cut panels in field where required using manufacturer's recommended methods.
2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.

C. Attach panel flashing trim pieces to supports using recommended fasteners.

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 CLEANING AND PROTECTION

A. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 54 23

ULTRAPLY™ MECHANICALLY ATTACHED TPO MEMBRANE ROOFING SYSTEM

I. GENERAL

The project, Triumph Public High School New Mercedes Campus located in Mercedes, TX, includes the provision of a complete Elevate UltraPly™ TPO membrane roofing system.

A. Summary

1. Furnish and install a complete TPO roofing system, including:
   a) Roofing Manufacturer's requirements for the specified warranty
   b) Preparation of roofing substrates
   c) Wood nailers for roofing attachment
   d) Insulation
   e) Mechanically Attached
   f) Metal roof edging and copings
   g) Flashings
   h) Walkway pads
   i) Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system

B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.

C. Comply with the published recommendations and instructions of the roofing membrane Manufacturer, at http://www.holcimelevate.com.

D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane Manufacturer.

E. Related Sections (as present or needed)

1. Section 06 10 00 – Rough Carpentry
2. Section 07 62 00 – Sheet Metal Flashing and Trim
3. Section 07 72 00 – Roof Accessories
4. Section 22 14 26.13 – Roof Drains

F. Definitions

1. Definitions in the current editions of ASTM D1079 and NRCA's “The NRCA Roofing Manual: Membrane Roof Systems” apply to work of this Section.

G. Submittals

1. Product Data

a) Provide membrane Manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane Manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
b) Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable. Include data itemizing the components of the classified or approved system.

2. Installation Instructions
   a) Provide Manufacturer's instructions to Installer, marked up to show exactly how all components will be installed.
   b) Where instructions allow installation options, clearly indicate which option will be used.
3. Shop Drawings
   a) Provide the roof membrane Manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
4. Provide copy of Pre-Installation Notice to show that Manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the Manufacturer.
5. Specimen Warranty
6. Closeout Submittals
   a) Executed Warranty
   b) Maintenance data

H. Quality Assurance

1. Applicator Qualifications
   a) Current Elevate Master Contractor status
   b) At least five years' experience in installing specified system
2. Pre-Installation Conference
   a) Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   b) Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
   c) Notify Architect well in advance of meeting.

I. Delivery, Storage and Handling

1. Deliver products in Manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
2. Discard and legally dispose of material that cannot be applied within its stated shelf life.
3. Store materials clear of ground and moisture with weather protective covering.
4. Keep combustible materials away from ignition sources.
5. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection

of deck and/or structural overloading.

J. Field Conditions

1. Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with Manufacturer's written instructions and warranty requirements.

K. Warranty

1. Provide Elevate 20-year Red Shield™ Roofing System Limited Warranty covering membrane, roof insulation, and system accessories. Comply with all warranty procedures required by Manufacturer, including notifications, scheduling, and inspections.
2. Limit of Liability: No dollar limitation (NDL)
3. Scope of Coverage: Repair leaks in the roofing system caused by
   a) Ordinary wear and tear
   b) Manufacturing defect in Elevate materials
   c) Defective workmanship used to install these materials
   d) Damage due to winds up to 55 mph
   e) Not Covered:
      (1) Damage due to winds in excess of 55 mph
      (2) Damage due to hurricanes or tornadoes
      (3) Hail
      (4) Intentional damage
      (5) Unintentional damage due to normal rooftop inspections, maintenance, or service

II. PRODUCTS

A. Manufacturers

1. Acceptable Manufacturer – Roofing System: Elevate roofing, lining, and wall systems, Nashville, TN, http://www.holcimelevate.com
   a) Roofing systems manufactured by others may be acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the Manufacturer meets the following qualifications:
      (1) Specializing in manufacturing the roofing system to be provided
      (2) Minimum ten years of experience manufacturing the roofing system to be provided
      (3) Able to provide a no dollar limit, single source roof system warranty backed by corporate assets in excess of one billion dollars
      (4) ISO 9001 certified
      (5) Able to provide polyisocyanurate insulation produced in own facilities
2. Manufacturer of Insulation and Cover Board: Same Manufacturer as roof membrane
3. Manufacturer of Metal Roof Edging: Same Manufacturer as roof membrane

a) Metal roof edging products by other Manufacturers are not acceptable.
b) Field- or shop-fabricated metal roof edgings are not acceptable unless the detail is ES-1 certified.

4. Substitution Procedures: See Instructions to Bidders
   a) Submit evidence that the proposed substitution complies with the specified requirements.

B. Roofing System Description

1. Roofing System
   a) Membrane: Thermoplastic polyolefin (TPO)
      (1) Thickness: 60-MIL
      (2) Membrane Attachment: Mechanically Attached
   b) Comply with applicable local building code requirements.
   c) Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification
   d) Provide assembly complying with Factory Mutual Corporation (FM) Roof Assembly Classification, FM Data Sheets 1-28 and 1-29, and meeting minimum requirements of FM 1-90 wind uplift rating.
2. Vapor Barrier over deck/deck cover:
   a) Membrane: High density polyethylene sheet with SBS modified bitumen adhesive
   b) Attachment: Self-adhering
   c) Insulation:
      (1) Total System R-Value: 30 minimum
         (a) Maximum Board Thickness: 3″ (76.2 mm)
         (b) Use as many layers as necessary to achieve required R-value
         (c) Stagger joints in adjacent layers
      (2) Base Layer: Polyisocyanurate foam board, non-composite
         (a) Attachment: Mechanical fastening
      (3) Fill Layers: Polyisocyanurate foam board, non-composite
         (a) Attachment: Mechanical fastening
      (4) Top Layer: Polyisocyanurate foam board, non-composite
         (a) Attachment: Mechanical fastening
         (b) Gypsum-Based Cover Board
            (i) Thickness: 0.5″ (12.7 mm)
            (ii) Attachment: Mechanical fastening

C. TPO Membrane Materials

1. Roofing and Flashing Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:

a) Thickness: 0.060″ (1.52 mm)
b) Color: White
c) Sheet Width: Use sheet width required to meet wind uplift and/or fastener spacing requirements
d) Acceptable Product: UltraPly™ TPO Membrane by Elevate

2. Membrane Fasteners: Type and size as required by roof membrane Manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane Manufacturer.
3. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18″ (457 mm) wide; UltraPly™ TPO 18″ Curb Flashing.
4. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber, color to match roof membrane; UltraPly™ TPO Unsupported Flashing by Elevate
5. Factory-formed Weldable Flashing Accessories: UltraPly™ TPO Flashing (various) by Elevate
6. Self-Adhering Flashing Membrane: Unsupported (non-reinforced) TPO membrane factory laminated to white seam tape; UltraPly™ TPO QuickSeam™ Flashing by Elevate
7. Factory-formed Self-Adhering Flashing Accessories: UltraPly™ TPO QuickSeam™ Flashing (various) by Elevate
8. Bonding Adhesive: Formulated for compatibility with TPO membrane and wide variety of substrate materials; UltraPly™ Bonding Adhesive by Elevate
9. Seam Edge Treatment: Clear polymer-based sealant, formulated for sealing exposed edges of membrane; UltraPly™ TPO Cut Edge Sealant by Elevate
10. Pourable Sealer: One part polyurethane; White One-Part Pourable Sealer by Elevate.
11. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed; Water Block Seal S-20 by Elevate
12. Metal Plates and Strips used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria
13. Termination Bars: Aluminum bars with integral caulk ledge; 1.3″ (33 mm) wide by 0.10″ (2.5 mm) thick; Termination Bar by Elevate
14. Roof Walkway Pads: TPO pad designed to provide protection from essential rooftop services and traffic and maintain the integrity of the existing roof surface; UltraPly™ TPO Walkway by Elevate

D. Roof Insulation and Cover Boards

1. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with glass reinforced mat laminated to facers, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
   a) Thickness: R30
   b) Size: 48″ (1.22 m) by 96″ (2.44 m), nominal (if mechanically fastened
   c) R-Value (LTTR) per inch (25 mm): min. 6.2R at 40 °F (4.4 °C) and min. 5.7R at 75 °F (23.9 °C)
   d) Compressive Strength: 20 psi (138 kPa)

e) Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents
f) Acceptable Product: ISOGARD GL polyiso board insulation by Elevate
g) Gypsum-Based Cover Board: Non-combustible, water-resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
   (1) Size: 48″ (1.22 m) by 96″ (2.44 m), nominal (if mechanically fastened)
   (2) Thickness: 0.5″ (12.7 mm)
   (3) Surface Water Absorption: 2.5 g max., when tested in accordance with ASTM C 473
   (4) Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84
   (5) Combustibility: Non-combustible, when tested in accordance with ASTM E 136
   (6) Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies
   (7) Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks

2. Insulation Fasteners: Type and size as required by roof membrane Manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane Manufacturer.
3. Low Rise Foam Adhesive: Two-component, low-rise polyurethane adhesive designed to attach polyisocyanurate insulation to a variety of acceptable substrates; Twin Jet by Elevate

E. Accessory Materials

1. Wood Nailers: PS 20-dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
   a) Width: 3 ½″ inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it
   b) Thickness: Same as thickness of roof insulation

III. INSTALLATION

A. General

1. Install roofing, insulation, flashings, and accessories in accordance with roofing Manufacturer's published instructions and recommendations for the specified roofing system. Where Manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
2. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
3. Do not start work until Pre-Installation Notice has been approved by Manufacturer as confirmation that this project qualifies for a Manufacturer's warranty.
4. Perform work using competent and properly equipped personnel.
5. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the Applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

6. Install roofing membrane only when surfaces are clean, dry, smooth, and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult Manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 °F (15 to 25 °C).
7. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
8. Protect from spills and overspray from bitumen, adhesives, sealants, and coatings.
9. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
10. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
11. Until ready for use, keep materials in their original containers as labeled by the Manufacturer.
12. Consult membrane Manufacturer's instructions, container labels, and Safety Data Sheets (SDS) for specific safety instructions. Keep all adhesives, sealants, primers, and cleaning materials away from all sources of ignition.

B. Examination

1. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment, and that deflection will not strain or rupture roof components or deform deck.
2. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
3. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
4. Examine roof substrate to verify that it is properly sloped to drains.
5. Verify that the specifications and drawing details are workable and not in conflict with the roofing Manufacturer's recommendations and instructions; start of work constitutes acceptance of project conditions and requirements.

C. Preparation

1. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease, and other materials that may damage the membrane.
2. Fill all surface voids in the immediate substrate that are greater than 1/4″ (6 mm) wide with fill material acceptable to membrane Manufacturer.
3. Seal, grout, or tape deck joints, where needed, to prevent seepage into building.

D. Insulation and Cover Board Installation

1. Install insulation in configuration and with attachment method(s) specified in PART 2, under Insulation.
2. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
3. Lay roof insulation in courses parallel to roof edges.
4. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than ¼″ (6 mm). Fill gaps greater than ¼″ (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than ¼″ (6 mm).
5. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for specified FM Class and membrane Manufacturer, whichever is more stringent.

E. Single-Ply Membrane Installation

1. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
2. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
3. Install membrane without wrinkles and without gaps or fishmouths in seams, and bond and test seams and laps in accordance with membrane Manufacturer's instructions and details.
   a) Mechanically Attached Membrane: Fasten membrane using membrane Manufacturer's recommended fasteners and plates, fastener spacing, and procedures.
4. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 1:12 inches (8.3%) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing Manufacturer. Exceptions: Round pipe penetrations less than 18″ (460 mm) in diameter and square penetrations less than 4″ (200 mm) square.
   a) Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing Manufacturer and compliant with IBC.

F. FLASHING AND ACCESSORIES INSTALLATION

1. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane Manufacturer's recommendations and details.
2. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
   a) Follow roofing Manufacturer's instructions.
   b) Use weldable TPO-coated metal where membrane-to-metal connections occur.
   c) Remove protective plastic surface film immediately before installation.
   d) Install water block sealant under the membrane anchorage leg.
   e) Flash with Manufacturer's recommended flashing sheet unless otherwise indicated.
   f) Where single application of flashing will not completely cover the metal flange, install additional

piece of flashing to cover the metal edge.

g) If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.

h) When the roof slope is greater than 1:12 (8.3%), apply seam edge treatment along the back edge of the flashing.

3. Scuppers: Set TPO-coated metal scuppers in sealant and weld to membrane as recommended by Manufacturer.
4. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing Manufacturer.
5. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces:
   a) Install weathertight flashing at all walls, curbs, parapets, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8″ (200 mm) above membrane surface.
   b) Use the longest practical flashing pieces.
   c) Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane Manufacturer's recommendations.
   d) Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
   e) Provide termination directly to the vertical substrate as shown on roof drawings.
6. Roof Drains:
   a) Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed Manufacturer's recommendations.
   b) Position membrane, then cut a hole for roof drain to allow ½″ to ¾″ (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
   c) Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
   d) Apply sealant on top of drain bowl where clamping ring seats below the membrane
   e) Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
7. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
8. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
9. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2″ (50 mm) deep, with at least 1″ (25 mm) clearance from penetration, sloped to shed water.
10. Structural Steel Tubing: If corner radii are greater than ¼″ (6 mm) and longest side of tube does not exceed 12″ (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.

11. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by Manufacturer.

G. Walkway Installation

1. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
   a) Use specified walkway pads unless otherwise indicated.
   b) Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1″ (25 mm) and maximum of 3″ (75 mm) from each other to allow for drainage.
   c) If installation of walkway pads over field fabricated splices or within 6″ (150 mm) of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6″ (150 mm) on either side.
   d) Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

H. Field Quality Control

1. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system Manufacturer specifically to inspect installation for warranty purposes (e.g., not a sales representative).
2. Perform all corrections necessary for issuance of warranty.

I. Cleaning

1. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
2. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of Manufacturers of components and surfaces.
3. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

J. Protection

1. Where construction traffic must continue over finished roof membrane, provide durable protection, and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 07 60 00
SHEET METAL FLASHING AND TRIM

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

A. Note: All metal shall be supplied by the roofing membrane manufacturer and shall comply with and be included in the warranty specified in Section 07550. Metal cladding to be in conformance with ANSI SPRI ES-1 certification program.

B. Pitch pans, scuppers and all metal requiring solder/welding shall be .040 stainless steel.

C. All flat stock sheet metal materials used in the roofing system shall be supplied by The Garland Company, Inc. to maintain campus wide system standard and to provide the 20 year No Dollar Limit, (NDL) “Edge to Edge” (ETE) total system warranty. Metal color as selected by Owner.

D. Provide all labor, equipment, and materials to fabricate and install the following.

1. Edge strip and flashing.

2. Fascia and trim.

3. Coping cap at parapets.

4. Thru-wall flashings

E. Related Work Specified Elsewhere:

1. Division 06 Section Rough Carpentry

2. Division 07 Section Modified Bituminous Membrane Roofing

3. Division 07 Section Roof Accessories

4. Division 07 Section Roof & Deck Insulation

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvannealed) by the Hot-Dip Process.

2. ASTM A792 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.

3. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

4. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

5. ASTM D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.

B. American National Standards Institute and Single Ply Roofing Institute (ANSI/SPRI)

1. ANSI/SPRI ES-1 Testing and Certification Listing of Shop Fabricated Edge Metal

C. Warnock Hersey International, Inc., Middleton, WI (WH)

D. Factory Mutual Research Corporation (FMRC)

E. Underwriters Laboratories (UL)

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

1. Latest Edition Architectural Sheet Metal Manual

G. National Roofing Contractors Association (NRCA)

1. Roofing and Waterproofing Manual

H. American Society of Civil Engineers (ASCE)

1. ASCE 7-05 Minimum Design Loads for Buildings and Other Structures.

1.4 SUBMITTALS FOR REVIEW

A. Product Data:

1. Provide manufacturer's specification data sheets for each product.

2. Metal material characteristics and installation recommendations.

3. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.

B. Samples: Submit two (2) samples, illustrating typical metal edge, coping, gutters, fascia extenders for material and finish.

C. Shop Drawings

1. For manufactured and shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.

2. Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.

3. Indicate type, gauge and finish of metal.

D. 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.

1.5 SUBMITTALS FOR INFORMATION

A. Design Loads: Any material submitted must be accompanied by a report signed by a certified testing company. This report shall show that the submitted equal meets the wind uplift and perimeter attachment requirements according to ASCE 7-05 and ANSI/SPRI ES-1.

B. A letter from an officer of the fabricating company certifying that the materials furnished for this project are the same as represented in tests and supporting data.

C. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

D. Certification of work progress inspection. Refer to Quality Assurance Article below.

E. Certifications:

1. Submit certification that the perimeter/edge metal products being used on this project have been tested according to ANSI/SPRI ES-1 criteria. Certification submitted must be provided by either NRCA, Independent Test Agency or the perimeter/edge metal manufacturer.

1.6 QUALITY ASSURANCE

A. Engage an experienced roofing contractor specializing in sheet metal flashing work with a minimum of five (5) years experience.

B. Maintain a full-time supervisor/foreman who is on the job-site at all times during installation. Foreman must have a minimum of five (5) years experience with the installation of similar system to that specified.

C. Upon request fabricator/installer shall submit work experience and evidence of financial responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.

B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials which may cause discoloration or staining.

1.8 PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal edge system.

1.9 DESIGN AND PERFORMANCE CRITERIA

A. Wind Uplift Pressures: Metal edge system must meet minimum design load pressures as determined by ASCE 7. Provide completed calculations to show ANSI/SPRI ES-1 test results meet the minimum wind uplift pressures.

B. Thermal expansion and contraction:

1. Completed metal edge flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

1.10 WARRANTIES

A. Owner shall receive one (1) warranty from manufacturer from Section 07550, including covering all of the following criteria. Multiple warranties are not acceptable.

1. Pre-finished metal material shall require a written twenty (20)-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D2244 or chalking excess of 8 units per ASTM D659. If either occurs material shall be replaced per warranty, at no cost to the Owner.

2. Changes: Changes or alterations in the edge metal system without prior written consent from the manufacturer shall render the system unacceptable for a warranty.

3. Warranty shall commence on date of substantial completion or final payment, whichever is agreed by contract.

4. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of two years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. Refer to Division 01 Section "Common Product Requirements."

B. All Flat-Stock sheet metal will be supplied by the Roof Membrane Manufacture to incorporate it into their Edge to Edge roof warranty.

C. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

2.3 ACCEPTABLE FABRICATORS

A. Any fabricator which has been certified by the NRCA (National Roofing Contractors Association) to fabricate their ANSI/SPRI ES-1 tested profiles on their Gravel-Stop, Metal Edge, Fascia and Coping Cap products**.**

B. Provide a product carrying a signed and sealed Performance Test Report from a testing company for ANSI/SPRI ES-1 on their Gravel-Stop, Metal Edge, Fascia and Coping Cap products.

C. Any fabricator with a Gravel-Stop, Metal Edge, Fascia and Coping Cap products that has been tested in accordance with ANSI/SPRI ES-1 standards. Proof of this testing must be provided via a report signed and sealed by a qualified third party testing agency. This report shall show that the submitted equal meets the wind uplift and perimeter attachment requirements according to ASCE 7-05 and ANSI/SPRI ES-1. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance

2.4 MATERIALS

A. Where sheet metal is required and no material or gauge is indicated, match existing, furnish and install the highest quality and gauges commensurate with referenced standard.

B. Flashing:

1. Steel: 20 gauge galvanized steel, G90 galvanizing, ASTM A 525.

2. Pre-finished sheet metal: 22 gauge galvanized steel. KYNAR 500 Fluorocarbon coated, <u>with strippable film</u>. Color selected by Architect.

3. Wall Reglet and Counter flashing: Fabricate to match Fry Reglet Springlok (2 piece spring action type), Type SM galvanized, with factory fabricated corners, end cap and lap joints. Include wind clips.

C. Termination Bar: Slotted aluminum bar, Olympic Fasteners.

D. Lead Flashings: Sheet complying with FS QQ-L-201. Grade B; formed from Common Desilverised Pig Lead complying with ASTM B-29. Weight 4.0 lbs./sq.ft. unless otherwise specified.

2.5 RELATED MATERIALS AND ACCESSORIES

A. Metal Primer: Zinc chromate type.

B. Plastic Cement: ASTM D 4586

C. Sealant: Tuff-Stuff One part polyurethane sealant.

D. Underlayment: Self Adhering SBS membrane.

E. Slip Sheet: Rosin sized building paper.

F. Fasteners:

1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.

2. Fastening shall conform to Factory Mutual requirements or as stated on section details, whichever is more stringent.

G. Gutter and Downspout Anchorage Devices: Material as specified for system.

PART 3 — EXECUTION

3.1 EXECUTION, GENERAL

A. Refer to Division 07 Section Common Work Results for Thermal and Moisture Protection.

3.2 PROTECTION

A. Isolate metal products from dissimilar metals, masonry or concrete with bituminous paint, tape, or slip sheet. Use gasketed fasteners where required to prevent corrosive reactions.

3.3 GENERAL

A. Secure fascia to wood nailers at the bottom edge with a continuous cleat.

B. Fastening of metal to walls and wood blocking shall comply with building code standards.

C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.

D. Allow sufficient clearances for expansion and contraction of linear metal components. Secure metal using fasteners as required by the system. Exposed face fastening will be rejected.

3.4 INSPECTION

A. Verify that curbs are solidly set and nailing strips located.

B. Perform field measurements prior to fabrication.

C. Coordinate work with work of other trades.

D. Verify that substrate is dry, clean and free of foreign matter.

E. Commencement of installation shall be considered acceptance of existing conditions.

3.5 SHOP-FABRICATED SHEET METAL

A. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

B. Hem exposed edges.

C. Angle bottom edges of exposed vertical surfaces to form drip.

D. Lap corners with adjoining pieces fastened and set in sealant.

E. Form joints for gravel stop fascia system, coping cap with a 3/8" opening between sections. Back the opening with an internal drainage plate formed to the profile of fascia piece.

F. Install sheet metal to comply with referenced ANSI/SPRI, SMACNA and NRCA standards.

3.6 CLEANING

A. Clean installed work in accordance with the manufacturer's instructions.

B. Replace damaged work than cannot be restored by normal cleaning methods.

3.7 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated. Comply with requirements of authorities having jurisdiction

3.8 FINAL INSPECTION

A. At completion of 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. Inspect work and 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. 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.

D. Notify the Contractor upon completion of corrections.

E. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

F. 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.

END OF SECTION

SECTION 0 76 10
METAL ROOFING

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

B. Furnish all labor, material, tools, equipment and services for all preformed roofing as indicated, in accord with provisions of Contract Documents.

C. Completely coordinate with work of all other trades.

D. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

E. See Division 1 for General Requirements.

F. Related work specified elsewhere:

G. Structural steel: Section 05100.

H. Steel joists: Section 05200 or 05400.

I. Flashing and sheet metal: Section 07600.

1.02 QUALITY ASSURANCE

A. Applicable Standards:

1. SMACNA: "Architectural Sheet Metal Manual", Sheet Metal and Air Conditioning Contractors National Association, Inc.
2. LGSI: “Light Gage Structural Institute”
3. AISC: "Steel Construction Manual", American Institute of Steel Construction.
4. AISI: "Cold Form Steel Design Manual", American Iron and Steel Institute (1996 Edition).
5. UL580: " Tests for Uplift Resistance of Roof Assembles", Underwriters Laboratories, Inc.
6. ASTM E 1592-95: "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference", American Society for Testing and Materials
7. UL2218: Class 4 Impact Resistance Rating
8. Dade County (Florida) Acceptance Report Number 01-0221.02. (Craftsman SB Only)

9. ASTM E 283-84: "Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen", American Society for Testing and Materials.

10. ASTM E 331-83: "Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference", American Society for Testing and Materials. ASTM A 792-83-AZ50 (Painted) & ASTM A792-83-AZ55 (Bare Galvalume Plus®): "Specifications for Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process, General Requirements (Galvalume®)", American Society for Testing and Materials
11. ASTM E 408-71: Standard Test Method for Total Normal Emittance of Surfaces Using Inspection- Meter Techniques. (Energy Star® for Roof Products).
12. ASTM E 903-96 Standard Test Method for Solar Absorptance, Using Integrating Spheres. (Energy Star® for Roof Products)

B. Manufacturer's Qualifications:
   1 Manufacturer has a minimum of five years experience in manufacturing metal roof systems of this nature. Panels specified in this section shall be produced in a factory environment (not with a portable roll former with fixed-base roll forming equipment) and in line leveling assuring the highest level of quality control. A letter from the manufacturer certifying compliance will accompany the product material submittals.

C. Installation Contractor's Qualifications:
   1. Installation contractor shall be an approved installer, certified by the manufacturer before the beginning of installation of the metal roof system, specifically for MBCI's Craftsman™ metal roof system, Certification by manufacturer must include the following:

   a. Maintain $250,000 minimum general liability insurance coverage.
   b. Maintain statutory limits of worker's compensation coverage as mandated by law.
   c. Have no viable claims pending regarding negligent acts or defective workmanship on previously performed or current projects.
   d. Has not filed for protection from creditors under any state or federal insolvency or debtor relief statutes or codes.
   e. Project foreman is the person having received certification by the manufacturer specific training in the proper installation of the selected metal roof system and will be present to supervise whenever material is being installed. Specific certified installer program shall include the following:
      1. The instructor must have a minimum of 10 years' experience in the application of metal roof systems.
      2. A formal syllabus for the classroom and hands-on training.
      3. Classroom instruction with review and thorough understanding of the specific product's technical manual.
      4. Hands-on mock-up instruction with a review and thorough understanding of the specific product's details.
      5. The installation contractor must pass a written and oral exam.
   f. Provide five references from five different architects or building owners for projects that have been in service for a minimum of two years, stating satisfactory performance by the installation contractor.
   g. Provide certification letter that installation contractor has a minimum of three years of metal product installation experience immediately preceding the date upon which work is to commence.

B. Pre-Installation Conference:
   1. Prior to installation of roofing system, conduct a pre-installation conference at the project site.

2. Attendance: Owner, Architect, Contractor, Project Superintendent, and Certified Installer
3. Agenda:
   a. Roofing details and agenda
   b. Critical work sequencing and review of phasing plan
   c. Inspection sequencing

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Performance Testing:
   1. Metal roof system must be tested in accordance with **Underwriters Laboratories, Inc. (UL) Test Method 580**
      "Tests for Uplift Resistance of Roof Assemblies".
   2. Metal roof system must be installed in accordance with UL Construction Method 280 or 310 (Small Batten). See the current UL Roofing Materials and Systems Directory for requirements of each Construction Method.
   3. Panel clip spacing will not exceed spacing specified in the UL Construction Method and must be designed to meet requirements of specified building codes and design loads.
   4. Metal roof system must be tested in accordance with ASTM E 1592-95 for negative loading. Determine panel
      bending and clip-to-panel strength by testing in accordance with ASTM E 1592-95 procedures. Capacity for gauge, span or loading other than those tested may be determined by interpolating between test values only.

   5. Metal roof system must be tested in accordance with ASTM E 283-84 "Standard Test Method for Air Infiltration" with a uniform static air pressure differential of 4 psf. The resulting air infiltration leakage rate will be a minimum of 12" Small Batten.
   6. Metal roof system must be tested in accordance with ASTM E 331-83 "Standard Test Method for Water Penetration" with a uniform static air pressure differential of 4 psf. The resulting water penetration rate will be no uncontrollable water leakage when five gallons of water per hour is sprayed per square foot of roof area (five gallons per hour equates to 8 inches of rainfall per hour).

   7. Metal Roof Panels shall be high reflectance and high emittance in accordance with Energy Star®. Initial Reflectance (Galvalume Only) shall be at least 0.68 when tested with ASTM E- 903. The three year aged reflectance shall be at least 0.57, when tested in accordance with ASTM E-1918 (Measured As Solar Reflectivity, Not Visible Reflectance).

1.04 DESIGN REQUIREMENTS

A. Roof Design Loads:
   1. Design criteria shall be in accordance with the most current version of IBC or an applicable national or local building code.
   2. Dead Loads
      a. The dead load shall be the weight of the SSMR system. Collateral loads, such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.
   3. Live Loads
      a. The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 20 psf.
   4. Roof Snow Loads
      a. The design roof snow loads shall be as shown on the contract drawings.
   5. Wind Loads

a. The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when calculating fastener design loads.
   aa. Single fastener in each connection: 3.00
   bb. Two or more fasteners in each connection: 2.25

6. Thermal Loads
   a. Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of degrees F during the life of the structure.

B. Framing Members Supporting the SSMR System
   1. Any additions/revisions to framing members supporting the SSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with [\-AISC-\] [\- AISI-\] [\-SJI-\] [\-LGSI-\]. Maximum deflection under applied live load, snow or wind load shall not exceed L/180 of the span length.

1.05 SUBMITTALS

A. Shop Drawings:
   1. Submit complete shop drawings and erection details, approved by the metal roofing manufacturer, to the architect (owner) for review. Do not proceed with manufacture of roofing materials prior to review of shop drawings and field verification of all dimensions. Do not use drawings prepared by the architect (owner) for shop or erection drawings.
   2. Shop drawings show methods of erection, roof and wall panel layout, sections and details, anticipated loads, flashings, sealants, interfaces with all materials not supplied and proposed identification of component parts and their finishes.
B. Performance Tests:
   1. Submit certified test results by a recognized testing laboratory or manufacturer's lab (witnessed by a professional engineer) in accordance with specified test methods for each panel system.
C. Calculations:
   1. Submit engineering calculations defining all cladding loads for all roof areas based on design criteria listed in Para
      1.04 Design Requirements, allowable clip loads and required number of fasteners to secure the panel clips to the designated substructure.
   2. Compute uplift loads on clip fasteners with full recognition of prying forces and eccentric clip loading.
   3. Calculate holding strength of fasteners in accordance with submitted test data provided by the fastener manufacturer based on length of embedment and properties of materials.
   4. Submit thermal calculations and details of floating clip, flashing attachments, and accessories certifying the free movement in response to the expansion/ contraction forces resulting from a total temperature differential of 110 degrees F.
D. Samples:
   1. Submit samples and color chips for all proposed finishes.
      a. Submit one 8-inch long sample of panel, including clips.
      b. Submit two 3 inches x 5 inch color chip samples in color selected by the architect (owner).
E. Warranties:
   Metal roof system manufacturer shall submit a specimen copy of the warranty upon final acceptance of the project. Provide one of the following warranties.
   1. Finish:
      a. Covering bare metal against rupture, structural failure and perforation due to normal atmospheric corrosion exposure for a period of 20 years.
      b. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking and fading for a period of twenty (20) years.

2. Weathertightness:
   Metal roof system manufacturer shall submit a specimen copy of manufacturer's Weathertightness Warranty, including evidence of application for warranty and manufacturer's acceptance of the applicator and warranty conditions.

   a. Standard Warranty (High Batten Only)

A. Test Reports:
   1. Submit Test Reports showing that metal panels have been tested in accordance with the Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference of ASTM E 1592-95.
   2. Submit Test Reports showing that metal panels meet the air infiltration requirements of ASTM E 283-84 "Standard Test Method for Air Infiltration" with a uniform static air pressure differential of 4 psf. The resulting air infiltration leakage rate will be a minimum 12" Small Batten or High Batten-0.048 cfm/sq ft.
   3. Submit Test Reports showing that metal panels meet the water penetration requirements of ASTM E 331-83 "Standard Test Method for Water Penetration" with a uniform static air pressure differential of 4 psf. The resulting water penetration rate will be no uncontrollable water leakage when five gallons of water per hour is sprayed per square foot of roof area (five gallons per hour equates to 8 inches of rainfall per hour.)
   4. Submit "Dade County Acceptance Reports" showing that metal panels meet the Dade County building code requirements).

B. Metal Roof System Fabrication Certification:
   1. Submit a letter from the metal roof system manufacturer certifying the **Craftsman™** panels have been produced in a factory environment (not job site roll formed) with fixed-base roll forming equipment and in line leveling.

C. Certified Installers Qualifications:
   1. Submit certificate from manufacturer certifying that installer of the metal roof system has met all of the criteria outlined in "1.02 C. Installer's qualifications" and is an authorized installer certified by the manufacturer.
   2. Submit the formal syllabus for the classroom and hands-on training.
   3. Submit five references from five different architects or building owners for projects that have been in service for a minimum of two years, stating satisfactory performance by the installation contractor.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver metal roof system to job site properly packaged to provide protection against transportation damage.

B. Handling:
   1. Exercise extreme care in unloading, storing and erecting metal roof system to prevent bending, warping, twisting and surface damage.

C. Storage:
   1. Store bundled sheets off the ground sufficiently high enough to allow air circulation beneath bundle and to prevent rising water from entering bundle. Slightly elevate one end of bundle. Prevent rain from entering bundle by covering with tarpaulin, making provision for air circulation between draped edges of tarpaulin and the ground. **Prolonged Storage of sheets in a bundle is not recommended**. If conditions do not permit immediate erection, extra care should be taken to protect sheets from staining or watermarks.

1.07 WEATHERTIGHTNESS WARRANTY

A. The Contractor shall provide to the Owner, a Standard warranty signed by the roofing manufacturer of the Craftsman® High Batten Standing Seam Roof System as outlined below:

B. Single Source Warranty: Single Source Warranties require a certified installer on site at all times.
   1. For a period of twenty (20), years from the date of substantial completion, the roofing manufacturer WARRANTS to the Building Owner ("Owner"): to furnish roof panels, flashing and related items used to fasten the roof panels and flashing including roof jack and curb attachments to the roof structure, will not

allow intrusion of water from the exterior of the roofing manufacturer's Roof System into the building envelope when exposed to ordinary weather conditions and ordinary wear and usage. The Date of substantial completion is the date that is certified by the Architect, Owner, or Owner's Representative, when the roofing manufacturer's Roofing System is completed and accepted by or on behalf of the Owner.

2. Manufacturer's Field Service
   a. During installation, provide for two on-site inspections of roof application by qualified technical representative of the manufacturer.
   b. Upon completion of installation, provide final inspection by a technical representative of roofing manufacturer to confirm that roofing system has been installed in accordance with manufacturer's requirements.

3. The roofing manufacturer shall have the SOLE AND EXCLUSIVE obligation for all warranty work commencing on the date of substantial completion and under all circumstances terminates on the 20 year anniversary of the date certified as Substantial Completion of the roofing manufacturer's Roof System. During the period in which the roofing manufacturer has any warranty obligation, the roofing manufacturer shall take appropriate actions necessary to cause the non-performing portions of the Roof System to perform their proper functions.

4. Roofing Manufacturer's Liability
   The total liability of the roofing manufacturer under
   Single Source III, a no dollar limit of the manufacturers Roof System as invoiced to the roofing manufacturer’s customer.

PART 2 - PRODUCTS

2.01 MATERIALS

Metal roof system profile:

A. Metal roof system profile:

1. 1 inch high x 3/8-inch wide battens (Small Batten-SB) x 12 inch, wide panels.

B. Metal roof system style:
   1. Snap on batten with factory applied mastic. SB 12 Small Batten
   2. Concealed fastener.

C. Gauge:
   1. (24 gauge) (UL-90 rated-Underwriters Laboratories)

D. Substrate:
   1. Galvalume sheet steel, 0.5-ounces/square foot, minimum yield 50,000 PSI.

E. Clip:
   1. One piece clip with factory applied mastic, 1 inch high by 1 inch wide by 2 inches long with one guide hole in the bottom to accommodate a clip fastener (Small Batten).

F. Texture:
   1. Smooth

G. Finish:
   1. Premium thermoset silicone polyester (20 year warranty).

H. Color:
   1. Selected from metal roof system manufacturers standard offering.

I. Acceptable manufacturer:
   1. MBCI - Houston, TX - (281) 445-8555.

J. Other manufacturers desiring approval, comply with Section 01630.
K. Acceptable Curb and Equipment Support units:
   1. LM Curbs - Longview, TX.
L. Prefabricated Roof Jacks:
   1. SFS- INTECH - Wyomissing, PA.
   2. ITW Buildex - Itasca, IL.
M. Rooftop Walkways:
   1. LM Curbs - Longview, TX.

2.02 MISCELLANEOUS MATERIALS

A. Fasteners:
   1. All self-tapping/self-drilling fasteners, bolts, nuts, self-locking rivets and other suitable fasteners shall be designed to withstand specified design loads.
   2. Use long life fasteners for all interior and exterior metal roof system applications.
   3. Provide fasteners with a factory applied coating in a color to match metal roof system application.
   4. Provide neoprene washers under heads of exposed fasteners.
   5. Locate and space all exposed fasteners in a true vertical and horizontal alignment. Use proper torque settings to obtain controlled uniform compression for a positive seal without rupturing the neoprene washer.
B. Accessories:
   1. Provide all components required per the metal roof system manufacturer's approved shop drawings for a complete metal roof system to include panels, panel clips, trim/flashing, fascias, ridge, closures, sealants, fillers and any other required items.
      a. All outside closures will be fabricated from Galvalume Plus® or Painted Galvalume® sheet steel of the same gauge, finish and color as the panels.
      b. All tape seal is to be a pressure sensitive, 100 percent solids, and polyisobutylene compound sealing tape with a release paper backing. Provide permanently elastic, non-sagging, non-toxic, non-staining tape seal approved by the metal roof system manufacturer.
      c. All joint sealant is to be a one-part elastomeric polyurethane sealant approved by the metal roof system manufacturer.

2.03 FABRICATION

A. Material shall be in-line leveled prior to roll forming the panel profile.
B. Where possible, roll form panels in continuous lengths, full length of detailed runs.
C. Standard panel length shall be no more than 40 feet long for 22 gauge and 24 gauge. (For longer length availability, contact manufacturer).
D. Fabricate trim/flashing and accessories to detailed profiles.
E. Fabricate trim/flashing from same material as panel.

2.04 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

A. Comply with loading and strength requirements as indicated where units support work of other trades. Coordinate dimensions of curbs and supports with equipment supplier/manufacturer.
B. Fabricate curbs of structural quality aluminum (Min. .080 in. thickness for mechanical gear up to 1000 lbs; .125 in. thickness for mechanical gear between 1000 lbs. and 2000 lbs.; use a two curb system per the manufacturer above 2000 lbs.), factory primed and prepared for painting with mitered and welded corner joints. Provide integral cap cells and water diverter crickets. The upper flange of the curb must be a minimum of 18" above the water diverter. (This allows 12" of free area after the panel is lapped over the flange on the high side.) Curbs shall be designed to install under metal roof system on the high side and over metal roof system on the low side.
C. Minimum height of prefabricated curb will be 8 inches above the finished metal roof system.
D. Curbs shall be constructed to match the slope of the roof and provide a level top surface for mounting equipment.
E. Curb flanges must be constructed to match the configuration of the metal roof panels and extend to a panel rib on each side. Minimum distance between curb wall and panel rib is 6”.

F. Curb manufacturer will provide their own curb structural support system that can be installed between the purlins that will allow proper thermal movement of the curb with the roofing system.
G. Submit roof curb manufacturer's shop drawings to metal roof system manufacturer for review **prior to** fabrication (refer to metal roof system manufacturer's standard installation details). Metal roof system manufacturer will review roof curb manufacturer's shop drawings for compatibility with metal roof system.

2.05 PREFABRICATED ROOF JACKS

A. Pipe flashings shall be a one piece [# choose one: EPDM (ethylene propylene diene monomer) molded rubber boot having a serviceable temperature range of -65°F to 212°F (for standard applications) or silicone molded rubber boot having a serviceable temperature range of -100°F to 437°F (for high temperature applications)] and shall be resistant to ozone and ultraviolet rays. Units shall have an aluminum flanged base ring. Do not install pipe flashings through any panel seams - install ONLY in the flat portion of the panel.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examination:
   1. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.
   2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions. This specifically includes verifying that secondary structural members and/or decking are installed to meet UL and building code requirements. Coordinate with metal roof system manufacturer to insure that reduced clip spacings at eave, rake, ridge and corner areas are accommodated.
B. Discrepancies:
   1. In event of discrepancy, notify the architect (owner).
   2. Do not proceed with installation until discrepancies have been resolved.

3.02 INSTALLATION

A. Install metal roof system so that it is weathertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
B. Install metal roof system in accordance with manufacturer's instructions and shop drawings.
C. Provide concealed anchors at all panel attachment locations.
D. Install panels plumb, level and straight with seams and ribs parallel, conforming to design as indicated.

3.03 ROOF CURB INSTALLATION

A. Comply with metal roof system manufacturer's shop drawings, instructions and recommendations for installation of roof curbs. Refer to metal roof system manufacturer's standard installation details. Anchor curbs securely in place with provisions for thermal and structural movement.

3.04 CLEANING, PROTECTION

A. Dispose of excess materials and remove debris from site.
B. Clean work in accordance with manufacturer's recommendations.
C. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the architect (owner), any work that becomes damaged prior to final acceptance.
D. Touch up minor scratches and abrasions with touch up paint supplied by the metal roof system manufacturer.
E. Do not allow panels or trim to come in contact with dissimilar metals such as copper, lead or graphite. Water run-off from these materials is also prohibited. This specifically includes condensate from roof top units. A/C units.

END OF SECTION

SECTION 07 72 00
SAFEPRO ROOF HATCH ACCESS DOOR

I. PART ONE - GENERAL

1.01 SUMMARY
A. Work included: Furnishing and installing factory fabricated roof hatches

1.02 REFERENCES
A. American Society for Testing and Materials (ASTM, 1916 Race Street, Philadelphia, PA 19103; (215) 299-5400, fax (215) 977-9679
1. ASTM A 36-93a: Standard Specification for Structural Steel

1.03 SUBMITTALS
A. Product Data: Provide manufacturer's product data for all materials in this specification. Data Sheet/Brochure.
B. Shop Drawings: Show profiles, accessories, location, and dimensions.
C. Samples: Manufacturer to provide upon request; sized to represent material adequately.
D. Contract Closeout: Roof hatch manufacturer shall provide the manufacturer's warranty prior to the contract closeout.

1.04 PRODUCT HANDLING
A. All materials shall be delivered in manufacturer's original packaging.
B. Store materials in a dry, protected, well-vented area. The contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
C. Remove protective wrapping immediately after installation.

1.05 SUBSTITUTIONS
A. Proposals for substitution products shall be accepted only from bidding contractors and not less than (10) working days before bid due date. Contractor guarantees proposed substitution shall meet the performance & quality standards of this specification.

1.06 JOB CONDITIONS
A. Verify that other trades with related work are complete before installing roof hatch(s).
B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.
D. Coordinate installation with roof membrane & roof insulation manufacturer's instructions before starting.
E. Observe and follow all appropriate Federal and State (if applicable) OSHA safety guidelines.

1.07 WARRANTY/GUARANTEE
A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Openers, special finishes, and other special equipment shall be warranted separately by the manufacturers of those products.

II. PART TWO - PRODUCTS

2.01 MANUFACTURER

A. SafePro, L.P.
1357 N. Walton Walker, Dallas, TX 75211
phone 1-877-723-3570
fax 1-214-330-5435
www.safeprosafety.com

2.02 ROOF HATCH

A. Furnish and install where indicated on plans metal roof hatch Model SPH 3036 size 30 (width) x 36 (length). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:
1. Cover(s) shall be reinforced to support a minimum live load of 40 psf (195 kg/m^2) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m^2) wind uplift.
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.

C. Cover: Shall be 14 gage (G90) galvanized steel with radius corners for safety and shall be fully welded at the corners for watertight construction. Cover shall have a rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be 1” thick polyisocyanurate with an R-value of 5.6 (New ASTM C1289-13e1), fully covered and protected by an 14 gauge (G90) steel liner.

E. Curb: shall be 14 gage (G90) galvanized steel with durable re-coatable gray primer finish. It shall be 12” in height with a 3-1/2” wide mounting flange with holes for roof attachment.
The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners.

F. Curb insulation: Shall be 1” Fiber board.

G. Lifting mechanisms: For smooth operation of the cover, provide compression springs encased in zinc-plated telescopic tubes.Furnish an automatic hold-open arm with vinyl grip. For safety and added security,latching shall include interior & exterior handles with provisions for an inside padlock.

H. Hardware
1. Heavy pintle hinges shall be provided.
2. Cover(s) shall be equipped with a spring latch with interior and exterior turn handles.
3. Roof hatch shall be equipped with interior padlock hasps.
4. The latch strike shall be a welded component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with an automatic hold-open arm with vinyl grip.

I. Finishes: Factory finish shall be Galvanized Steel with are-coatable gray primer finish.

III. PART THREE - EXECUTION

3.01 INSPECTION

A. Verify that roof hatch installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.02 INSTALLATION

A. Submit product design drawings for review and approval to the architect and/or specifier before fabrication.

B. The installer shall check as-built conditions and verify the manufacturer's roof hatch details for accuracy to fit the application prior to fabrication. The installer shall comply with the roof hatch manufacturer's installation instructions.

C. The installer shall furnish mechanical fasteners consistent with the roof requirements.

END OF SECTION

SECTION 07 72 60.01
ROOF HATCH SAFETY RAIL SYSTEM AND LADDER EXTENSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory fabricated roof hatch fall protection safety rail and ladder extension system installed on [existing] roof hatches.

1.02 RELATED REQUIREMENTS

A. Section 07 72 00 - Roof Accessories: Roof hatches.

B. Section 07 72 33 - Roof Hatches.

C. Section 07 72 33.01 [07 72 60.01] - Roof Hatch Safety Rail System: Fall protection safety rail system on roof hatches.

1.03 REFERENCE STANDARDS

A. ASTM A 500/A 500M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2007.

B. California Occupational Safety & Health Administration (CAL OSHA): 3209 - Standard Guardrails.

C. California Occupational Safety & Health Administration (CAL OSHA): 3212 - Floor Openings, Floor Holes and Roofs.

D. Occupational Safety & Health Administration (OSHA): 29 CFR 1910.23 - Guarding Floor and Wall Openings and Holes.

E. Occupational Safety & Health Administration (OSHA): 29 CFR 1910.27 - Fixed Ladders.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of roof hatch safety rail and ladder extension system with installation of new roof hatch and roof flashing. [Coordinate installation of roof hatch safety rail and ladder extension system with retrofit work on existing roof hatch].

B. Sequencing: Ensure that roof hatches and related flashings are complete prior to proceeding with installation of safety rail and ladder extension system.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's product data for complete safety rail system, including finishes.

C. Shop Drawings: Indicate profiles, accessories, location, quantities and dimensions.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate complete instructions for proper installation of safety rail

system.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 2 years of documented experience.

B. Installer Qualifications: Manufacturer's certified installer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging.

B. Store products under cover, dry and elevated above grade.

1.08 FIELD CONDITIONS

A. Existing Conditions: Verify that existing roof hatches are suitable to receive proper installation of safety rail and ladder extension system. Notify Architect of conditions that would prevent proper installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Materials shall be free of defects in material and workmanship for a period of twenty (20) years from the date of purchase. Within this period, manufacturer shall replace defective components at no charge to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. SafePro L.P., 1355 N. Walton Walker, Dallas, TX 75211; Phone: 1-877-723-3570; Fax: 214-330-5435; Website: www.safeprosafety.com

B. Substitutions: See Section 01 60 00 - Product Requirement.

2.02 ROOF HATCH FALL PROTECTION SAFETY RAIL AND LADDER EXTENSION SYSTEM

A. Basis of Design: Roof Hatch Fall Protection Safety Rail Model No. SP-3630 by SafePro L.P.

B. Description: Steel tube railing system mounted on roof hatch providing an ergonomically correct power grip in a safe upright egress and ingress through roof hatches in addition to protection from accidental falls through roof opening while roof hatch is open. Includes top and mid-rail and wrap around self-closing gravity gate mounted with heavy duty hinges acting as a ladder extension.
   1. Steel Tubing: 1-1/2 inch hot rolled electric welded steel tubing, ASTM A500, Grade B, hot formed.
   2. Size: Formed to fit roof hatch size of 36 x 30 inches.
   3. Height: 42 inch above roof surface when mounted on standard roof hatch cap flashing.
   4. Mounting System: Integrated stanchions of rail system through bolted to extended cap flashing of roof hatch using 3/8 inch bolts.
   5. Gate System: Gravity self-closing, non-collapsible full wrap around steel tubing grab hold, welded construction. Heavy duty hinges with 5/8 inch hinge pin with built in pinch-less gate

stop and pull up full open positioning.

6. Fasteners: Stainless steel 316 Grade Hex head bolts, 3/8 inch x 2 inch, Nylon locking Hex nut and flat washers.
7. Labels: Furnish with manufacturer's standard labels containing safety warnings, fall dangers, “No Hoisting” warning and manufacturer identification.

C. Performance:
   1. Meets and exceeds OSHA Standard CFR 29 1910.23 and CFR 29 1910.27.
   2. Meet and exceeds Cal-OSHA §3212. Floor Openings, Floor Holes and Roofs and §3209. Standard Guardrails.

D. Fabrication: Factory formed and fully welded construction, free of sharp edges and snag points.

E. Finish: Factory finished with powder coating.
   1. Powder Coat Finish: Manufacturer's standard powder coating; color: Safety Yellow.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that roof hatch is suitable to receive proper installation of safety rail and ladder extension system. Report unsatisfactory conditions to Architect [Owner].

3.02 INSTALLATION

A. Install safety rail and ladder extension system in accordance with manufacturer's instructions using bolts furnished by railing manufacturer.

B. Install safety rail and ladder extension system by through-bolting to integral curb flashing of roof hatch, avoiding penetration of roof base flashing.

3.03 ADJUSTING

A. Adjust gate for smooth operation, free of binding.

END OF SECTION

SECTION 07 84 56
FIRE SAFING

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, and services necessary for Insulation Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Fire Safing Insulation.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Concrete Work - Section 03 30 00.

2. Masonry - Section 04 20 00.

3. Steel Roof Decking - Section 05 31 23.

4. Cold-Formed Metal Framing - Section 05 40 00.

5. Rough Carpentry Work - Section 06 10 00.

6. Sheet Metal Work - Section 07 60 00.

7. Joint Protection - Section 07 90 00.

8. Aluminum Window Framing - Section 08 41 00.

9. Gypsum Sheathing and Wallboard - Section 09 29 00.

1.02 QUALITY ASSURANCE

A. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.03 SUBMITTALS

A. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

B. General: Submit Samples and manufacturer's literature to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

C. Samples: Submit two (2) 12" x 12" typical Samples of insulation type.

1.04 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Store materials at the site off the ground and in properly protected dry storage facilities, until ready for use. Provide a tarpaulin covering over the materials, securely tied down. Wet, damp, or damaged materials shall not be used.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.05 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and ladders in accordance with applicable code requirements. Erect at times and locations so as not to delay any part of the Work, and promptly remove when no longer required.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 SAFING INSULATION

A. Manufacturer: Safing insulation specified herein shall be as manufactured by Thermafiber, Inc., 3711 West Mill Street, Wabash, IN 46992, (888) 834-2371 or (260)563-2111; www.thermafiber.com.

1. Insulation: "Thermafiber® Safing Insulation", mineral-wool type insulation, UL Reference = TYPE SAF, with approximate density of 4.0 to 6.0 pcf.

B. Comparable Products: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review.

C. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 90 percent.

D. Surface Burning Characteristics: Class A fire hazard classification in accordance with ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1. Regular (Unfaced): Flame Spread 0, and Smoke Developed 0.

2. Foil-Faced: Flame Spread maximum 25, and Smoke Developed 0.

E. Type and Quality: Rated noncombustible as defined by National Fire Protection Association NFPA Standard 220, when tested in accordance with ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C. Insulation shall be nonasbestos, moisture-resistant, noncorrosive, nondeteriorating, mildew-proof and vermin-proof.

F. Clips and Adhesives: Provide manufacturer's recommended galvanized steel safing clips and fire-resistant adhesives for installation of safing insulation.

1. Volatile Organic Compounds (VOC) Content: Adhesives and sealants product specified herein shall have a VOC content of 70 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 SAFING INSULATION INSTALLATION

A. Install safing insulation at locations indicated on the Drawings.

B. Install safing insulation (fire-stop insulation) at all openings through fire-rated partitions, and as indicated on the Drawings.

C. Compress and tightly fit safing insulation into the specified openings, securing in place with fireresistant adhesive and safing clips.

3.03 CLEAN-UP

A. Work Required: Clean-up any Work soiled in the performance of the Work under this section.

B. Debris and Waste Materials: During progress of the Work, upon completion of Work, and before final acceptance of the Work, keep the premises free of debris and waste materials resulting from Work of this section. Remove all debris and rubbish to central area designated by the General Contractor, for general clean-up by the General Contractor, or if directed by the General Contractor to remove from the site and legally dispose.

C. Unused Materials, Tools, and Equipment: Upon completion of Work and before final acceptance of the Work, remove all unused materials, tools, and equipment from the site.

D. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 07 90 00
JOINT PROTECTION

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Caulking Work indicated on the Drawings and specified herein. Work includes, but is not limited to the following:

1. Preparation of surfaces.

2. Exterior and interior caulking of the following joint types. Exterior caulking shall be done with sealants, and interior caulking shall be with caulking compounds, however, selected interior locations noted on Drawings or specified herein will require sealant in lieu of caulking compound.

   a. Between dissimilar materials, including concrete or masonry to metal (aluminum, steel, stainless steel), and steel to aluminum (at non-metallic shims).

   b. Between similar materials as detailed, unless specifically excluded.

3. Expansion and control joints.

4. Between thresholds and adjoining materials.

5. Exterior joints where Mechanical and Electrical Work penetrates concrete or masonry.

6. Wherever indicated by the words, “Seal”, “Sealer”, “Sealant”, “Caulk”, or “Caulking” on the Drawings.

7. Acoustical Sealant.

8. Compressible Back-up Material as required.

9. Firestopping Systems.

10. Cleaning and removing excess materials.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Cast in Place Concrete - Section 03 30 00.

2. Unit Structural Masonry - Section 04 23 0.

3. Rough Carpentry - Section 06 10 00.

4. Thermal Insulation - Section 07 21 00.

5. Sheet Metal Work - Section 07 60 00.

7. Fire Safing - Section 07 84 56.

8. Hollow Metal Doors and Frames - Section 08 11 13.

9. Aluminum Storefronts - Sections 08 41 10.

10. Gypsum Wallboard - Section 09 29 00.

11. Paints and Coatings - Section 09 90 00.

12. Caulking and Mastic Operations at Roof and Sealing Sheet Metal Flashings - By Roofing Contractor.

1.02 QUALITY ASSURANCE

A. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.03 SUBMITTALS

A. General: Submit Product Data and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

C. Product Data: Submit manufacturer’s specification and recommendations for each type of sealant, caulking compound, expansion joint cover, and miscellaneous material required.

D. Sealant Compatibility and Test Reports: Provide reports from sealant manufacturer certifying that materials forming joint substrates of system have been tested for compatibility and adhesion with joint sealants; include sealant manufacturer's interpretation of results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

E. Samples: Submit Samples of sealants and caulking for review and approval by the Architect. Do not commence Work until the Architect's written approval of the Samples has been received.

1. General: Submit two (2) 12" long Samples of each color and type of exposed-to-view sealant and caulk. Install Sample in 1/2" wide joints between two (2) strips of material representative of exposed surfaces adjacent to joint sealants. Manufacturer's color charts and/or color swatches will not be accepted as Samples.

2. Expansion Joint Covers: Provide samples of sealant system in colors as required to match with adjacent finished surfaces.

1.04 PRODUCT DELIVERY AND STORAGE

A. Delivery: Ship material to job site in plainly marked, original containers, with seals unbroken. Do not ship opened or partially full containers to the site. Materials will be subject to inspection, and rejection at any time. Unload materials at locations designated by the General Contractor.

B. Storage: All materials shall be stored in sheltered enclosures with ambient temperature range of 60 to 80 degree F° at the site until ready for use.

C. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.05 PROJECT CONDITIONS

A. Temperature and Temporary Enclosures: Do not install compounds when ambient air temperature is less than 40°F. or when recesses are wet or damp. Temporary enclosures and temporary heat may be provided to maintain temperature requirements.

B. Protection: Adjacent finished surfaces shall be protected from damage, by masking or other approved methods, prior to sealing. Remove protection when no longer needed, clean adjacent surfaces smeared by compounds.

1.06 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and tarpaulin enclosures, complying with governing code requirements. Erect apparatus at times and locations so as not to delay any part of Work. When Work
has been completed, promptly dismantle all scaffoldings and remove from site.

1.07 WARRANTY

A. General Requirements: The warranty shall state that the Contractor will make good at his expense, all imperfections which may develop in Caulking and Sealing Work during the warranty period, as well as damage to other Work caused by imperfections or by repairing imperfections.

B. Sealant Work: Execute a warranty in the approved written form, warranting all Sealant Work to remain in a serviceable, watertight, elastic, adhesive and perfect condition for a period of not less than three (3) years from date of Owner's acceptance of the installation.

C. Caulking Work: Execute a warranty in the approved written form, warranting all Caulking Work to remain in a serviceable, watertight, elastic, adhesive and perfect condition for a period of not less than two (2) years from date of Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. Colors: Sealants and caulking compounds shall be of colors as selected and/or reviewed by the Architect to match adjacent finish surfaces.

2. Grade and Consistency: Sealants and caulking compounds shall be of correct grade and consistency for application, to flow easily from application gun, and to tool without excessive tackiness.

3. Material Properties: Set sealants and caulking compounds shall be waterproof, elastic, non-staining and non-corrosive; firm but not brittle hard; remain plastic without cracking at low temperatures; non-sagging at temperatures up to 120°F for 24 hours.

4. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements

of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

5. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   a. Architectural Sealants: Not more than 250 g/L.

   b. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.

   c. Sealant Primers for Porous Substrates: Not more than 775 g/L.

B. Sealants:

1. Sealants - General: Multiple-component polyurethane sealant, non-sag type, conforming to ASTM C920 - Standard Specification for Elastomeric Joint Sealants, Type M, Grade NS, and Federal Specification TT-S-00227E, Type II, Class A, by one of the following manufacturers:

   a. Manufacturer: BASF Construction Chemicals, LLC - Building Systems, 889 Valley Park Drive, Shakopee, MN 55379, (800)243-6739 or (800)433-9517; www.BuildingSystems.BASF.com.

      1) Product: Sonneborn® "Sonolastic® NP 2Ô.

   b. Manufacturer: Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (800)523-6688 or (215)723-6051; www.pecora.com.

      1) Product: Dynatrol® II.

   c. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

      1) Products: Dymeric 240 or Dymeric® 240FC.

2. Sealant for Exterior Plaster Veneer System: Product shall be acceptable to Plaster Veneer System Manufacturer. Sealant shall conform to ASTM Standard C920, Grade NS, Class 50, by one of the following manufacturers:

   b. Manufacturer: Dow Corning Corporation, South Saginaw Road, Midland, MI 48686, (800)662-0661 or (989)496-6000; www.dowcorning.com.

1) Product: Dow Corning® 790 Silicone Building Sealant, one-component silicone sealant.

c. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

1) Products: Spectrem® 1 or Spectrem® 3 one-component silicone sealant, “Spectrem® 4-TS” multiple-component silicone sealant or “Dymeric® 240FC” multiple-component polyurethane sealant.

3. Sealant for Traffic Areas: One-component polyurethane sealant, non-sag type, for use in traffic areas, per ASTM Standard C920, by one of the following manufacturers:

a. Manufacturer: BASF Construction Chemicals, LLC - Building Systems, 889 Valley Park Drive, Shakopee, MN 55379, (800)243-6739 or (800)433-9517; www.BuildingSystems.BASF.com.

1) Product: Sonneborn® Sonolastic® NP 1Ô.

b. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

1) Products: Dymonic® FC or Vulkem® 45 SSL.

c. Manufacturer: LymTal International, Inc., 4150 S. Lapeer Road, Lake Orion, MI 48359, (248)373-8100; www.lymtal.com.

1) Product: Iso-Flex® 830, Joint Sealant.

4. Acoustical Sealant: Equivalent to SHEETROCK® Brand Acoustical Sealant as manufactured by United States Gypsum Company, A Subsidiary of USG Corporation, 550 West Adams Street, Chicago, IL 60661, (800)874-4968; www.usg.com.

a. Product Requirements: Acoustical sealant shall be an acrylic, latex-based caulk for use as a joint sealant for sealing sound-rated systems. Sealant shall be non-staining and paintable. Sealant shall meet ASTM Standard C834 and tested in accordance with ASTM Standard E90.

b. Surface Burning Characteristics: Classified by UL, and tested in accordance with ASTM Standard E84:

1) Flame Spread: 0.

2) Smoke Developed: 0.

c. VOC Content: Less than 15 grams/liter.

C. Caulking Compounds:

1. Caulking Compounds - General: One-part, acrylic latex sealant, non-sag type, conforming to ASTM C834 - Standard Specification for Latex Sealants, by one of the following manufacturers:

a. Manufacturer: Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (800)523-6688 or (215)723-6051; www.pecora.com.

1) Product: AC-20® + Silicone.

b. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

1) Product: Tremflex® 834.

D. Primers: Provide primer products recommended by the sealant or caulking compound manufacturer, to provide adhesion of the sealant and caulking compounds to, and to prevent staining of adjacent surfaces.

E. Back-up Material:

1. Manufacturer: Construction Foam Products, a Division of Nomaco, Inc., 501 NMC Drive, Zebulon, NC 27597, (800)345-7279 or (919)380-6640; www.cfoamproducts.com.
2. Product: Round, Foam Rod, cylindrical, flexible, extruded, compressible closed cell, polyethylene foam backer rod, Type C - per ASTM Standard C1330, such as Closed-Cell Backer Rod “HBR®”. Provide backer rods in diameters 1/2 larger than width of joints in which rods are installed.

2.02 FIRESTOPPING SYSTEMS:

A. Construction Penetrations: UL Listed firestopping system for through-penetrations shall meet the requirements of ASTM Standard E814 (UL 1479) and provide a fire rating equal to that of construction being penetrated. Backing material and sealant shall not contain asbestos, halogens, and volatile solvents, and shall be flexible to allow for normal movement of building and penetrating items without adversely affecting the integrity of the system.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: Not more than 250 g/L.

2. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.

3. Sealant Primers for Porous Substrates: Not more than 775 g/L.

C. Firestopping Systems: Provide system/products by one of the following manufacturers:

1. Manufacturer: Hilti, Inc., 5400 South 122nd. East Avenue, Tulsa, OK 74146, (800)879-8000 or (918)252-6000; www.us.hilti.com.

   a. System/Products: Hilti Firestop Systems.

2. Manufacturer: Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (800)523-6688 or (215)723-6051; www.pecora.com.

   a. System/Products: Firestop Systems-UL® Classified.

3. Manufacturer: RectorSeal® Corporation, 2601 Spenwick Drive, Houston, TX 77055, (800)231-3345 or (713)263-8001; www.rectorseal.com.

   a. System/Products: Metacaulk® Firestop Materials.

4. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

   a. System/Products: TREMstop® Fire Protection Products and related products.

D. Comparable Systems/Products: Comparable equivalent products of other manufacturers may be acceptable, subject to conformance with these Specifications and the Architect's review.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSPECTION

A. Inspect all joints to be caulked. Notify the General Contractor in writing (copy to the Architect), of any condition that will prevent the required performances of the compounds, for correction. Installation of the compounds will be considered Contractor's acceptance of the joints. Promptly repair or replace all Caulking and Sealing Work that becomes damaged or defective because of defects in the joint surfaces,
to the satisfaction of the Architect, and at no cost to the Owner.

3.03 PREPARATION

A. Joints to be caulked will be raked out or left open 3/8" to 1/2" deep, maximum by others. Joint width to be 1/2" maximum, 3/8" width for control joints.

B. Clean recesses to receive compound so as be free of dirt, dust, loose material, oil, grease, and all other substances detrimental to the material's performance. Remove lacquer or other protective coatings from metal surfaces, without damage to the surface, prior to sealing. Recesses shall be dry when compounds are installed.

C. If sealing or caulking compounds cause stains on, or do not adhere to, adjacent materials, or if recommended by compound manufacturer, prime all surfaces with specified primer in accordance with compound manufacturer's recommendations.

D. Width or depth of the joint shall be not less than 1/4". In joints up to 1/2" wide, the depth of the sealant shall be equal to the width. In joints wider than 1/2", but not exceeding 1", the depth shall be maintained at 1/2". Joints wider than 1" shall maintain a width to depth ratio of 2 to 1. Fill recesses with backer rod, held back the specified depth from the surface, where joint depths exceed the specified maximums.

E. If joints to receive sealant are filled with other than backer rod specified material, adhere a strip of polyethylene film over the exposed edge of the material, to break the bond of the sealant.

F. Use materials as manufactured, without additives or adulterations. Mix two (or three) component materials until thoroughly and uniformly blended, and then install such materials prior to start of hardening or curing of the materials.

3.04 INSTALLATION OF SEALANTS AND CAULKING COMPOUNDS - GENERAL

A. Sealants and caulking compounds for use in any one area shall be of one brand throughout, mixing of brands on a single wall or in a single room or area is prohibited.

B. All Work shall be done by experienced workmen, in accordance with manufacturer's recommendations, and as specified herein.

C. Install all sealing and caulking compounds immediately after the adjoining Work of other trades is in proper condition to receive same, but before Work has been given applied finishes such as painting or staining, and in a manner to prevent damage occurring by reason of any delay in providing the Work specified herein. No sealing or caulking shall be done until the General Contractor has inspected and approved the preparatory Work and the condition of the adjoining Work.

D. Fill joints completely with sealant and/or caulking compound, without extra cost to the Owner, regardless of variance in joint widths.

E. Install sealants and caulking compounds under pressure, without smearing adjacent surfaces. Compounds shall have full and uniform contact and adhesion with sides of joint recesses.

F. Finish sealants and caulking compounds in recesses, in angular surfaces, with a smooth surface, flush with face of material at each side. Finish sealants and caulking compounds, in recesses, between masonry and jambs, with a smooth surface, flush with the face of the metal frame on one side and with face of masonry on the other side. Finish sealants and caulking compounds in recesses, in flush surfaces (including masonry walls), with a smooth concave surface, flush with face of material at each side.

G. Surfaces of sealants and caulking compounds in joints shall be smooth and even, free from dirt, stain or other defacements, and be uniform in color throughout.

H. Tooling of joints will be allowed, provided that such operations do not damage the seal or tear the compounds.

3.05 INSTALLATION OF SEALING COMPOUNDS

A. Building Exterior: Fill with sealant, as required to provide a weathertight condition, all exposed joints that are not subject to movement but require finishing, and all joints that are not subject to excessive movement. Principal locations shall include, but not be limited to, the following:

1. Joints between Dissimilar Materials: All exposed joints in the exterior walls, between dissimilar materials, including masonry or concrete construction to metal

(aluminum, steel, stainless steel) such as door frames, frames for glass and other miscellaneous openings; and steel to aluminum (at non-metallic shims).

2. Joints between Similar Materials: All joints between similar materials such as masonry control joints, etc., unless specifically excluded.

3. Noted Locations: Wherever indicated by the words “seal” or “sealant” on the Drawings.

4. Exterior Plaster Veneer: Joint filler, primer, and bond breaker shall be in accordance with the sealant manufacturer’s specifications and instructions. Application of the sealant shall be as recommended by the plaster veneer system manufacturer, subject to review by the Architect.

   a. Back-up Material: Sealant backer rods, as required by field conditions shall be of closed cell.

   b. Textured Finishes or Base Coat Surfaces: Sealant shall not be applied directly to textured finishes or base coat surfaces. Plaster veneer system base coat surfaces subject to be in contact with sealant shall be coated with acrylic coating or pigmented acrylic primer. Coordinate Work with Plaster Veneer System Contractor.

B. Building Interior: Fill with sealant, as required to provide a closed condition, all exposed joints that are subject to movement, but not excessive movement, or where specifically noted on Drawings. Principal locations shall include, but not be limited to the following:

1. Joints Between Dissimilar Materials: All exposed joints in exterior and interior walls, between dissimilar materials generally, including masonry or concrete to metal (aluminum, steel, stainless steel), such as door frames, frames for glass and other openings, and steel to aluminum (at non-metallic shims).

2. Joints Between Similar Materials: All exposed joints between similar materials such as masonry control joints, unless specifically excluded.

C. Acoustical Sealant: Comply with sealant manufacturer’s written directions and instructions for preparation and application of sealant.

1. Coordinate with Gypsum Wallboard Contractor for installation of coustical sealant at sound-rated partitions where indicated on the Drawings; applied in accordance with ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications, using conventional caulking equipment.

2. At partition walls, provide continuous beads of acoustic sealant at juncture of both faces of runners with floor and ceiling construction, and wherever gypsum board abuts dissimilar materials, prior to installation of gypsum board.

3. At ceilings, provide continuous beads of sealant wherever gypsum board abuts dissimilar materials.

4. Provide continuous bead of sealant behind faces of control joints prior to installation of control joint accessories.

5. After installation of gypsum board base layer(s), fill open space between gypsum board and floor, ceiling and dissimilar vertical construction with continuous sealant beads after installation of face layer.

6. At openings and cutouts, fill open spaces between gypsum board and fixtures, cabinets, ducts and other flush or penetrating items, with continuous bead of sealant.

7. Seal sides and backs of electrical boxes to completely close off openings and joints.

8. Sound Flanking Paths:

   a. Where sound-rated partition walls intersect non-rated gypsum board partition walls, provide acoustical sealant at extended sound-rated construction to completely close sound flanking paths through non-rated construction.

   b. Seal joints between face layers at vertical interior angles of intersecting partitions.

3.06 INSTALLATION OF CAULKING COMPOUNDS

A. Building Interior: At interior of building, fill with caulking compound, all exposed joints not subject to movement that require a finished appearance. Principal locations shall include, but not be limited to the following:

1. Joints in interior walls, between masonry and metal frames.

2. Joints in interior walls, between masonry and adjacent construction.

3. Wherever indicated by the words “caulk” or “caulking” on the Drawings, except if the locations are specified to be sealed.

3.07 INSTALLATION OF FIRESTOPPING SYSTEM

A. Prepare substrate surfaces to insure proper support for firestop system. Clean surfaces of all foreign material including loose debris, dirt, oil, grease, and wax. Install firestop material in accordance with manufacturer’s printed instructions and UL requirements.

3.08 CLEANING

A. Excess Sealing and Caulking Materials: Remove excess sealing and caulking materials from adjacent surfaces before materials have set up. Follow manufacturer's instructions for removal of sealing and caulking materials from finished surfaces. Repair surfaces damaged by sealing and caulking operations. Obtain written approval, from the Architect, of the entire installation after completion.

B. Debris and Waste Materials: During progress of the Work, keep the premises free of debris and waste materials resulting from Sealing and Caulking Work. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site, and dispose of legally. Upon completion and before final acceptance of the Work, remove unused materials, tools, and equipment from the site.

C. Waste Management: Collect field generated construction waste created during construction or final.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

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. Silicone joint sealants.
2. Urethane joint sealants.
3. Polysulfide joint sealants.
4. Latex joint sealants.
5. Solvent-release-curing joint sealants.
6. Preformed joint sealants.
7. Acoustical joint sealants.

B. Related Sections:

1. Section 04 20 16 "Reinforced Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
2. Section 079500 "Expansion Control" for building expansion joints.
3. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
4. Section 084423 "Structural-Sealant-Glazed Curtain Walls" for structural and other glazing sealants.
5. Section 088000 "Glazing" for glazing sealants.
6. Section 088400 "Plastic Glazing" for plastic glazing sealants.
7. Section 092613 "Gypsum Veneer Plastering" for sealing perimeter joints and penetrations.
8. Section 092900 "Gypsum Board" for sealing perimeter joints.
9. Section 093000 "Tiling" for sealing tile joints.
10. Section 095113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.
11. Section 096313.35 "Chemical-Resistant Brick Flooring" for sealing flooring joints.
12. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than 5 pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

   a. Each kind of sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

G. Field-Adhesion Test Reports: For each sealant application tested.

H. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf
c. Tremco Incorporated; Spectrum 1.

B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, provide the following:
   a. Dow Corning Corporation; 795.
   b. GE Advanced Materials - Silicones; SilPruf SCS2000.
   c. Tremco Incorporated; Spectrem 2.

C. Mildew Resistant, Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide the following:
   a. Dow Corning Corporation; 999-A.
   b. GE Advanced Materials - Silicones; Contractors SCS1000 .
   c. Tremco Incorporated; Tremsil 200.

D. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.

1. Products: Subject to compliance with requirements, provide the following:

   a. Dow Corning Corporation; NS Parking Structure Sealant.
   b. Pecora Corporation; 301 NS.
   c. Tremco Incorporated; Spectrem 800.
   .

E. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, provide the following:

   a. Tremco Incorporated; Spectrem 4TS.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide the following:

   a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
   b. Tremco Incorporated; Dymonic 100

B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide the following:

   a. BASF Building Systems; Sonolastic NP1.
   b. Sika Corporation, Construction Products Division
   c. Tremco Incorporated; Vulkem 45SSL.

C. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, provide the following:

   a. Pecora Corporation; Dynatrol II.
   b. Polymeric Systems, Inc.; PSI-270.
   c. Tremco Incorporated; Dymeric 240 FC.

D. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.

1. Products: Subject to compliance with requirements, provide the following:

   a. Polymeric Systems, Inc.; PSI-270.
   b. Tremco Incorporated; Dymeric 240 FC.

E. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.

1. Products: Subject to compliance with requirements, provide the following:

   a. BASF Building Systems; Sonolastic NP1.
   b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
   c. Tremco Incorporated; Vulkem 45SSl.
   .

F. Immersible, Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Uses T and I.

1. Products: Subject to compliance with requirements, provide the following:

   a. Sika Corporation, Construction Products Division; Sikaflex - 1CSL.
   b. Tremco Incorporated; Vulkem 45.

G. Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I.

1. Products: Subject to compliance with requirements, provide the following:

   a. BASF Building Systems; Sonolastic NP 2.

b. Pecora Corporation; Dynatred.
c. Tremco Incorporated; Vulkem 45SSL.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide the following:

a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. Tremco Incorporated; Tremflex 834.

2.5 PREFORMED JOINT SEALANTS

A. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Corning Corporation; 123 Silicone Seal.
b. GE Advanced Materials - Silicones; UltraSpan US1100.
c. Tremco Inc, Simple Seal

B. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Products: Subject to compliance with requirements, provide the following:

a. Dayton Superior Specialty Chemicals; Polytite Standard.
b. EMSEAL Joint Systems, Ltd.; Emseal 25V.
a. Tremco Inc; illmod 600.

2.6 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide the following:

a. Pecora Corporation; AC-20 FTR.

b. USG Corporation; SHEETROCK Acoustical Sealant.
c. TREMCO INC, TREMflex 834.

2.7 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

I. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at

perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

   a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
   b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces JS-#.

1. Joint Locations:

a. Control and expansion joints in brick pavers.
b. Isolation and contraction joints in cast-in-place concrete slabs.
c. Joints between plant-precast architectural concrete paving units.
d. Joints in stone paving units, including steps.
e. Tile control and expansion joints.
f. Joints between different materials listed above.
g. Other joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
3. Urethane Joint Sealant: Single component, nonsag, traffic grade.
4. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade.
5. Preformed Joint Sealant: Preformed foam sealant.
6. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion JS-#.

1. Joint Locations:

a. Joints in pedestrian plazas.
b. Joints in swimming pool decks.
c. Other joints as indicated.

2. Urethane Joint Sealant: Immersible, single component, nonsag, traffic grade.
3. Polysulfide Joint Sealant: Immersible, multicomponent, nonsag, traffic grade.
4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-#.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Joints between plant-precast architectural concrete units.
    c. Control and expansion joints in unit masonry.
    d. Joints in dimension stone cladding.
    e. Joints in glass unit masonry assemblies.
    f. Joints in exterior insulation and finish systems.
    g. Joints between metal panels.
    h. Joints between different materials listed above.
    i. Perimeter joints between materials listed above and frames of doors and windows.
    j. Control and expansion joints in ceilings and other overhead surfaces.
    k. Other joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50, Class 25.
3. Urethane Joint Sealant: Single component, nonsag, Class 100/50] [Single component, nonsag, Class 50.
4. Polysulfide Joint Sealant: Single component, nonsag.
5. Preformed Joint Sealant: Preformed silicone.
6. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-#.

1. Joint Locations:

    a. Isolation joints in cast-in-place concrete slabs.
    b. Control and expansion joints in stone flooring.
    c. Control and expansion joints in brick flooring.
    d. Control and expansion joints in tile flooring.
    e. Other joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
3. Urethane Joint Sealant: Single component, nonsag, traffic grade.
4. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade.
5. Preformed Joint Sealant: Preformed foam.
6. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical joints on exposed surfaces of interior unit masonry, concrete walls and partitions.
    e. Perimeter joints between interior wall surfaces and frames of [interior doors and windows].
    f. Other joints as indicated.

2. Joint Sealant: Latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces JS-#.

1. Joint Location:

a. Acoustical joints where indicated.
b. Other joints as indicated.

2. Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 08 Section "Access Control Hardware".
7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
8. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
9. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access control system.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.

6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and

Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”.

    a. Provide 22-gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
    b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
    c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.

3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.

   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. CECO Door Products (C) Honeycomb Core - Regent Series.
2. CECO Door Products (C) Energy Efficient - Trio-E Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Manufacturers Basis of Design:

   a. CECO Door Products (C) – SU SR Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.

2. Manufacturers Basis of Design:

   a. CECO Door Products (C) - BU DU Series.
   b. CECO Door Products (C) - SU Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.

2. Shop priming flush wood doors.

3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 062000 "Finish Carpentry”.

2. Section 088000 "Glazing" for glass view panels in flush wood doors.

3. Section 099000 "Paints and Coatings.”

1.3 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site

1.4 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.

2. Dimensions and locations of mortises and holes for hardware.

3. Dimensions and locations of cutouts.

4. Undercuts.

5. Requirements for veneer matching.

6. Doors to be factory finished and finish requirements.

7. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification WI Certified Compliance Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during remainder of construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

3. Warranty Period for Solid-Core Interior Doors: Life of installation.

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. Ampco.

2. Eggers Industries.

3. Graham Wood Doors; an Assa Abloy Group Company.

4. Haley Brothers, Inc

5. Marlite.

B. Source Limitations: Obtain flush wood doors indicated to be blueprint matched with paneling and wood paneling from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. WDMA I.S.1-A Performance Grade: Heavy Duty.

D. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.

E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

2. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

6. Pairs: Provide formed-steel edges and astragals with intumescent seals.

   a. Finish steel edges and astragals with baked enamel same color as doors.

   b. Finish steel edges and astragals to match door hardware (locksets or exit devices).

F. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

G. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.

2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware. 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. 4-1/2-by-10-inch lock blocks 5-inch midrail blocking], in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

   a. Screw-Holding Capability: 475 lbf 2110 N per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

1. Species: Select white birch

2. Cut: Rift sawn.

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.

2. Species: Select white birch

3. Cut: Rift sawn.

4. Assembly of Veneer Leaves on Door Faces: Center-balance match.

5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

6. Exposed Vertical and Top Edges: Same species as faces or a compatible species - edge Type A

7. Core: Particleboard.

8. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot

9. Construction: Seven plies, either bonded or non-bonded construction.

10. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber**,** rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

3. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming factory finishing.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors with plastic laminate as noted on the drawings (PL-).

C. Factory finish doors where indicated in schedules or on Drawings as factory finished.

D. Use only paints and coatings that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Finish:

1. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish.

2. Finish: As noted on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.

2. Install smoke- and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 41 00
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
1. Aluminum doors complete with hardware.
2. Thermally broken storefronts for 1” glazing.
3. Non-thermal storefronts for ¼” glazing.

C. Products to be Furnished by Genera; Contractor But Not Installed Under This Section:
1. Anchoring devices which are built into masonry.
2. Anchoring devices which are cast in concrete.

D. Related Sections:
1. Section 01 43 39 Mockup
2. Section 05 50 00 Metal Fabrications.
3. Section 06 10 00 Rough Carpentry.
4. Section 07 92 00 Joint Sealants.
5. Section 08 71 00 Door Hardware.
6. Section 08 81 00 Glass Glazing.

1.02 REFERENCES

A. Aluminum Association (AA):
1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
1. 501.2 Field Check of Metal Curtain Walls for Water Leakage.
2. 2605 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
3. 606.1 Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
4. 607.1 Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
5. 608.1 Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
6. 701.2 Specifications for Pile Weatherstripping.
7. Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
8. SFM-1 Aluminum Storefront and Entrance Manual.

C. American National Standards Institute (ANSI):
1. A117.1 Safety Standards for the Handicapped.

D. American Society for Testing and Materials (ASTM):
1. A36 Structural Steel.
2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. B209 Aluminum and Aluminum - Alloy Sheet and Plate.

4. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
5. B308 Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
6. E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
7. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
8. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS):
1. TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces).
2. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.

F. Steel Structures Painting Council (SSPC):
1. Paint 12 Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM REQUIREMENTS

A. Design Requirements:
1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
7. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01 30 00.

B. Product Data:
1. Submit manufacturer's descriptive literature and product specifications.
2. Include information for factory finishes, hardware, accessories, and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.

C. Shop Drawings:
1. Submit shop drawings covering fabrication, installation and finish of specified systems.
2. Include following:
   a. Fully dimensioned plans and elevations with detail coordination keys.
   b. Locations of exposed fasteners and joints.
3. Provide detailed drawings of:
   a. Composite members.
   b. Joint connections for framing systems and for entrance doors.
   c. Anchorage.

d. System reinforcements.
e. System expansion and contraction provisions.
f. Glazing methods and accessories.
g. Internal sealant requirements and recommended types.

4. Schedule of finishes.

D. Samples:
1. Submit manufacturers standard samples indicating quality of finish.
2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
3. Submit samples for each type of glass, 12 x 12 inch size.

E. Qualification Data:
1. Submit installer qualifications verifying years of experience.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility:
1. To ensure quality of appearance and performance, obtain materials for systems from either a single manufacturer or from manufacturer approved by systems manufacturer.

B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.

C. Perform Work in accordance with AAMA SFM-1 and manufacturer's written instructions.

D. Conform to requirements of ANSI A117.1 and local amendments.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 65 00 - 01 66 00.

B. Protect finished surfaces as necessary to prevent damage.

C. Do not use adhesive papers or sprayed coatings which become firmly bonded when exposed to sun.

D. Do not leave coating residue on any surfaces.

E. Replace damaged units.

1.07 WARRANTY

A. Provide warranties in accordance with Section 01 78 36.

B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 5 years from date of Substantial Completion.

C. Warranty shall cover following:
1. Complete watertight and airtight system installation within specified tolerances.
2. System is structurally sound and free from distortion.

D. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 5 years from date of Substantial Completion and agreeing to promptly correct defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements indicated, provide products by one of the following:
   1. Oldcastle BuildingEnvelope®, Terrell, TX.

B. Substitutions: Submit under provisions of Section 01 63 00, a minimum of 10 days prior to bid date.

C. Basis of Design: Oldcastle Building Envelope® Entrance & Storefront Systems:

   1. **Series 500 Wide Stile Doors**: (0.125" wall thickness; 1-3/4" deep), (10" bottom rail, 4-1/2" top rail, 5-1/2" verticals)
   2. **Series 3000 Thermal Multiplane – Center Set:** 2” x 4-1/2” thermally-broken. Door frames will be non-thermal. All designed to receive 1” glazing infill.
   3. **Series 2000 Non-Thermal – Center Set:** 1-3/4” x 4-1/2” for ¼” glazing infill.

2.02 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:
   1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
   1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
   2. Shapes and sizes to suit installation.
   3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Anchorage Devices:
   1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
   2. Hot-dip galvanize steel assemblies after fabrication, comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:
   1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
   2. Provide concealed fasteners wherever possible.
   3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
   4. For concealed locations, provide manufacturer's standard fasteners.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

G. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641.

H. Glazing Gaskets:
   1. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).

2. Profile and hardness as required to maintain uniform pressure for watertight seal.

I. Weather-stripping:
1. Wool pile conforming to AAMA 701.2.
2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

2.03 GLASS AND GLAZING ACCESSORIES
A. Refer to Section 08 80 00.

2.04 DOOR HARDWARE: **Coordinate with 08 71 00**

2.05 FABRICATION
A. Coordination of Fabrication:
1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
2. Fabricate units to withstand loads which will be applied when system is in place.

B. General
1. Conceal fasteners wherever possible.
2. Reinforce work as necessary for performance requirements, and for support to structure.
3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators which will prevent contact and corrosion.
4. Comply with Section 08810 for glazing requirements.

D. Entrance Doors:
1. Fabricate with mechanical joints using internal [steel] reinforcing plates and shear blocks attached with fasteners and by welding.
2. Provide extruded aluminum glazing stops, permanently anchored on security side and removable on opposite side.

E. Hardware:
1. **Receive hardware supplied in accordance with Section 08 71 00 and install in accordance with requirements of this Section.**
2. Cut, reinforce, drill and tap frames and doors as required to receive hardware.
3. Comply with hardware manufacturer's templates and instructions.
4. Use concealed fasteners wherever possible.

F. Welding:
1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

G. Flashings: Form from sheet aluminum with same finish as extruded sections. Material thickness as required to suit condition without deflection or "oil-canning".

2.06 FINISHES: Where indicated on the drawings shall be either:

A. Organic Coating (high performance fluorocarbon):
1. Comply with requirements of AAMA 2605.
2. Surfaces cleaned and given conversion coating pre-treatment prior to application of 0.3 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.

B. Clear Anodized:
   1. Conforming to AA-M12C22A31 and AAMA 607.1.
   2. Architectural Class I, etched, medium matte, clear anodic coating, 0.7 mil minimum thickness.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine conditions and proceed with Work in accordance with Section 01 40 00.

3.02 INSTALLATION
A. Erection Tolerances:
   1. Limit variations from plumb and level:
      a. 1/8 inch in 10'-0" vertically.
      b. 1/8 inch in 20'-0" horizontally.
   2. Limit variations from theoretical locations: 1/4 inch for any member at any location.
   3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.
B. Install doors and hardware in accordance with manufacturer's printed instructions.
C. Set units plumb, level and true to line, without warp or rack of frame.
D. Anchor securely in place, allowing for required movement, including expansion and contraction.
E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact and corrosion.
F. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weathertight construction.
G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07 92 00.
H. Glazing: Refer to requirements of Section 08 80 00.

3.03 ADJUSTING
A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.04 CLEANING
A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

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 aluminum windows for exterior locations.

B. Related Requirements:

1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: Five years from date of Substantial Completion.
c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. All Seasons Window & Door Mfg., Inc.; All Seasons Commercial Division, Inc.
2. Boyd Aluminum Manufacturing.
3. Custom Window Company.
4. DeSCo Architectural Inc.
5. EFCO Corporation; a Pella company.
6. EXTECH Exterior Technologies, Inc.
7. Fleetwood Windows & Doors.
8. Gerkin Windows and Doors.
9. Graham Architectural Products Corp.
10. Kawneer North America; an Alcoa company.
11. Mannix Exterior Wall Systems, Inc.
12. Peerless Products Inc.
13. Quaker Windows Products Co.Thermal Windows, Inc.
14. TRACO.
15. Wausau Window and Wall Systems.
16. Winco.
17. YKK AP America Inc.

C. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AMMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: R.
2. Minimum Performance Grade: 30

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F.

G. Sound Transmission Class (STC): Rated for not less than 30. STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

H. Outside-Inside Transmission Class (OITC): Rated for not less than 26. OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

I. Windborne-Debris Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: Project out.
2. Awning: Project out.
3. Hopper: Project in.
4. Single hung.
5. Double hung.
6. Horizontal sliding.
7. Fixed.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Glass: Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.

1. Kind: Fully tempered where indicated on Drawings.

D. Insulating-Glass Units: ASTM E 2190.

1. Glass: ASTM C 1036, Type 1, Class 1, q3.

a. Tint: Solar Blue Tint.
b. Kind: Fully tempered where indicated on Drawings.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Pyrolytic on second surface.

E. Glazing System: PPG Pacifica Glass.

1. Dual Glazing:

a. Interior Lite: Glass.
b. Exterior Lite: Glass.

F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Integral Ventilating System/Device: Where indicated, provide weather-stripped, adjustable, horizontal fresh-air vent, with a free airflow slot, full width of window sash by approximately 1 inch when open, complying with AAMA/WDMA/CSA 101/I.S.2/A440. Equip vent bar with an integral insect screen, removable for cleaning.

B. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

C. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

F. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weather tight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Window Assemblies: Provide fixed units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weather tight installation, including the following:

1. Angled mullion posts with interior and exterior trim.
2. Angled interior and exterior extension and trim.
3. Exterior head and sill casings and trim.

H. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular 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 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weather tight window installation.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weather tight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

    a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
    b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

    a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
    b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weather tight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Interior Aluminum Doors and Frames”.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in

writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. McKinney (MK) - TA/T4A Series, 5 knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

a. Pemko (PE).

2.4 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. McKinney (MK) - QC (# wires) Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - SER-QC (# wires) Option.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney (MK) - QC-C Series.

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

    a. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
6. Manufacturers:

    a. Rockwood (RO).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.

5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer's Standard.

C. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.

1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
2. Manufacturers:

a. Sargent (SA) - Degree DG1.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).

c. Telkee (TK).

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all features and functionality as specified herein.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.

2.9 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 4870 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds.

Locks to be capable of accepting between 12 to 24 volts direct current and be UL listed for use on fire rated door assemblies. Electromagnetic coils are to consume no more than 1.5W during normal operation. Locks are to have an integrated door position switch, tamper switch, and lock bond sensor. Locks are to have integrated motion sensor and/or security camera as indicated in the hardware sets. Locks to be capable of detecting door prop conditions and entering low power mode. Provide mounting accessories as needed to suit opening conditions. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Manufacturers:

    a. Securitron (SU) - M680E Series.

2.12 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.

2.13 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.
3. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
4. Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.

2.14 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:

a. Norton Rixson (NO) - 9500 Series.
b. Sargent Manufacturing (SA) - 281 Series.

C. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:

a. Norton Rixson (NO) - 7500 Series.
b. Sargent Manufacturing (SA) - 351 Series.

2.15 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

a. Rockwood (RO).

2.16 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Rockwood (RO).

2.17 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.18 ELECTRONIC ACCESSORIES

A. Push-Button Switches: Industrial grade momentary or alternate contact, back-lighted push buttons with stainless-steel switch enclosures. 12/24 VDC bi-color illumination suitable for either flush or surface mounting.

1. Manufacturers:

a. Alarm Controls (AK) - TS Series.
b. Securitron (SU) - PB Series.

B. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.

1. Manufacturers:

a. Securitron (SU) - XMS Series.

C. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 3280 Series.
b. Securitron (SU) - DPS Series.

D. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
2. Manufacturers:

a. Securitron (SU) - AQL Series.

2.19 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - SARGENT
5. SU - Securitron
6. AK - Alarm Controls
7. OT - Other

Hardware Sets

Set: 1.0

Doors: 100B, 124B

2 Continuous Hinge	CFM__SLF-HD1		PE	
2 Magnetic Lock	M680EBD x Mntg Brackets	630	SU	⚡
1 CVR Exit, NL	DG1 AD8610 106	US32D	SA	

1	CVR Exit, EO	AD8610	US32D	SA	
2	Offset Door Pull	RM3311-24	US32D	RO	
2	Door Closer w Stop	281 CPS	EN	SA	
2	Drop Plate & Mounting Hardware	as required	EN	SA	
1	Perimeter Seal	by door / frame mfg			
2	Sweep	315CN x Width		PE	
1	Threshold	2005AT x Width		PE	
1	Door Release	TS-18		AK	⚡
1	Motion Sensor	XMS		SU	⚡
2	Position Switch	DPS-M/W-WH (as required)		SU	⚡
1	Push Button	EEB3N		SU	⚡
1	Card Reader	By Security		OT	
1	Power Supply	AQLX-E1 - Size as required		SU	⚡

Notes: Door is normally closed and secured. Ingress by valid credential or remote release. Fail safe tied to fire alarm for simultaneous release, free egress at all times. Coordinate with security and electrical.

Set: 2.0

Doors: 124A, 125

2	Continuous Hinge	CFM__SLF-HD1		PE	
2	Magnetic Lock	M680EBD x Mntg Brackets	630	SU	⚡
1	CVR Exit, NL	DG1 AD8610 106	US32D	SA	
1	CVR Exit, EO	AD8610	US32D	SA	
2	Offset Door Pull	RM3311-24	US32D	RO	
2	Door Closer w Stop	281 CPS	EN	SA	
2	Drop Plate & Mounting Hardware	as required	EN	SA	
1	Perimeter Seal	by door / frame mfg			
2	Sweep	315CN x Width		PE	
1	Threshold	2005AT x Width		PE	
1	Motion Sensor	XMS		SU	⚡
2	Position Switch	DPS-M/W-WH (as required)		SU	⚡
1	Push Button	EEB3N		SU	⚡
1	Card Reader	By Security		OT	
1	Power Supply	AQLX-E1 - Size as required		SU	⚡

Notes: Door is normally closed and secured. Ingress by valid credential. Fail safe tied to fire alarm for simultaneous release, free egress at all times. Coordinate with security and electrical.

Set: 3.0

Doors: 117

2	Continuous Hinge	CFM__SLF-HD1		PE
1	CVR Exit, NL	DG1 AD8610 106	US32D	SA
1	CVR Exit, EO	AD8610	US32D	SA
2	Offset Door Pull	RM3311-24	US32D	RO
2	Door Closer w Stop	281 CPS	EN	SA
2	Drop Plate & Mounting Hardware	as required	EN	SA
1	Perimeter Seal	by door / frame mfg		
2	Sweep	315CN x Width		PE
1	Threshold	2005AT x Width		PE

Set: 4.0

Doors: 100A

1	Continuous Hinge	CFM__SLF-HD1 SER		PE
1	Rim Exit, NL, RX, ELR	DG1 55 56 8804	US32D	SA
1	Offset Door Pull	RM3311-24	US32D	RO
1	Door Closer w Stop	281 CPS	EN	SA
1	Drop Plate & Mounting Hardware	as required	EN	SA
1	Perimeter Seal	by door / frame mfg		
1	Sweep	315CN x Width		PE
1	Threshold	2005AT x Width		PE
1	ElectroLynx Harness - Frame	QC-C1500P		MK
1	ElectroLynx Harness - Door	QC-C*** x Length as required		MK
1	Door Release	TS-18		AK
1	Position Switch	DPS-M/W-WH (as required)		SU
1	Card Reader	By Security		OT
1	Power Supply	AQLX-E1 - Size as required		SU

Notes: Door is normally closed, latched, and secured. Valid credential or remote release for ingress, free egress at all times. Coordinate with security and electrical.

Set: 5.0

Doors: 126

1	Continuous Hinge	CFM__SLF-HD1		PE

1	Storeroom Lock	DG1 8204 LNMD	US26D	SA
1	Door Closer w Stop	281 CPS	EN	SA
1	Drop Plate & Mounting Hardware	as required	EN	SA
1	Perimeter Seal	by door / frame mfg		
1	Sweep	315CN x Width		PE
1	Threshold	2005AT x Width		PE

Set: 6.0

Doors: 135

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Storeroom Lock	DG1 8204 LNMD	US26D	SA
1	Door Closer w Stop	281 CPS	EN	SA
1	Kick Plate	K1050 10" High x LDW CSK	US32D	RO
1	Gasketing	2891APK (Head & Jambs)		PE
1	Rain Guard	346C x Width		PE
1	Sweep	3452AV x Width		PE
1	Threshold	2005AT x Width		PE

Set: 7.0

Doors: 114

4	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Magnetic Lock	M680EBD x Mntg Brackets	630	SU	⚡
2	CVR Exit, CL	DG1 NB WD8613 ETMD	US32D	SA	
2	Surface Closer	351 Reg / PA	EN	SA	
2	Kick Plate	K1050 10" High x LDW CSK	US32D	RO	
2	Door Stop	406 / 409 / 446 as required	US26D	RO	
2	Silencer	As req'd		RO	
1	Door Release	TS-18		AK	⚡
1	Motion Sensor	XMS		SU	⚡
2	Position Switch	DPS-M/W-WH (as required)		SU	⚡
1	Push Button	EEB3N		SU	⚡
1	Card Reader	By Security		OT	
1	Power Supply	AQLX-E1 - Size as required		SU	⚡

Notes: Door is normally closed and secured. Ingress by valid credential or remote release. Fail safe tied to fire alarm for simultaneous release, free egress at all times. Coordinate with security and electrical.

Set: 8.0

Doors: 110

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Dust Proof Strike	570	US26D	RO
1	Flush Bolt (Automatic)	2842 / 2942 (as required)	US26D	RO
1	Storeroom Lock	DG1 8204 LNMD	US26D	SA
1	Coordinator (W/mtg plates)	2672 x Mtg Brkts	Black	RO
2	Surface Closer	351 Reg / PA	EN	SA
2	Kick Plate	K1050 10" High x LDW CSK	US32D	RO
2	Door Stop	406 / 409 / 446 as required	US26D	RO
2	Astragal	18061CNB x Height		PE
1	Gasketing	S88D (Head & Jambs)		PE

Set: 9.0

Doors: 111

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Dust Proof Strike	570	US26D	RO
1	Flush Bolt (Automatic)	2842 / 2942 (as required)	US26D	RO
1	Office Lock	DG1 8205 LNMD	US26D	SA
1	Coordinator (W/mtg plates)	2672 x Mtg Brkts	Black	RO
2	Surface Closer w Positive Stop	351 PS	EN	SA
2	Kick Plate	K1050 10" High x LDW CSK	US32D	RO
2	Astragal	18061CNB x Height		PE
1	Gasketing	S88D (Head & Jambs)		PE

Set: 10.0

Doors: 112, 113, 128

2	Hinge, Full Mortise	TA2714	US26D	MK	
1	Hinge, Full Mortise [Elec]	TA2714 QCxx	US26D	MK	⚡
1	Fail Secure Lock	DG1 RX 8271-24V LNMD	US26D	SA	⚡
1	Surface Closer	351 Reg / PA	EN	SA	
1	Kick Plate	K1050 10" High x LDW CSK	US32D	RO	
1	Door Stop	406 / 409 / 446 as required	US26D	RO	
1	Gasketing	S88D (Head & Jambs)		PE	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	ElectroLynx Harness - Door	QC-C*** x Length as required		MK	⚡
1	Door Release	TS-18		AK	⚡

1	Position Switch	DPS-M/W-WH (as required)	SU	⚡
1	Card Reader	By Security	OT	
1	Power Supply	AQLX-E1 - Size as required	SU	⚡

Notes: Door is normally closed, latched, and secured. Valid credential or remote release for ingress, free egress at all times. Coordinate with security and electrical.

Set: 11.0

Doors: 103A

2	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Hinge (heavy weight-Elec)	T4A3786 QCxx	US26D	MK	⚡
1	Rim Exit, ST, RX, ELR	DG1 12 55 56 8804 ETMD	US32D	SA	⚡
1	Surface Closer	351 Reg / PA	EN	SA	
1	Kick Plate	K1050 10" High x LDW CSK	US32D	RO	
1	Door Stop	406 / 409 / 446 as required	US26D	RO	
1	Gasketing	S88D (Head & Jambs)		PE	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	ElectroLynx Harness - Door	QC-C*** x Length as required		MK	⚡
1	Door Release	TS-18		AK	⚡
1	Position Switch	DPS-M/W-WH (as required)		SU	⚡
1	Card Reader	By Security		OT	
1	Power Supply	AQLX-E1 - Size as required		SU	⚡

Notes: Door is normally closed, latched, and secured. Valid credential or remote release for ingress, free egress at all times. Coordinate with security and electrical.

Set: 12.0

Doors: 127

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom Lock	DG1 8204 LNMD	US26D	SA
1	Surface Closer	351 Reg / PA	EN	SA
1	Kick Plate	K1050 10" High x LDW CSK	US32D	RO
1	Door Stop	406 / 409 / 446 as required	US26D	RO
1	Gasketing	S88D (Head & Jambs)		PE

Set: 13.0

Doors: 101, 102, 104, 105, 106, 107, 108, 109, 115, 116

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Office Lock	DG1 8205 LNMD	US26D	SA
1 Surface Closer	351 Reg / PA	EN	SA
1 Kick Plate	K1050 10" High x LDW CSK	US32D	RO
1 Door Stop	406 / 409 / 446 as required	US26D	RO
1 Gasketing	S88D (Head & Jambs)		PE

Set: 14.0

Doors: 118

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Privacy Lock	V20 8265 LNMD	US26D	SA
1 Surface Closer	351 Reg / PA	EN	SA
1 Mop Plate	K1050 4" High x LDW CSK	US32D	RO
1 Kick Plate	K1050 10" High x LDW CSK	US32D	RO
1 Door Stop	406 / 409 / 446 as required	US26D	RO
1 Gasketing	S88D (Head & Jambs)		PE

Set: 15.0

Doors: 123

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Storeroom Lock	DG1 8204 LNMD	US26D	SA
1 Surface Closer	351 Reg / PA	EN	SA
1 Kick Plate	K1050 10" High x LDW CSK	US32D	RO
1 Door Stop	406 / 409 / 446 as required	US26D	RO
3 Silencer	As req'd		RO

Set: 16.0

Doors: 129, 130, 131, 132, 133, 134

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Classroom Lock	DG1 8237 LNMD	US26D	SA
1 Surface Closer	351 Reg / PA	EN	SA
1 Kick Plate	K1050 10" High x LDW CSK	US32D	RO
1 Door Stop	406 / 409 / 446 as required	US26D	RO
3 Silencer	As req'd		RO

Set: 17.0

Doors: 119, 120, 121, 122

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Classroom Deadlock	DG1 4877	US26D	SA
1	Pull Plate	BF 110 x 70C	US32D	RO
1	Push Plate	70E	US32D	RO
1	Surface Closer	351 Reg / PA	EN	SA
1	Mop Plate	K1050 4" High x LDW CSK	US32D	RO
1	Kick Plate	K1050 10" High x LDW CSK	US32D	RO
1	Door Stop	406 / 409 / 446 as required	US26D	RO
3	Silencer	As req'd		RO

END OF SECTION 087100

SECTION 08 80 00
GLAZING

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Storefront framing.
4. Glazed entrances.

B. Related Sections:

1. Section 057300 "Decorative Metal Railings" for glass panels in railings.
2. Section 084126 "All-Glass Entrances and Storefronts."
3. Section 084229.13 "Folding Automatic Entrances."
4. Section 084229.23 "Sliding Automatic Entrances."
5. Section 084229.33 "Swinging Automatic Entrances."
6. Section 084233 "Revolving Door Entrances."
7. Section 084423 "Structural-Sealant-Glazed Curtain Walls" for glazing sealants.
8. Section 088113 "Decorative Glass Glazing."
9. Section 088300 "Mirrors."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 and ICC's International Building Code by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: 110 mph.
    c. Exposure Category: C.
2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
3. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:

    a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
    b. Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.
    c. Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
4. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-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 glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight (8) 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.

1.6 ACTION SUBMITTALS

A. Product Data: As provided by: PPG Solar Cool Glass - 1.888.774.4332.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Tinted glass.
2. Insulating glass.
3. Reflective – tinged glass.

C. Glazing Accessory Samples: For gaskets, sealants and, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings and sealant testing agency.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, insulating glass, glazing sealants and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Source Limitations for Glass: Obtain tinted float glass and insulating glass from single source from single manufacturer for each glass type.

F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

G. Glazing Publications: Comply with published recommendations of glass product 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. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

L. Preinstallation Conference: Conduct conference at Project site.

   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: (10) Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness: Not less than **¼".** (2 pane insulated).

B. Strength: Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic protection testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.

4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

2.3 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Manufacturers Name: Vitro (1.855.887.6457).
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
   2. Spacer: Aluminum with dark bronze, color anodic finish.
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

   1. Neoprene complying with ASTM C 864.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned **neoprene** gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

A. General:

   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements: Tremco Incorporated; Spectrem 1.

2. Applications: Architects Approved Equal.

C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.9 INSULATING-GLASS TYPES

A. Glass Type:

1. Overall Unit Thickness: 1 inch at exterior windows.
2. Thickness of Each Glass Lite: Composed of two ¼" panels at exterior windows, one panel for interior windows.
3. Outdoor Lite: Solexia Solarban 70XL.
4. Interspace Content: Air.
5. Indoor Lite: Clear fully tempered float glass.
6. Low-E Coating: Pyrolytic on second surface.
7. Provide safety glazing labeling.
8. Interior Glass: ¼" Clear Safety glass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. 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.

L. 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 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to

produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.
Wash glass are recommended in writing by glass manufacturer.

END OF SECTION

SECTION 09 24 00
CEMENT PLASTERING

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 portland cement plasterwork (stucco) on paper backed metal lath over unit masonry.

B. Related Sections:

   1. Section 054000 "Cold-Formed Metal Framing" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.
   2. Section 061000 "Rough Carpentry" for wood framing and furring included in portland cement plaster assemblies.
   3. Section 061600 "Sheathing" for sheathing and water-resistant barriers included in portland cement plaster assemblies.
   4. Section 072100 "Thermal Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.
   5. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support lath and portland cement plaster.
   6. Section 092300 "Gypsum Plastering" for gypsum-based conventional plaster and associated lath.
   7. Section 092613 "Gypsum Veneer Plastering" for gypsum-based veneer plaster applied on gypsum base for veneer plaster, unit masonry, and monolithic concrete.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Initial Selection: For each type of factory-prepared finish coat indicated.

D. Samples for Verification: For each type of textured finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by, and displaying a classification label from, a qualified independent testing agency acceptable to the authority having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Construct fire-resistance rated partitions in compliance with tested assembly requirements where indicated on drawings.
2. Rated assemblies to be substantiated from applicable testing using proposed products, by Contractor.
3. Both metal framing and wallboard manufacturers must submit written confirmation that they accept the other manufacturer's product as a suitable component in the assembly. Acceptance is as follows:

   a. If installation of both products is proper, no adverse effect will result in the performance of one manufacturer's product by the other's product.
   b. Combining products can be substantiated by required assembly tests.

4. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

C. Mockups: Before plastering, install mockups of at least 100 sq. ft. (9.3 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for each type of finish indicated.
2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

B. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.

1. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
2. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

C. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

D. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet, ASTM A 653/A 653M, G60 (Z180). Equal to: Clark Dietrich paper backed galvanized metal lath.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable product by one of the following:

   a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
   b. CEMCO.
   c. MarinoWARE.
   d. Phillips Manufacturing Co.

2. Diamond-Mesh Lath: Flat, Self-furring, 3.4 lb/sq. yd. (1.8 kg/sq. m)].

3. V Truss Corners - Exterior Corner Reinforcements:

   a. Profile: Straight.
   b. Finish: Class 1 Galvanized Coating complying with ASTM A 641.
   c. As per ICC ESR-2017.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Davis Wire Corporation; a Heico Wire Group company.
   b. Jaenson Wire Company.
   c. Keystone Steel & Wire Co.
   d. K-Lath; a division of Georgetown Wire.
   e. Architect approved equal.

B. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper.

1. Provide paper-backed lath unless otherwise indicated at all exterior locations.

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable product by one of the following:

a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
b. CEMCO.
c. MarinoWARE.
d. Phillips Manufacturing Co.
e. Architect approved equal.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
3. Cornerite: Fabricated from expanded metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
4. Strip Lath: Fabricated from expanded-metal lath with ASTM A653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
5. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
6. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.

a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
b. Small nose cornerbead with perforated flanges; use on curved corners.
c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.

7. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
8. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
9. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
10. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6.34 to 16 mm) wide; with perforated flanges.

C. Accessories for Portland Cement Base Plaster: ASTM C 1063. Fabricated from Zinc Alloy (99 percent pure zinc), galvanized (zinc coated) steel, rigid PVC or CPVC plastic, or anodized aluminum alloy.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable products by one of the following:

    a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
    b. Phillips Manufacturing Co.
    c. Plastic Components, Inc.
    d. Vinyl Corp.
    e. TXI Model Lone Star Stucco

2. Corner beads: With perforated flanges.

    a. Small nose corner bead; use unless otherwise indicated.

3. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.

    a. Square-edge style; use unless otherwise indicated.

4. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
5. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1-inch-(25-mm-) wide reveal; with perforated concealed flanges.
6. Soffit Reveals: PVC reveals conforming to ASTM C 1047.

    a. Vinyl Corp. "No. DC58-50SE".

7. Soffit Vents: Vinyl soffit vent.

    a. Vinyl Corp. "No. CSJ50-200V".

D. Plastic Accessories for Gypsum Wallboard and Gypsum Veneer Base: ASTM C847. Fabricated from plastic or plastic and paper in combination shall be manufactured from rigid PVC, ABS, PETG, high-impact polystyrene (HIPS), or polycarbonate (PC) plastic not less than 0.028 inch (0.7112 mm) and Section 4.3.1 PVC specification D 3678 Class II.

1. Basis-of Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable products by one of the following:

    a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
    b. Plastic Components, Inc.
    c. Vinyl Corp.
    d. Architect approved equal

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.

2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150,Type II.

1. Color for Finish Coats: Gray.

B. Masonry Cement: ASTM C 91, Type N.

1. Color for Finish Coats: Gray.

C. Plastic Cement: ASTM C 1328.

D. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

E. Sand Aggregate: ASTM C 897.

1. Color for Job-Mixed Finish Coats: White note: stucco is to be painted with elastomeric paint.

F. Perlite Aggregate: ASTM C 35.

G. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, and proprietary ingredients.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bonsal American, an Oldcastle Company; Marblesil Stucco Mix.
b. TXI Model- Lone Star Stucco
c. El Rey Stucco Company, Inc., a brand of ParexLaHabra, Inc.; Premium Stucco Finish.
d. Florida Stucco; Florida Stucco.
e. LaHabra, a brand of ParexLaHabra, Inc.; Exterior Stucco Color Coat.
f. Omega Products International, Inc.; ColorTek Exterior Stucco.
g. QUIKCRETE; QUIKCRETE Finish Coat Stucco, No. 1201.

2. Color: with-out color agent as the stucco is to receive coats of elastomeric paint.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

2. Masonry Cement Mixes:

a. Scratch Coat: 1 part masonry cement and 2-1/2 to 4 parts aggregate.
b. Brown Coat: 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.

3. Portland and Masonry Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

4. Plastic Cement Mixes:

a. Scratch Coat: 1 part plastic cement and 2-1/2 to 4 parts aggregate.
b. Brown Coat: 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.

5. Portland and Plastic Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:

1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
2. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
3. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

D. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:

1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
2. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
3. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

E. Job-Mixed Finish-Coat Mixes:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
2. Masonry Cement Mix: 1 part masonry cement and 1-1/2 to 3 parts aggregate.
3. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
4. Plastic Cement Mix: 1 part plastic cement and 1-1/2 to 3 parts aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 1063.

1. Partition Framing and Vertical Furring: Install flat diamond-mesh lath.
2. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh lath.
3. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh welded-wire lath.

3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:

1. Install lath-type, external-corner reinforcement at exterior locations.
2. Install corner bead at interior and exterior locations.

C. Control Joints: Install control joints at locations indicated on Drawings.

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:

a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
b. Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).

2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on unit masonry plaster bases.

C. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork**,** on masonry; 3/4-inch (19-mm) thickness.

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

D. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 3/4 inch (19 mm) .

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

E. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch (10 mm) thick on concrete masonry.

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

F. Ceilings; Base-Coat Mix: Scratch coat for two-coat plasterwork, 1/4 inch (6 mm) thick on concrete.

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

G. Plaster Finish Coats: Apply to provide sand texture finish at all exterior walls..

H. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.

I. Concealed Interior Plasterwork:

1. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
2. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
3. Where plaster application will be used as a base for adhesive application of tile and similar finishes, omit finish coat.

3.7 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 09 28 13
CEMENTITIOUS BACKING BOARDS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Cementitious Backing Board Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Cement Board and Accessories.

2. Joint Treatment.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Metal Stud Framing System for Interior Work - Section 09 29 00.

2. Tile Work - Section 09 31 00.

1.02 REFERENCE SPECIFICATIONS

A. ASTM International Standard Specifications: As refered to herein, and throughout this section.

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C.

1.03 QUALITY ASSURANCE

A. General: All materials, articles, accessories incorporated in the Work shall be type and quality specified herein, and subject to the Architect’s review. Methods of preparation, construction and installation of such materials, articles and accessories shall be strictly in accordance with the accepted standard practices, manufacturer’s printed specifications and/or instructions, the Architect’s Drawings and Specifications, and as directed by the Architect.

1.04 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. General: Submit Product Data to Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

1.05 DELIVERY AND STORAGE

A. General:

1. Deliver all materials to the site in their original protective wrappings and/or packages, clearly labeled with pertinent information to facilitate checking. Unload in areas designated by the General Contractor. Damaged or deteriorated materials shall be removed from the premises.

2. When material delivery schedules necessitate delivery of the materials before the building is enclosed, or prior to installation of the materials, provide storage and weathertight protection from damage and exposure to the elements in the form of an enclosed shelter of frame construction, with solid wall sheathing and a pitched roof, for the temporary storage of the materials. A waterproof covering of allboard in lieu of the temporary building is not acceptable.

B. Cement Board: When delivered, the cement board panels with unbroken bundling tape shall be neatly piled flat on the floor without overlapping the floor. Storage area shall be protected from the weather.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 PROJECT ENVIRONMENTAL CONDITIONS

A. Interior cement board panel installations; during installation, maintain temperatures in the building within the range of 40°F. to 100°F.

B. Provide adequate ventilation to carry off excess moisture.

C. Cement board panels shall not be installed when the board is wet.

1.07 INSPECTION

A. Carefully inspect all surfaces upon which the Work of this section is to be installed; and notify the General Contractor, in writing, for correction, of any condition, detrimental to the installation of this Work. The installation of any materials of this section will be considered this Contractor's acceptance of the field conditions. Therefore, if any defective Work is covered in, remove and replace the affected Work of this section, without extra cost to the Owner.

B. Steel stud wall framing to receive cement board panels shall be structurally sound, free from bow, and in general compliance with local building code requirements. Damaged and excessively bowed studs shall be replaced before installation of cement board panels. Framing shall be designed (based on stud properties alone) not to exceed L/360 deflection for tile. Steel stud framing must be 20 gauge or heavier with corrosion-resistant metal coating equivalent to G60 hot-dipped galvanized.

1.08 SCAFFOLDING

A. Provide, erect, and maintain all scaffolding, ladders, etc., as required by field conditions, all in accordance with the standards of all governing local, state, and national safety codes, as required for the performance of all Work of this section of the Specifications. Such equipment shall be erected at times and locations so as not to delay any part of this or any other Work. When no longer required, promptly dismantle the equipment and remove same from the site.

1.09 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 CEMENT BOARD AND ACCESSORIES

A. Manufacturer: Products specified herein, unless otherwise indicated, shall be as manufactured by United States Gypsum Company, 550 West Adams Street, Chicago, IL 60661, (800)874-4968.

B. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

1. Interior Cement Board Panels: DUROCK® Brand Cement Board, 1/2" thickness, noncombustible cement backerboard substrate excedding ANSI A118.9 for cementitious backer units, provided in widths and lengths as required by Drawings and/or field conditions.

    a. Material Composition: Cement board shall be formed in a continuous process of aggregated Portland cement slurry with polymer-coated, glass-fiber mesh completely encompassing edges, back and front surfaces. The edges shall be formed smooth, and ends square cut.

    b. Edges: Formed smooth.

    c. Ends: Square cut.

    d. Strength: High flexural strength, bend resistant to prevent finish cracking. Boards shall have high compressive strength to resist impact damage.

    e. Surface Finishes: Cement board shall have dual surface finishes; a smooth surface side for mastic applications; and a textured surface side for mortar applications.

    f. Surface Burning Characteristics: Test in accordance with ASTM Standard E84.

        1) Flame Spread maximum 5, and Smoke Developed 0.

2. Accessories: Provide accessory items and Prep products as recommended and acceptable with the specified cement board manufacturer.

    a. Joint Reinforcement Material: DUROCK™ Brand Joint Tape, not less than 2" wide (alkali-resistant) glass-fiber mesh tape.

    b. Fasteners: DUROCK™ Brand Screws (No. 8) corrosion-resistant, 8-gauge, wafer head wood and/or steel screws with self-drilling points and countersinking ribs to prevent strip-out. Both wood and/or steel screw types shall have heads with a minimum of 0.40" in diameter; driving recess shall be a No. 2 “Phillips” design. Provide types and of lengths as recommended by cement board manufacturer for installations as indicated on the Drawings and/or required by field conditions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 CEMENT BOARD INSTALLATIONS

A. Interior Walls: Install interior cement board over metal stud framing at locations as indicated on the Drawings to receive wall tile.

B. General:

1. Inspect the metal stud framing and verify proper placement. Studs shall be straight line, with no protrusions from the line of the studs, such as screws and nail heads, mounting brackets and flanges of electrical outlet boxes. Interior metal stud framing shall be a maximum of 16" O.C.

2. Report to the General Contractor, in writing, any metal stud framing conditions of poor placement, protrusions, or other conditions interfering with the proper installation of cement boards. Installation of cement boards without notification shall be considered Contractor's acceptance of the metal stud framing, and claims for failure of cement board Work because of unsatisfactory framing conditions will not be allowed. Contractor shall be responsible for all faulty Work resulting from improper installation of the cement boards.

C. Installation: Cement board shall be installed in accordance with the manufacturer's written instructions and as specified herein.

1. Panel Application: Pre-cut board to required sizes and make necessary cut-outs. Fit ends and edges closely but not forced together, leaving a 1/8" gap. Install board abutting top of spacer strip. Stagger end joints in successive courses. Fasten cement board to steel studs spaced maximum 16" O.C. and bottom runners with steel screws spaced 8" O.C. with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges.

2. Prohibited Fasteners: Do not use drywall screws or drywall nails.

D. Joint Treatment Application: Prefill all cement board joints, and joints where cement boards abut other panels or surfaces such as gypsum board, with mortar as specified herein, and then immediately embed tape and level the joints.

3.03 CLEAN-UP

A. During progress of the Work, keep the premises free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish to central

area designated for clean-up by the General Contractor. Remove all unused materials, tools, and equipment from site.

B. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 09 29 00
GYPSUM WALLBOARD

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Gypsum Wallboard Work indicated on the Drawings and specified herein. Work includes, but is not limited to the following:

1. Gypsum Wallboard Materials and Accessories.
2. Sound-rated Construction.
3. Non-Load Bearing Metal Stud Framing for Interior Work.
4. Load-Bearing Metal Stud Framing for Interior Work.
5. Suspension System for Gypsum Wallboard.
6. Fire-Rated Wall Construction.
7. Gypsum Sheathing Panels and Accessory Materials.
8. Sanding preparation for painting.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Concrete Forms and Accessories- Section 03 10 0.
2. Unit Structural Masonry - Section 04 23 00.
3. Cold-Formed Metal Framing- Section 05 40 00.
4. Miscellaneous Metal Work - Section 05 50 00.
5. Rough Carpentry Work - Section 06 10 00.
6. Thermal Insulation - Section 07 21 00.

7. Board Insulation - Section 07 21 20.

8. Plaster Veneer System - Section 07 24 00.

9. Joint Protection - Section 07 90 00.

10. Aluminum Storefronts - Section 08 41 10.

11. Tile Work - Section 09 31 00.

12. Acoustical Panel Ceiling - Section 09 51 13.

13. Resilient Bases and Accessories- Section 09 65 13.

14. Paint and Coatings - Section 09 90 00.

1.02 REFERENCE SPECIFICATIONS

A. ASTM International Standard Specifications: As refered to herein, and throughout this section.

1. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems.

2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

3. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

4. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

5. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

6. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.

7. ASTM C1396 - Standard Specification for Gypsum Board.

8. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C.

1.03 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. Product Data: Submit Product Data for each type of product specified.

D. Shop Drawings:

1. Load Bearing Framing: Include placing drawings for framing members showing size and gauge designations, number, type, location, and spacing. Indicate supplemental strapping, bracing, splices, accessories, and details required for proper installation. Detail connections to structural steel and structural concrete. Indicate member gauges, spacing, and sizes.

2. Structural Calculations: Submit complete structural calculations for load bearing metal stud framing indicating loads, stresses, and deflections for members and connections. Calculations shall be sealed by a Professional Engineer licensed in the State of the proposed Project, experienced in the design of light gauge framing.

1.05 SYSTEM REQUIREMENTS

A. Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products, under the following conditions:

1. Gypsum Board Partitions:

a. Standard Systems: Maximum deflection of L/240 of partition height.

b. Systems to receive Water-Resistant Gypsum Board or Cement Backer Board: Maximum deflection of L/360 of partition height.

2. Interior Suspended Ceilings and Soffits: Maximum deflection of L/360 of distance between supports.

B. Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission Class (STC) scheduled or indicated in accordance with ASTM E90 - Standard Test ethod for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.06 DELIVERY AND STORAGE

A. General:

1. Deliver all materials to the site in protective wrappings, clearly labeled with pertinent information to facilitate checking. Unload in areas designated by the General Contractor.

2. When material delivery schedules necessitate delivery of the materials before the building is enclosed, or prior to installation of the materials, provide weathertight protection in the form of frame construction, with solid wall sheathing and a pitched roof, for the temporary storage of the materials. A waterproof covering of wallboard in lieu of the temporary building is not acceptable.

B. Gypsum Wallboard: When delivered, the wallboard with unbroken bundling tape shall be neatly piled flat on the floor without overlapping the floor. Storage area shall be protected from the weather.

C. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.07 PROJECT CONDITIONS

A. Exterior gypsum soffit panel application and joint finishing, exterior Work temperature shall be a minimum of 55°F.

B. Interior gypsum panel application and joint finishing within the building, maintain temperatures within the range of 55°F. to 70°F.

C. Provide ventilation to remove excess moisture.

D. Rooms or areas in which Work is to be installed shall be at temperatures as specified herein, twenty-four (24) hours prior to installation to at least five (5) days after completion of installation. Refer to Division 00 “Supplementary Conditions” for description of temporary heat.

1.08 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and ladders in accordance with local, state, and national safety codes. Equipment shall be erected at times and locations so as not to delay any part of Work. When no longer required, promptly dismantle equipment and remove from site.

1.09 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

1.10 MATERIAL DELIVERY, STORAGE & HANDLING

A. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 GYPSUM WALLBOARD MATERIALS AND ACCESSORIES

A. Gypsum Wallboard: ASTM Standard 48" wide sheets with tapered or rounded (eased) edges, in lengths as long as practical to minimize jointing, of thickness shown on Drawings, as manufactured by United States Gypsum Company, a subsidiary of USG Corporation; National Gypsum Company; or G-P Gypsum Corporation. Provide the following types:

1. Standard Gypsum Wallboard: ASTM Standard C1396 (formerly ASTM Standard C36).

2. Type X Fire-Rated Gypsum Wallboard: ASTM Standard C1396 (formerly ASTM Standard C36).

3. Water-Resistant Gypsum Wallboard: ASTM Standard C1396 (formerly ASTM C630).

4. Foil-Back Standard Gypsum Wallboard: ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. Joint Tape, Joint Cement, and Adhesives:

1. Joint Tape: Perforated paper tape made especially for drywall joint reinforcing, conforming with ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

2. Joint Cement: Two compound system (joint compound and topping compound) conforming with ASTM Standard C475.

a. Provide special joint cement recommended by manufacturer for water-resistant gypsum board.

3. Adhesives: Provide adhesives conforming to ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Frame, as recommended by the wallboard manufacturer.

a. Volatile Organic Compounds (VOC) Content: paint and coatings product specified herein shall have a VOC content of 50 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

C. Metal Stud Framing Systems:

1. Non Load-Bearing: Framing system consisting of metal studs of sizes required for wallthicknesses, or of sizes noted on the Drawings, with mating floor and ceiling track, and all erection accessories. Studs and tracks shall be of cold rolled steel channels conforming to ASTM Standard C645, with an electro-galvanized finish, of not less than the following thicknesses.

a. 25 gauge thick for partitions up to 16'-0" high at 16" O.C.

b. 20 gauge thick for partitions over 16'-0" high (but less than 18'-0" high), at 16" O.C.

c. Where partitions of greater height are required by the Drawings, a heavier gauge shall be required and shall be subject to the Architect's review.

2. Load-Bearing: Galvanized steel framing system conforming to ASTM C955 – Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; shall be 20 gauge (min.) “SJ” style stud members (“C” type studs with stiffening ribs) of sizes and lengths noted on

Drawings, with mating running track, and all required erection accessories such as lintels, strappings, clip angles, joists, as manufactured by United States Gypsum Company.

3. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

D. Steel Channels: 1-1/2" cold rolled steel channels weighing not less than 475 pounds per 1000 linear feet; 2-1/2" cold rolled steel channels weighing not less than 800 pounds per 1000 linear feet. All channels shall be galvanized.

1. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

E. Furring Channels: Provide furring widths (depths) as noted on the Drawings.

1. Hat-Shaped Channels: Cold rolled, electro-galvanized sheet steel, United States Gypsum Company, #DWC-25, 7/8" deep, 25 gauge minimum, conforming to ASTM Standard C645.

2. Z-Furring Channels: Interior Framing Product, Z-Furring (ZF-Series) as manufactured by Dietrich Metal Framing, 200 Old Wilson Bridge Road, Columbus, OH 43085, (800)873-2604. Furring channels shall be 25 gauge (minimum) corrosion resistant galvanized steel, conforming to ASTM Standards A653 and A754.

3. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

F. Felt Protection Strips: Provide Type I, No. 15, unperforated felt conforming to ASTM D226 – Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing, in width as required to fully cover contact surface area between metal studs and/or furring channels and exterior wall.

G. Hangers: Not less than 8 ga. annealed zinc coated steel wire or 1" x 1/8" unperforated galvanized steel bands.

H. Tie Wire: Stainless steel or annealed zinc coated steel wire, 16 gauge minimum.

I. Screws: Phillips head screw fasteners conforming to ASTM Standard C954, with self-drilling point, self-tapping thread, and rust resistant coating, not less than #6 x 1" long, except as otherwise required for fire resistive ratings.

J. Nails: GWB-54, bright finish, annular ringed nails conforming with ASTM Standard C514 (formerly ASTM Standard C380), of length to provide 3/4" minimum penetration into framing or furring, except as otherwise required for fire resistive ratings.

K. Corner Beads: Formed to an angle of 90 degrees, zinc-coated steel not lighter than 26 gauge (0.0179 inch in normal thickness) with wings not less than 7/8 inch wide and perforated for screws/nails and cement treatment, or formed of zinc-coated steel or protected aluminum with legs approximately 3/4" wide and cemented under pressure with a rubber base adhesive to tough paper jointing tape wings not less than 1" wide. Zinc-coated steel shall conform to Federal Specification QQ-S-775 Type I, Class C.

L. Casing Beads: United States Gypsum Company, USG - No. 200-A galvanized metal trim, or equivalent 26 gauge galvanized casing bead by National Gypsum Company.

M. Control Joints: United States Gypsum Company, USG - Zinc Control Joint No. 093, or equivalent 26 gauge galvanized metal control joint product by National Gypsum Company.

N. Special Trim: Provide where/if indicated, special trim fabricated from No. 26 gauge galvanized sheet steel to the shape shown on Drawings.

O. Angle-Type Hangers: Unless otherwise indicated on the Drawings provide angles with legs not less than 7/8 inch wide, formed from 0.0635 inch thick galvanized steel sheet complying with ASTM Standard A653 (formerly ASTM Standard A446), Coating Designation G90, with bolted connections and 5/16 inch diameter bolts.

2.03 GYPSUM SHEATHING PANELS AND MATERIALS

A. Manufacturers: Panels specified herein shall be as manufactured by Georgia-Pacific Gypsum LLC, 133 Peachtree Street, Atlanta, GA, 30303, (800)947-4497 or (800)225-6119.

1. Comparable Products: Gypsum sheathing panels by manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect’s review.

B. Gypsum Sheathing Panels:

1. At Plaster Veneer System: ASTM Standard C1396 (formerly ASTM Standard C79).

2. At Plaster Veneer System: When extensive winter weather exposure is anticipated, provide square edge, noncombustible, gypsum sheathing panels, in

accordance with ASTM Standards E136, C1177 and C1396 (formerly ASTM Standard C79), 1/2" (nominal thickness) Dens- Glass™ Exterior Sheathing (formerly Dens-Glass® Gold Exterior Sheathing with R-Value of 0.56 when tested in accordance with ASTM Standard C518. Gypsum panels shall be made of a treated, water-resistant core, surfaced with fiberglass mats and a “Gold” colored primer coating.

C. Accessory Materials:

1. Fasteners: Steel drill screws, in lengths recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating.

a. For steel framing less than 0.0329 inch thick, attach sheathing with steel drill screws complying with ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

b. For steel framing from 0.033 to 0.112 inch thick, attach sheathing with steel drill screws complying with ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 COLD-FORMED (LOAD-BEARING) METAL FRAMING

A. Exterior Metal Framing: Metal framing shown on Drawings for gypsum wallboard sheathing shall be furnished and installed by the Cold-Formed Metal Framing Contractor.

B. Wood Framing and Furring: Wood framing and furring where shown on Drawings for gypsum wallboard finish shall be furnished and installed by the Rough Carpentry Contractor.

C. Load Bearing Metal Stud Framing: Provide load bearing metal stud and joist framing at the following locations:

1. Toilet Room walls and ceilings.

2. As indicated on the Drawings.

3.03 METAL STUD FRAMING (NON LOAD-BEARING TYPE STUDS)

A. Furnish and install non-load bearing metal stud framing for gypsum wallboard partitions, support of gypsum wallboard in locations noted, or where other types of framing are not provided. Framing shall consist of vertical studs framed into continuous top and bottom tracks. Studs shall be of sizes noted on the Drawings or as required to produce the partitions of thicknesses noted, and tracks shall be of mating sizes. In general, framing shall be of single stud depth. Where wall thickness is greater than stud depths, and where plumbing spaces are indicated, frame each wall surface with a separate stud frame.

1. Where partitions are to have gypsum wallboard on both sides, use 25 gauge metal studs for partitions up to 16'-0" high; use 20 gauge metal studs for partitions from 16'-0" to 18'-0" in height.

2. Where partitions are to have gypsum wallboard on one side only, use 25 gauge metal studs for partitions up to 14'-6" high; use 20 gauge metal studs for partitions from 14'-6" to 17'-3" in height. At these partitions (wallboard at one side), provide continuous cold rolled stiffener channels at third points, secured with screws or by welding. Securing by wiring shall not be accepted.

3. The above gauge requirements are based on 3-5/8 inch deep studs at 16" centers. Metal gauges for studs of different depth or spacings shall be subject to review by the Architect.

B. Extend partition framing from floor to underside of finish ceilings, to 6" minimum above finish ceilings, or to underside of metal roof deck construction above, as indicated on the Drawings.

C. Bottom and Top Track Installation:

1. Secure bottom tracks to supporting construction, both ends, corners, jambs of openings, and 24" centers with bolts and metallic expansion sleeves.

2. Where partition framing extends to underside of metal roof deck, secure top track to roof steel framing where perpendicular thereto. Where partitions are parallel to roof steel, brace top track to adjacent building framing with pieces of studs, at 48" O.C., maximum. Insulation Contractor shall furnish safing insulation for top track and where indicated on Drawings.

a. Isolate stud system from transfer of structural loading to system, horizontally and vertically. Provide slip type joints to attain lateral support, allowances for deflection, and avoid axial loading.

3. Where partition framing are ceiling high and ceilings are finished with gypsum wallboard, secure top track through wallboard to ceiling framing, at each intersection.

4. Where partition are ceiling high and ceilings are acoustical ceilings, after acoustic panels above partition are installed, install top track at underside of ceiling grid by bolting the tracks to the grid, separating top track from ceiling with a strip of polyethylene film.

5. In all areas of ceiling high partition, and in areas where framing extends only 4" above finish ceilings, conceal brace the top of the partition to steel framing at 48" O.C., maximum, in the area above the ceilings.

D. Furnish single length, unspliced studs for all locations. Furnish studs cut short to provide a 1/2" space between top of stud and underside of top track. Secure studs at corners, intersections, ends and both sides of openings to bottom track, at both stud flanges, with screws. In all other locations studs shall twist into tracks so as to be held by friction and to permit differential deflection between top and bottom track support construction. NOTE: In fire-rated walls frame fastening shall be in accordance with code requirements governing fire-rated construction.

E. Framing:

1. Frame partition corners by butting one wall against the other, with one stud at the end of the abutting wall and with two studs at the end of the other wall, forming a three stud corner.

2. Frame partition intersections by butting the intersecting wall against the wallboard-finished through-wall, providing two studs at intersection in through-wall, one stud at end of abutting wall, and bolting stud at end of abutting wall to wallboard of through-wall, at 24" O.C.

3. Frame openings with floor track at head and sills, welded to stud at jambs, with jack studs above and below openings to continue stud spacing pattern, omitting sill and bottom studs at door openings. Brace studs at jambs of openings back to first adjacent stud with furring channels at head and at 24" O.C. to floor line, welded in place at both ends.

4. Control joints shall be framed by placing two studs back to back, with a 1/2" open space between backs, and by interrupting tracks with a 1/2" open space, at the joint.

F. Completed framing shall provide straight true, plumb planes to receive the gypsum wallboard. Openings shall be true rectangles.

3.04 CEILING AND SOFFIT FRAMING

A. Furnish and install a concealed framing system for all gypsum wallboard ceilings (except toilet room ceiling), consisting of 1-1/2" runner channels, spaced not over 4'-0" on centers, erected parallel to partitions and walls. Hang suspended ceiling framing from the steel framing above.

B. Hang runner channels from above the hangers spaced at 48" O.C., maximum, along each channel. Erect hangers approximately plumb. Wrap each wire hanger around the runner channel, the steel joist, and around itself three times. If steel band hangers are used, secure each steel band to the runner channel by wrapping tightly around the channel and bolting to itself. All connections shall develop the full strength of the hangers.

1. Do not attach hangers to roof deck, ductwork, duct supports, piping, conduit or hangers for same.

2. Where ductwork or other construction interferes with typical hanger spacing, provide trapezes, or other approved framing, to frame around such items and to support the hangers.

3. Pairs of diagonal hangers, extending from runner at midpoint between joists to top chord of joists at each side may be provided to reduce hanger spacing to 48" centers or less along the runner.

4. Provide additional hangers at light fixtures, diffusers, grilles, and other points of extra loading.

C. Erect runners level, parallel to room walls and parallel to each other. Provide a runner adjacent to, and within 3" of, walls where parallel to same. Provide runners at top and bottom edges of all ceiling drops. Cut off ends of runners 1/2" from walls where perpendicular thereto. Splice, when required, at hangers only, by lapping 12" and securely tying.

D. Where control joint or expansion joint is required by Drawings or Specifications, and runners are parallel to the joint, provide runner channel at each side of joint and secure each, independently of each other, to the framing above. Where runners are perpendicular to the joint, terminate runners at each side of joint, allowing a 1/2" wide, minimum, break in the runners, aligned with joint.

E. Frame and brace all openings in ceilings that have any side dimension over 2 ft. as a part of the suspension system. Provide all required metal framing, bracing, supports, blocking

and wedging necessary to install the framing rigidly and securely in position. Do all cutting and drilling required to install and fasten framing and furring in place. Erect runners to true lines, levels and planes so as to provide a true, flat, system or surface to receive the succeeding Work.

3.05 METAL FURRING

A. Furnish and install metal furring to support gypsum wallboard ceilings, ceiling drops, and soffits at the lines and elevations as shown and/or noted on the Drawings.

B. Erect furring in straight continuous rows and in parallel alignment, spaced l6" O.C. Splice furring, where required, by nesting or lapping adjacent members not less than 8" and by double tying the lap splice.

1. At ceilings, ceiling drops, and soffits, erect furring at right angles to supporting framing.

2. Where furring is parallel to edges of wallboard finish, provide a furring member at wallboard edge.

3. Where furring is at right angles to edges of wallboard finish, extend furring to such edges, mitering or coping members at corners.

C. Where control joint or expansion joint is required provide a furring member at each side of joint, along edge of wallboard.

D. Provide steel framing, bracing, shimming and supplementary framing as required to erect furring at the required lines and elevations. Secure furring to ceiling framing runners and to building framing by saddle tying with two (2) strands of tie wire.

E. Direct Metal Stud and/or Furring Channel Attachment to Walls: Where dampproofing is not indicated and/or specified and metal stud and/or furring channel is installed directly to exterior wall, install felt protection strip between metal stud and/or furring channel and wall. Attach metal furring channels, spaced 24" O.C. maximum unless otherwise as noted on the Drawings, to interior of masonry and/or concrete surfaces with hammer-set or power-driven fasteners staggered 24" O.C. maximum on opposite flanges.

3.06 GYPSUM WALLBOARD INSTALLATION

A. Furnish and install gypsum wallboard on the exposed side or sides of stud partition framing and coldformed metal framing, on one side of all furred areas, fire stops, and where shown on Drawings.

1. Unless otherwise indicated on the Drawings, provide multiple-layer wallboard as indicated or required for fire-rated partition construction. Provide single layer wallboard for all other locations.

    a. Refer to the Drawings for partition framing construction requiring wallboard to metal roof deck.

    b. Provide fire-rated gypsum wallboard where indicated on Drawings.

    c. Provide exterior gypsum wallboard sheathing at exterior wall areas for plaster veneer system as indicated on Drawings.

    d. Provide water-resistant gypsum wallboard at interior face side of Toilet Room walls, and other locations as indicated on the Drawings.

    e. Provide foil-faced gypsum wallboard where indicated on Drawings.

    f. Provide standard gypsum wallboard at all other areas.

2. Cover full height of stud partition framing with wallboard, including the portion above ceilings.

3. In all wall and partition Work, except where partition framings terminate at underside of ceilings, extend wall and partition wallboard up past edge of ceiling wallboard, and cope edge of ceiling wallboard to such vertical surfaces forming a control joint.

4. At all control joints, provide a 1/4" wide, straight open joint in the wallboard, at the joint centerline.

5. In addition to the required fastening of wallboard panels vertically, secure gypsum wallboard at partitions with screws 16" O.C. to bottom and top track; at FIRE-RATED PARTITION(S), spacing of screws at bottom and top track shall be 8" O.C.

B. Installations:

1. Single Layer Installations:

    a. If wallboard is obtainable in length to span full height in a single piece, install wallboard with long dimension vertical; otherwise install wallboard with long dimension horizontal; with vertical joints aligned over studs or furring in both cases.

b. At soffit/ceiling and soffit/ceiling drop Work, install wallboard with long dimension at right angles to support framing, with end joints aligned over framing members.

c. Apply all wallboard with the reverse side against the framing members, and with the separate boards in moderate contact, but not forced into place. At internal and external corners, conceal the cut edge of the boards with the overlapping covered edge of the abutting board. Stagger the boards so that the corners of any four boards will not meet at a common point except in vertical corners.

2. Double Layer Installations:

a. Install and secure the base layer of wallboard in accordance with requirements specified above for single layer installation, except wallboard on walls and partitions may be installed with long dimension horizontal in all cases.

b. Apply face layer of wallboard over base layer in same manner and positioning as specified for base layer, off-setting joints not less than 10" from joints of base layer. Secure face layer to base layer with full, uniform coatings of adhesive, applied to both contact surfaces with a brush, roller or serrated spreader. Impact layers together to insure thorough and maximum bonding. Form corners by overlapping board ends of base layer. Provide screw or nail fastening to supplement adhesive fastenings as may be required.
NOTE: At fire-rated installations, supplemental fastening is required, with screws 24" O.C. along center line and edges of each sheet - joints finished.

C. Screw Fastening:

1. Power drive all screws with an electric screwdriver until the screw head provides a slight depression below the surface of the wallboard, but no further. Do not break the paper covering in the board. If the paper surface is broken, place another screw approximately 2 inches from the damaged surface.

2. Screws shall be spaced a maximum of 8" O.C., and not closer than 3/8" to edges. Pair, not stagger, fasteners at edge joints between adjacent sheets.

3. Fastening for vertical and horizontal application shall begin at the top center of the panel and proceed outward to the edges or ends, with the top completed before proceeding. Fastening the field of the panel shall begin with the member nearest the center of the panel and proceed outward to the edges or ends, with the fastening completed on each member before proceeding to the next member.

D. Nail Fastening:

1. Where wallboard is required to be secured to wood furring member, installation shall be with annular nails. Nailing for vertical and horizontal application shall be as specified for screw fastening above, except with maximum (nail) spacings of 7" O.C. at ceilings, and 8" O.C. at walls.

2. Wallboard may also be secured to wood framing members and furring with screws, in which case, the application shall be as specified for screw fastening above, including maximum screw spacings.

3.07 EXPANSION JOINTS AND CONTROL JOINTS

A. Expansion Joints: Provide expansion joints where noted on the Drawings and/or required by field conditions. Provide two (2) metal casing beads, back to back, with open space of size detailed on Drawings between backs, at expansion joint centerlines.

B. Control Joints: Where not indicated on Drawings, gypsum panel surfaces shall be isolated with control joints where partition or furring run exceeds 30 ft.; where soffit/ceiling dimensions exceed 50 ft. in either direction, or area within separate soffit/ceiling sections exceeds 2,500 sq. ft.; where wings of “L”, “U”, and “T” shaped soffit/ceiling areas are joined; where soffits/ceilings abut partition or vertical surface; and where expansion or control joints occur in base exterior wall. Back joint by double studs or furring channels.

1. Where soffits/ceilings abut partitions or vertical surfaces, install dust stop gasket (with slight fullness to allow for movement of joint), then install soffit/ceiling wallboard with metal casing bead at exposed edge, forming a 1/8" to 1/4" wide open space between the abutting surfaces. Casing beads shall be flushed with wallboard in same manner as hereinafter specified for edge treatment.

2. Install at all other control joint locations, approved, roll-formed zinc control joints, attaching with Bostich® 9/16" “G” staples, or approved equal, spaced not over 6" apart. Cut end joints square and align for neat fit. Control joint shall then be given joint finishing treatment as hereinafter specified. Remove protective tape when joint treatment is completed.

3.08 SOUND-RATED CONSTRUCTION:

A. Insulation: Coordinate with Acoustic Insulation Contractor for installation of acoustic insulation in sound-rated partitions where indicated on the Drawings.

B. Gypsum Board:

1. Install gypsum board same as for interior partitions and ceilings.

2. Coordinate with installation of perimeter sealants.

3. After installation of gypsum board base layer(s), cut face layer sheets 1/2 inch less than floor-to-ceiling height and position with 1/4 inch open space between gypsum board and floor, ceiling and dissimilar vertical construction.

C. Sound Flanking Paths: Where sound-rated partition walls intersect non-rated gypsum board partition walls, extend sound-rated construction to completely close sound flanking paths through non-rated construction.

3.09 CORNER AND EDGE TREATMENT

A. Internal Corners: Treat all exposed internal corners, as specified herein under Article for FINISHING. Reinforcing tape shall be folded lengthwise through the middle and fitted neatly into the corner.

B. External Corners: At external corners neatly fit a corner bead over the corner and secure with the same type screws used for applying wallboard. Space screws approximately 6 inches on centers, driving through the wallboard into the framing member. After the corner piece has been secured in place, treat the corner with joint cement and reinforcing tape in the manner as specified herein under Article for FINISHING. Feather final coat of topping compound out from 12 to 16 inches on both sides of corner.

C. Edges: Finish all exposed edges of wallboard, including perimeter of all soffit/ceiling areas, and edges abutting masonry, concrete, door frames, window frames, and other finish construction, with metal casing beads. Casing beads shall be flushed with wallboard surface in manner herein before specified for external corners, topping compound feathered out from 12 to 16 inches to surfaces of wallboard.
All Work shall be sanded smooth when dry.

3.10 FINISHING

A. Levels of Finish: Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA-214, “Recommended Levels of Gypsum Board Finish”.

1. Level 1: All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

a. Locations: Provide Level 1 finish for gypsum board surfaces in ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.

2. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

    a. Locations: Provide Level 2 finish for gypsum board substrate at tile and FRP panels, except remove tool marks and ridges.

3. Level 3: All joints and interior angles shall have tape embedded in joint compound and one (1) additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two (2) separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: The prepared surface shall be coated with a drywall primer by the Painting Contractor prior to the application of final finishes as specified in Division 09.

    a. Locations: Provide Level 3 finish for gypsum board surfaces, where heavy- or medium textured finishes or heavy-grade vinyl wallcovering will be used.

4. Level 4: All joints and interior angles shall have tape embedded in joint compound and two (2) separate coats of joint compound applied over all flat joints and one (1) separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three (3) separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: The prepared surface shall be coated with a drywall primer by the Painting Contractor prior to the application of final finishes as specified in Division 09.

    a. Locations: Provide Level 4 finish for gypsum board surfaces, where smooth flat paints, light textures, or light- or medium-grade wallcoverings are to be applied.

B. Interior Gypsum Board:

1. Prefill:

    a. Use setting-type joint compound. Mix joint compound according to manufacturer’s directions.

    b. Fill joints between boards flush to top of eased or beveled edge.

c. Wipe off excess compound and allow compound to harden.

2. Taping (Level 1):

a. Use taping or all purpose compound.

b. Butter taping compound into inside corners and joints.

c. Center tape over joints and press down into fresh compound.

d. Remove excess compound.

e. Tape joints of gypsum board above suspended ceilings.

3. First Coat (Level 2):

a. Use taping or all-purpose drying-type compound, or setting-type joint compound.

b. Immediately after bedding tape, apply a thin skim coat of joint compound trowel applied over body of tape and allow to dry completely in accordance with manufacturer's instructions.

c. Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.

4. Second Coat (Level 3): Use all purpose or topping drying type joint compound. After first coat treatment is dried, apply second coat of compound over tape and trim, feathering compound 2 inches beyond edge of first coat.

5. Third Coat (Level 4):

a. Use all purpose or topping drying type joint compound.

b. After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 2 inches beyond edge of second coat.

c. Allow third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, and make suitable and ready for application of final finish by others.

C. Water-Resistant Gypsum Board: Treat fastener heads and joints with setting-type joint compound.

1. For joints to be covered with tile, apply tape and joint compound bedding coat and skim coat only; do not apply finish coats.
   a. Do not crown joints or leave excess compound on panels.

   b. Remove tool marks and ridges.

   c. For fastener heads to be covered with tile, apply one (1) coat of joint compound.

D. Joint Compound:

1. After skim coat sets, apply finish coat of compound feathering 3 to 4 inches beyond tape edges.

2. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.

E. Trim:

1. Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by trim manufacturer.

2. Install metal corner beads at external corners.

3. Install metal casing bead trim whenever edge of gypsum base would otherwise be exposed or semi-exposed, and where gypsum base terminates against dissimilar material.

F. Control Joints: Install where indicated and specified.

G. Special Trim and Reveal Joints: Install as indicated on Drawings and in accordance with manufacturer’s instructions.

3.11 GYPSUM SHEATHING PANELS

A. Preparation: Examine exterior metal stud framing and verify that the surface of the framing members to receive the sheathing does not vary more than 1/4" from the plane of faces of adjacent members.

1. Inspection: Steel framing stud spacing shall not exceed 16 inches O.C. for 1/2 inch thick gypsum sheathing panels and 24 inches O.C. for 5/8 inch thick gypsum sheathing panels.

2. Notification: Contact the General Contractor, in writing, for correction, of any condition, detrimental to the installation of this Work.

B. Sheathing Installation: Provide sheathing where indicated on the Drawings and as specified herein. Install sheathing in accordance with ASTM Standard C1280 and the manufacturer's written installation instructions and recommendations.

1. Fiberglass-faced gypsum sheathing, where indicated on the Drawings, over metal stud framing shall be installed with the "gold side" out (exposed to exterior view/side).

a. Fasteners shall be flush to the face of the board, not countersunk.

b. Do not laminate sheathing to masonry surfaces.

3.12 SURFACE PREPARATION FOR PAINTING

A. Where painting of gypsum wallboard surface or vinyl wallcovering is indicated on the Drawings, tape, spackle and sand flush all surface imperfections, cracks, and gouges to make suitable for finish painting by the Painting Contractor.

3.13 CLEAN-UP

A. During progress of the Work, keep the premises free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish to central area designated for clean-up by the General Contractor. Remove all unused materials, tools, and equipment from site.

B. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 09 30 00
TILING

PART 1 GENERAL

1.1 SCOPE:

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Thin-Set Tile Work as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following Tile and Accessories:

1. ColorBody Porcelain
2. Special Tile Shapes
3. Quarry
4. Ceramic Wall Tile
5. Trim and Accessories
6. Setting Materials, Accessories, and Sealants.

B. Color Selections: Refer to Color Legend on the Drawings.

C. Room Finish Schedule and Colors: Refer to the Drawings.

1.2 RELATED SECTIONS

Related Sections: The following Work will be provided under other sections of the Specifications:

1. Unit Structural Masonry - Section 04 23 00.
2. Rough Carpentry - Section 06 10 00.
3. Joint Protection - Section 07 90 00.
4. Joint Sealants- Section 07 92 00.
5. Aluminum Framed Entrances and Storefronts - Section 08 41 13.
6. Cementitious Backing Boards - Section 09 28 13.
7. Gypsum Wallboard - Section 09 29 00.
8. Resilient Bases and Accessories - Section 09 65 13.
9. Paints and Coatings - Section 09 90 01.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Requirements of Regulatory Agencies: Furnish and install all Tile Work in strict compliance with the laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

B. References: Unless otherwise specified herein, all tile materials, installation, and workmanship shall conform to the following:

American National Standards Institute (ANSI):

a. A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex- Portland Cement Mortar.

b. A118.1 Specifications for Dry-Set Portland Cement Mortar.

c. A118.3 Specifications for Chemical-Resistant, Water-Cleanable Tile-Setting and Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.

1. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
2. 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.
3. 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.
4. ANSI A108.4 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
5. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
6. ANSI A108.6 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy.
7. ANSI A108.8 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
8. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
9. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
10. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
11. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.

12. ANSI A118.4 - Latex-Portland Cement Mortar.
13. ANSI A118.5 - Chemical-Resistant Furan Mortar and Grout.
14. ANSI A118.6 - Standard Ceramic Tile Grouts.
15. ANSI A118.7 - Polymer Modified Cement Grouts
16. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
17. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units.
18. ANSI A118.10 - Load bearing, Bonded, Waterproof Membranes for Thinset Ceramic Tile and Dimensional Stone.
19. ANSI A118.11 - Exterior Grade Plywood (EGP) Latex-Portland Cement Mortar.
20. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
21. ANSI A137.1 - Specifications for Ceramic Tile.

C. ASTM International (ASTM):
1. ASTM C 50 - Standard Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products.
2. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C 241 - Standard Test Method For Abrasion Resistance of Stone Subjected to Foot Traffic.
5. ASTM C 503 - Standard Specification for Marble Dimension Stone.
6. ASTM C 615 - Standard Specification for Granite Dimension Stone.
7. ASTM C 629 - Standard Specification for Slate Dimension Stone.
8. ASTM C 847 - Standard Specification for Metal Lath.
9. ASTM C 1028 - Standard Test method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.
10. ASTM D 4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

D. Tile Council of North America (TCNA): TCA Handbook for Ceramic Tile Installation, 2007.

E. Codes and Ordinances: Where requirements of governing Federal, Local and/or State Codes and Ordinances are more stringent than the requirements specified herein, the requirements of such Codes and Ordinances shall govern, as applicable.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
1. Level Surfaces: Minimum of 0.6 (Wet).
2. Step Treads: Minimum of 0.6 (Wet).
3. Ramp Surfaces: Minimum of 0.8 (Wet).

1.5 SUBMITTALS

A. General: Submit Samples, Product Data, and Certificates to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

1. Mark each tile and/or marble Sample legibly, with the Identity of the Sample, the Name of the Installer, the Name of the Project, and the Location in the Building.

B. Submit under provisions of Section 01 30 00 - Administrative Requirements.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations. For information only, submit two (2) copies of manufacturer's technical information and installation instructions for all materials required, except bulk materials.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

D. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

E. Selection Samples: Submit two (2) full size actual tile Samples of each type (including special shapes) and colors of tile, and provide letters of intent to the Architect, for review and approval prior to starting the Work for selection.

F. Samples: Mount tile and apply grout on two plywood panels, illustrating pattern, color variations, and grout joint size variations.
   Marble Threshold Samples: Submit two (2) Samples not less than 3" x 5", of marble in thickness required.

G. Quartz Countertop Samples: Submit two (2) Samples not less than 6" x 6", of granite in thickness required.

H. Sealant Samples: Submit Samples of sealant for review and approval by the Architect. Do not commence Work until the Architect's written approval of the Samples has been received.

   1. Submit two (2) Samples of each color required for each sealant exposed to view. Install Sample between two (2) Samples of tile and/or marble material representative of typical joint widths.
      Manufacturer's color charts and/or color swatches will not be acceptable as Samples.

I. Grouting Mortar Samples: Submit two (2) Samples of each color required for review and approval by the Architect. Do not commence Work until written approval from the Architect has been received.

J. Metal Edge Trim Strip Samples: Submit two (2) 12" long Samples of metal edge trim angle strip for Architect's review and approval.

K. Manufacturer's Certificate: Before proceeding with the Tile Work, furnish the Architect with a Master Grade Certificate, in the form shown in the TCNA Al37.l signed by the manufacturer and the Contractor certifying the grade, type, and

quantity of each kind of tile, together with adequate information for identification of the containers to which they apply.

1. Certify that products meet or exceed specified requirements.
2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.

L. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

A. General: Contractor for Tile Work shall be responsible for an acceptable completed installation for areas designated to be tiled. Work shall be in complete conformity to the type of tile, dimensions, colors, grades, patterns, and necessary trim units as shown on Drawings and/or required by field conditions.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years' of proven successful experience satisfactory to the Architect and/or Owner. Work shall be performed by qualified workmen in a manner conforming to best current practice of the trade.

C. Performance Requirements: Tiles and countertops shall be new materials conforming to performance requirements as specified herein. Materials of “second” quality not meeting or exceeding the requirements of these Specifications shall not be accepted.

D. Material Shelf Life: Do not retain setting and sealant materials at the jobsite which have exceeded the shelf life recommended by the manufacturer.

E. Tile Mock-Ups: Prior to installation Work, lay-out in the building, full-size mock-ups of each tile pattern to be used in the Work.

1. Sample areas shall be prepared in the building where and as directed by the Architect and/or Owner’s Supervising Engineer.

2. Size of Sample area shall be as designated by the Architect.

3. Remove tile mock-up as directed by Architect.

F. Visual Approvals: Obtain Architect and/or Owner’s Supervising Engineer acceptance of visual qualities of the Work during progress of the Work before proceeding with the Work.

G. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in original, unopened containers, branded or labeled with the proper grade seal. Mark all containers with designations corresponding with information given on the grade certificates. The containers shall be subject to inspection by the Architect before being opened, as well as during the progress of the Work.

B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.

C. Store tile. Protect materials, and setting materials within waterproof enclosures to prevent water absorption and on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating. Handle materials to prevent damage.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during tiling and for a minimum of 7 days after completion.

C. Schedule installation of tile with the Owner’s Representative to assure completion of all Tile Work, including all protective measures, prior to receipt and installation of Tenant and/or Owner supplied fixtures, equipment, furnishings, etc.

D. When installing tiles and marble over new concrete slabs, do not start installation until concrete has cured for at least five (5) days and then aged for fourteen (14) additional days, or for such additional time as required for the concrete to have shrunk and attained equilibrium.

E. Install tiles when ambient air temperatures, and temperatures of all materials, is 55°F. or higher. Rooms or areas in which Work is to be installed shall be at temperatures of 55°F. or higher twenty-four (24) hours prior to installation to at least five (5) days after completion of installation. Refer to Division 0 “Supplementary Conditions” for description of temporary heat.

1.9 EXTRA MATERIALS

A. General: Not less than 30 days prior to opening of the facility, deliver to the Owner’s Representative, the following materials for future use. Materials shall be delivered with a list of manufacturer’s names, product designations, addresses, and phone numbers. Materials shall be boxed, sealed, and clearly identified as to product and specific location of use. Furnish the following quantities of material for use within the designated area.

1. Provide for Owner's use a minimum of 2 percent of the primary sizes and colors of tile specified, boxed and clearly labeled.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Tile Manufacturer:
   1. As specified in drawings.

B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

C. Tile Products: Provide tile products of manufacturers, product lines, colors and sizes as noted on the Drawings.

D. Tile Installation Products:

   1. Mapei setting and grouting materials as specified herein shall establish the commercial standard of quality and performance required. Mapei® tile installation products as manufactured by Mapei Corporation, 1144 East Newport Center Drive, Deerfield Beach, FL 33442, (954)246-8888 or (800)426-2734; www.mapei.com, will be acceptable, and subject to review by the Architect

2.2 TILE

A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
   1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
   2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
   3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.

B. Porcelain Tile: PT-1
   1. Product: Keystones.
   2. Moisture Absorption: Less than .5 percent to less than 20 percent.
   3. Size and Shape: 2 inches square, nominal.
   4. Surface Finish: Unpolished.
   5. Colors: As scheduled.
   6. Pattern: As indicated on the Drawings.
   7. Trim Units: Matching bullnose, cove base corner, cove base outcorner, jolly, grooved bullnose, cement bullnose, fabric bullnose, shapes in sizes coordinated with field tile.

C. Wall Tile: CT-1, CT-2, CT-3, CT-4, CTB-1
   1. Product: Color Wheel.
   2. Size and Shape: 3 inches by 6 inches, nominal.
   3. Surface Finish: Polished.

4. Colors: As scheduled.
5. Trim Units: Cement Bullnose, Cove Base, Cove Base Corner, Fabric Bullnose, Groover Bullnose, Jolly shapes in sizes coordinated with field tile shapes.

2.3 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
1. Soap Dish: With wash cloth holder, clam shell design, surface mounted or recessed; cast strength sufficient to resist lateral pull force of 75 lbs (34 Kg).
2. Toilet Tissue Holder: Surface mounted or recessed, for single roll, with spring loaded holder.
3. Towel Bars: Standard design, surface mounted with extensions for casting into small wall openings; cast strength sufficient to resist lateral pull force of 30 lbs. (14 Kg).

4. Corner Shelf.

2.4 SETTING MATERIALS

A. Organic Adhesive: ANSI A136.1, thin set bond type; use Type I in areas subject to prolonged moisture exposure.

B. Epoxy Adhesive: ANSI A118.3, thin set bond type.

C. Mortar Bed Materials:
1. Portland cement: ASTM C150, type 1, gray or white.
2. Hydrated Lime: ASTM C207, Type S.
3. Sand: ASTM C144, fine.
4. Latex additive: As approved.
5. Water: Clean and potable.

D. Mortar Bond Coat Materials:
1. Dry-Set Portland Cement type: ANSI A118.1.
2. Latex-Portland Cement type: ANSI A118.4.
3. Epoxy: ANSI A118.3, 100 percent solids.

E. Standard Grout: Cement grout, sanded or unsanded, as specified in ANSI A118.6; color as selected.

F. Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7; color as selected.

G. Epoxy Grout: ANSI A118.8, 100 percent solids epoxy grout; color as selected.

H. Silicone Sealant: Silicone sealant, moisture and mildew resistant type, white; use for shower floors and shower walls.

I. Cleavage Membrane:
1. No. 15 (6.9 kg) asphalt saturated felt, ASTM D226, Type 1.
2. Polyethylene film, ASTM D4397, 4.0 mil thickness.

J. Waterproofing Membrane at Floors: Membrane in accordance with ANSI A118.10

and as follows:
1. Chlorinated Polyethylene Sheet with polyester fabric reinforcing.
2. Fabric Reinforced, Fluid-Applied elastomeric membrane.
3. Un-Reinforced, Fluid-Applied elastomeric membrane.
4. Polyethylene Sheet Product.
5. Fabric-Reinforced, Modified-Bituminous Sheet Product.
6. Urethane Waterproofing and Tile-Setting Adhesive Product.

K. Membrane at Walls: No. 15 (6.9 kg) asphalt saturated felt, ASTM D226, Type 1.

L. Membrane at Walls: 4 mil (0.1 mm) thick polyethylene film, ASTM D4397.

M. Membrane at Walls: Reinforced asphalt paper.

N. Reinforcing Mesh: 2 by 2 inch (50 by 50 mm) size weave of 16/16 wire size; welded fabric, galvanized.

O. Metal Lath: ASTM C847, Flat expanded diamond mesh, not less than 2.5 lbs/SY, galvanized finish.

P. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced with 2 inch (50 mm) wide coated glass fiber tape for joints and corners:
1. Thickness: 1/4 inch (6 mm).
2. Thickness: 1/2 inch (13 mm).
3. Thickness: 5/8 inch (16 mm).

Q. Water: Potable water (suitable for drinking) shall be clean, free from oils, alkalies, acids, organic water, or other deleterious materials.

R. Epoxy Adhesive: Latapoxy® 310 Stone Adhesive, two-component, non-sag, high strength construction epoxy adhesive, meeting and exceeding ANSI A 118.3.

1. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2.5 SPECIAL SHAPES

A. General: Provide special shapes, such as wall base materials, trim pieces, interior cove, corner bullnose, and exterior/interior corner units, to be used in their respective places as required by the Drawings and/or field conditions.

2.6 METAL EDGE TRIM STRIPS

A. Manufacturer: Schluter Systems L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841, (800)472-4588; www.schluter.com, or comparable equivalent manufacturer’s product subject to review by the Architect.

B. Product: Edge-protection trim as indicated on the Drawings and/or required by field conditions.

2.7 SEALANTS

A. Floor Joint Sealant: Dynatred®, Non-Sag, Traffic-Grade Polyurethane Sealant, two-part, chemically curing, cold-applied elastomeric sealant, conforming to Federal Specification TT-S-00227E, as manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (215)723-6051 or (800)523-6688.

1. Primer: As recommended by the specified sealant manufacturer.

2. Colors: Sealant color shall match grout joint colors, and shall be subject to review and approval by the Architect and/or Owner.

3. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 EXECUTION

3.01 EXAMINATION

A. Surface Inspections: Carefully inspect all surfaces upon which materials will be applied, and report to the General Contractor in writing, any condition detrimental to the installation, for correction prior to proceeding with the Work. The installation of Tile Work will be considered an acceptance of the surfaces to be covered, and claims for failure of Tile and Countertop Work because of unsatisfactory sub-surfaces will not be allowed within tolerances specified in ANSI A137.1, and are ready to receive tile.

B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.

C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

E. Concrete Floor Slab Tolerance Flatness/Levelness: Floor shall comply with ASTM E1155 – Standard Test Method for Determining Fꞟ Floor Flatness and FL Floor Levelness Numbers; using the F-Number System.

1. If concrete floor slab surfaces exceed the maximum variation, Tile Contractor shall notify the General Contractor for correction of any defects. Starting Work shall imply acceptance of the job conditions, and an unsatisfactory surface condition for the installation of the materials will not be considered valid in waiving any portion of the warranty.

3.02 PREPARATION

F. Prepare all surfaces upon which materials will be applied as required to receive Work. Remove all dirt, grease, oil, paint, and other surface contaminations that will prevent proper bonding from the substrate surfaces. Remove all ridges, fins, projections, high spots and other irregularities that would interfere with proper installation Work.

G. Protect surrounding work from damage.

H. Remove any curing compounds or other contaminates.

I. Vacuum clean surfaces and damp clean.

J. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

K. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

L. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than 1/2 width is used. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

K. Allow tile to set for a minimum of 48 hours prior to grouting.

L. Grout tile joints. Use standard grout unless otherwise indicated.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

N. Locate cuts to be inconspicuous.

O. Align all floor joints to have straight, uniform grout lines parallel with adjacent walls and surfaces.

P. Whenever possible, align grout joints of wall tile and base tile with floor tile joints.

Q. Neatly cut and accurately fit all Tile Work around piping and other installations which pierce the Tile Work; at irregular shaped places; and at the junction with other materials. The surface of the tile shall not be chipped or otherwise be damaged in cutting. Grind cut edges smooth and even.

3.04 WORKMANSHIP AND APPLICATION

A. General: Install tile as indicated on the Drawings and specified herein.

1. Select tile from the same shade and lot number.

2. Visually inspect the tile prior to installation.

3. Mix tiles from several boxes.

4. Rotate the tiles to ensure a non-repeat look.

B. Installations: Work shall be performed according to industry standards, manufacturer's written specifications, and reference standards.

C. Porcelain Ceramic Floor Tile Applications - Thin Bed (Thin Set) Method:

1. Mixing requirements as per Mapei product requirements.

a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Apply the mortar with the flat side of the trowel, being sure to work the material into the surface of the concrete substrate. Comb the surface of the mortar with the notched side of the trowel. Use the proper size notched trowel for the size of tile to be installed.

3. Before placing tiles into the fresh mortar, wipe the back of each tile with a damp sponge or "Scotch Brite™" pad, to remove any dirt or dusty release agents on the tile backs to enhance the bonding strength.

4. Apply mortar to the back of the cleaned tiles to completely cover the back of the tile with a minimum 3/32" to 1/8" uniform thickness.

5. Place the tiles while the mortar is wet and tacky and beat the tile with a rubber mallet and beating block to firmly bed the tiles into the mortar. Occasionally lift a tile off the mortar bed to check for proper coverage of the mortar. Before hardening, excess mortar shall be cleaned with a damp sponge. Tiles may then be grouted when firmly set.

6. Grouting: Provide stain resistant, colorfast, epoxy grout “Mapei”. Exposed joint widths based on manufacturer's tiles as specified herein shall be typically 1/4" wide for nominal 6" x 6" tiles and 5/16" wide for nominal 12" x 12" tiles. Note:
Joint widths for use with other manufacturer’s products shall be verified with the Architect.

   a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).
   b. Preparation: Before starting to grout, remove debris in grout joints and lightly sponge the tile surface to remove all dust and dirt. Water shall not be left standing in joints.

   c. Installation Method:

7. Empty entire contents of packed liquid premeasured kit product jars into a clean pail/container using a clean mixing stick or margin trowel. Mix thoroughly for one minute. Add at least 3/4 of powder product, using more powder for wider joints, as recommended by the manufacturer.

8. Immediately pour entire content of pail/container onto working area. Use standard epoxy grouting techniques to work grout into grout joints. Insure that all grout joints are fully packed.

9. Clean-up by using a hard epoxy rubber grout float at 90° angle to remove as much excess material as possible before initial cleaning with nylon scrub pad. Do not leave excess grout on the face of tiles.

10. Wash the installation within 12 to 24 hours after grouting using a detergent solution such as “Spic n Span®”, Trisodium Phosphate, “Ajax®”, “Comet®”, or non-abrasive cleaner to remove any haze or

residue. Do not allow grout film to remain on surface for more than 24 hours.

D. Metal Edge Trim Strips: Verify in field, height dimension of trim product in relation to thickness of the tile and/or mortar bed, and report to the General Contractor, in writing, any discrepancy detrimental to the proper installation of the product. Install specified metal edge trim angles where shown, and as detailed on the Drawings.

1. Installation: Press the perforated anchoring leg of the trim strip into the tile adhesive and align.
Trowel tile adhesive over the anchoring leg. Surface of the tile shall level with the top of the trim (the trim shall not be higher than the surface of tile, rather slightly lower – approximately 1/32"). The joint between the tile and the trim (approximately 1/32" - 1/8") shall be filled completely with grout.

E. Floor Joint Sealant: Provide control joints in floor Work where Tile Work abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes and where changes occur in backing materials as detailed on the Drawings and/or required by field conditions.

3.05 MARBLE THRESHOLD INSTALLATIONS

A. Install thresholds in white dry set mortar (with latex system) similar to setting of floor tile, and point joints between marble and tile flush.

3.06 COUNTERTOP INSTALLATION

A. Adhesive Applications: Provide Epoxy Adhesive product as specified herein for installation of granite on substrate, as indicated on the Drawings.

1. Preparation:

a. Before using, store resins at room temperature (70°F+21°C+) for 24 hours to ensure ease of mixing. All surfaces must be sound, clean, free of oil, waxes, or other bond inhibiting contaminants.

b. Clean and grind back of granite at areas to receive the Epoxy Adhesive spots using a mechanical wheel grinder with a diamond wheel/blade. Remove dust with a stiff brush, wipe entire surface. Using a damp sponge (not wet), wipe the granite to remove any particles or remaining dust to ensure a clean direct bond and that all ground material is removed. Wipe dry with a clean cloth, then apply Epoxy Adhesive. NOTE: Epoxy Adhesive should not be applied to saturated or wet

granite. If wetness or dampness is observed inside the granite after grinding off the top layer, the granite is saturated and must be allowed to dry out.

2. Mixing: Combine equal volumes of Epoxy Adhesive Part A and Part B (1:1 mix ratio by volume). Mix until uniform in color; no swirls. Small quantities may be mixed with a putty knife or margin trowel. Larger quantities may be mixed with an electric drill mixer (low speed).

3. Application:

   a. Apply dabs evenly distributed on back of the granite as recommended by manufacturer. Finished dab thickness must be a minimum of 1/8" (3mm).

   b. After installation of Epoxy Adhesive onto the substrate, install onto substrate and adjust for plumb and level.

4. Cleaning: Clean tools and Work while epoxy is fresh, using warm water. Detergent or soap may be added to the water for easier cleaning.

3.07 IMPERFECT TILE WORK

A. When directed by the Architect and prior to final acceptance of the Work, remove all broken, chipped, loose or otherwise unsatisfactory installed Tile and Countertop Work.

B. Patch and restore imperfect tile materials and workmanship to good condition satisfactory to the Architect and/or Owner.

3.08 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F131.

3.09 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F111, with cleavage membrane, unless otherwise indicated.

   1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCA Handbook Method F121.

2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F132, bonded.

3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCA Handbook Method F114, with cleavage membrane.

B. Cleavage Membrane: Lap edges and ends.

C. Waterproofing Membrane: Install as specified in ANSI A108.13.

D. Mortar Bed Thickness: 1-1/4 to 2 inch (32 to 51 mm) maximum, unless otherwise indicated.

3.10 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordancewith TCA Handbook Method W244, using membrane at toilet rooms.

B. Over cementitious backer units install in accordance with TCA Handbook Method W223, organic adhesive.

C. Over gypsum wallboard on wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-portland cement bond coat, unless otherwise indicated.
1. Where mortar bed is indicated, install in accordance with TCA Handbook Method W222, one coat method.
2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCA Handbook Method W222, one coat method.

D. Over interior concrete and masonry install in accordance with TCA Handbook Method W202, thin-set with dry-set or latex-portland cement bond coat.

E. Over wood studs without backer install in accordance with TCA Handbook Method W231, mortar bed, with membrane where indicated.

F. Over metal studs without backer install in accordance with TCA Handbook Method W241, mortar bed, with membrane where indicated.

3.11 CLEANING

A. During progress of the Work, keep the premises free of all debris and waste materials resulting from the Work of this section. Remove all debris and rubbish from the site. Upon completion and before final acceptance of the Work, remove all debris, rubbish, unused materials, tools, and equipment from the site.

B. When directed by the Architect, after the Work of other trades is substantially completed, remove and dispose of protective coverings and thoroughly clean all Work installed under this section. Use of acid will not be permitted. Use clean water in initial cleaning. Remove all stains, excessive mortar, etc.

C. Cleaner shall be a neutral, general, all-purpose cleaner free of acids, alkalies and abrasives such as one of the following:

1. Mira Clean #1 by Miracle Sealants Company, 12318 Lower Azusa Road, Arcadia, CA 91006-5872, (800)350-1901 or (626)443-6433.

a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Super Shine-All® by Hillyard, Inc., 302 North 4th. Street, P.O. Box 909, St. Joseph, MO, 64501, (816)233-1321 or (800)365-1555.

a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

D. Waste Management: Collect field generated construction waste created during construction or final cleaning.

E. Clean tile and grout surfaces.

3.12 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 72 hours after installation.

B. Cover floors with kraft paper and protect from dirt and residue from other trades.

C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways.

D. Properly protect all finished Work from damage that is in place at the time this Work is being done. Tile Contractor shall be responsible and will be required to pay for all damage to other Work caused by the Contractor's workmen.

E. Protective covering shall be non-staining multi-purpose building paper with compatible seam tape. Product shall be such as "SealTight® Red Rosin Paper" as manufactured by W.R. Meadows, Inc., 300 Industrial Drive, P.O. Box 338, Hampshire, IL 60140-0338, (800)342-5976, (847)214-2100; www.wrmeadows.com, or comparable equivalent product subject to review by the Architect.

3.13 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

B. Systems Guarantee: Obtain from the setting materials manufacturer, a written Systems Guarantee, guaranteeing that the products specified herein shall be free from manufacturing defects and will not break down or deteriorate for a period of not less than five (5) years from the date of the installation, when installed in accordance with the manufacturer's written specifications and guidelines.

3.14 SCHEDULE

A. Floor Tile:
As indicated on the Drawings.

B. Wall Tile:
As indicated on the Drawings.

END OF SECTION

SECTION 09 31 00
THIN-SET TILE WORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Thin-Set Tile Work as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Porcelain Ceramic Floor and Wall Tiles.

2. Special Tile Shapes.

3. Setting Materials, Accessories, and Sealants.

B. Room Finish Schedule and Colors: Refer to the Drawings.

C. Related Sections: The following Work will be provided under other sections of the Specifications:

1. Cast In Place Concrete - Section 03 30 00.

2. Unit Structural Masonry - Section 04 23 00.

3. Rough Carpentry - Section 06 10 00.

4. Joint Protection - Section 07 90 00.

5. Glass, Glazing, and Aluminum Work - Section 08 41 00.

6. Gypsum Wallboard - Section 09 29 00.

7. Resilient Bases and Accessories - Section 09 65 13.

8. Resilient Tile Flooring - Section 09 65 19.

9. Paints and Coatings - Section 09 90 00.

10. Toilet Compartments - Section 10 21 13.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Requirements of Regulatory Agencies: Furnish and install all Tile Work in strict compliance with the laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans With Disabilities Act (ADA), Public Law 101-336.

B. References: Unless otherwise specified herein, all tile materials, installation, and workmanship shall conform to the following:

1. American National Standards Institute (ANSI):

a. A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex- Portland Cement Mortar.

b. A118.1 Specifications for Dry-Set Portland Cement Mortar.

c. A118.3 Specifications for Chemical-Resistant, Water-Cleanable Tile-Setting and Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.

2. Tile Council of North America, Inc. (TCNA): Amercian National Standards Specifications for Ceramic Tile - ANSI 137.1, current edition.

C. Codes and Ordinances: Where requirements of governing Federal, Local and/or State Codes and Ordinances are more stringent than the requirements specified herein, the requirements of such Codes and Ordinances shall govern, as applicable.

1.03 QUALITY ASSURANCE

A. General: Contractor for Tile Work shall be responsible for an acceptable completed installation for areas designated to be tiled. Work shall be in complete conformity to the type of tile, dimensions, colors, grades, patterns, and necessary trim units as shown on Drawings and/or required by field conditions.

B. Installer: Firm shall have specialized in Tile and Countertop Work for a period of not less than five (5) years of proven successful experience satisfactory to the Architect and/or Owner. Work shall be performed by qualified workmen in a manner conforming to best current practice of the trade.

C. Performance Requirements: Tiles and countertops shall be new materials conforming to performance requirements as specified herein. Materials of “second” quality not meeting or exceeding the requirements of these Specifications shall not be accepted.

D. Material Shelf Life: Do not retain setting and sealant materials at the jobsite which have exceeded the shelf life recommended by the manufacturer.

E. Tile Mock-Ups: Prior to installation Work, lay-out in the building, full-size mock-ups of each tile pattern to be used in the Work.

1. Sample areas shall be prepared in the building where and as directed by the Architect and/or Owner's Supervising Engineer.

2. Size of Sample area shall be as designated by the Architect.

3. Remove tile mock-up as directed by Architect.

F. Visual Approvals: Obtain Architect and/or Owner's Supervising Engineer acceptance of visual qualities of the Work during progress of the Work before proceeding with the Work.

1.04 SUBMITTALS

A. General: Submit Samples, Product Data, and Certificates to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

1. Mark each tile and/or marble Sample legibly, with the Identity of the Sample, the Name of the Installer, the Name of the Project, and the Location in the Building.

B. Tile Samples: Submit two (2) full size Samples of each type (including special shapes) and colors of tile, and provide letters of intent to the Architect, for review and approval prior to starting the Work.

C. Marble Threshold Samples: Submit two (2) Samples not less than 3" x 5", of marble in thickness required.

D. Granite Countertop Samples: Submit two (2) Samples not less than 6" x 6", of granite in thickness required.

E. Sealant Samples: Submit Samples of sealant for review and approval by the Architect. Do not commence Work until the Architect's written approval of the Samples has been received.

1. Submit two (2) Samples of each color required for each sealant exposed to view. Install Sample between two (2) Samples of tile and/or marble material representative of typical joint widths.
Manufacturer's color charts and/or color swatches will not be acceptable as Samples.

F. Grouting Mortar Samples: Submit two (2) Samples of each color required for review and approval by the Architect. Do not commence Work until written approval from the Architect has been received.

G. Metal Edge Trim Strip Samples: Submit two (2) 12" long Samples of metal edge trim angle strip for Architect's review and approval.

H. Product Data: For information only, submit two (2) copies of manufacturer's technical information and installation instructions for all materials required, except bulk materials.

I. Certificates: Before proceeding with the Tile Work, furnish the Architect with a Master Grade Certificate, in the form shown in the TCNA Al37.l signed by the manufacturer and the Contractor certifying the grade, type, and quantity of each kind of tile, together with adequate information for identification of the containers to which they apply.

1.05 PRODUCT DELIVERY

A. Delivery: Deliver all products in original, unopened containers, branded or labeled with the proper grade seal. Mark all containers with designations corresponding with information given on the grade certificates. The containers shall be subject to inspection by the Architect before being opened, as well as during the progress of the Work.

B. Storage: Store and protect materials within waterproof enclosures to prevent water absorption. Handle materials to prevent damage.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 PROJECT CONDITIONS

A. Schedule installation of tile with the Owner's Representative to assure completion of all Tile Work, including all protective measures, prior to receipt and installation of Tenant and/or Owner supplied fixtures, equipment, furnishings, etc.

B. When installing tiles and marble over new concrete slabs, do not start installation until concrete has cured for at least five (5) days and then aged for fourteen (14) additional days, or for such additional time as required for the concrete to have shrunk and attained equilibrium.

C. Install tiles when ambient air temperatures, and temperatures of all materials, is 55°F. or higher. Rooms or areas in which Work is to be installed shall be at temperatures of 55°F. or higher twenty-four (24) hours prior to installation to at least five (5) days after completion of installation. Refer to Division 0 "Supplementary Conditions" for description of temporary heat.

1.07 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

B. Systems Guarantee: Obtain from the setting materials manufacturer, a written Systems Guarantee, guaranteeing that the products specified herein shall be free from manufacturing defects and will not break down or deteriorate for a period of not less than five (5) years from the date of the installation, when installed in accordance with the manufacturer's written specifications and guidelines.

1.08 EXTRA MATERIAL

A. General: Not less than 30 days prior to opening of the facility, deliver to the Owner's Representative, the following materials for future use. Materials shall be delivered with a list of manufacturer's names, product designations, addresses, and phone numbers. Materials shall be boxed, sealed, and clearly identified as to product and specific location of use. Furnish the following quantities of material for use within the designated area.

1. 1% of the total of each color, size, and shape of the tile used, including bases.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Tile Manufacturer:

1. Daltile Commercial, SUNNYVALE, TX (972) 203-0200. Regular mail 199 Planters Rd Sunnyvale, TX 75182. www.daltile.com

B. Tile Products: Provide tile products of manufacturers, product lines, colors and sizes as noted on the Drawings.

C. Tile Installation Products:

1. Mapei setting and grouting materials as specified herein shall establish the commercial standard of quality and performance required. Mapei® tile installation products as manufactured by Mapei Corporation, 1144 East Newport Center Drive, Deerfield Beach, FL 33442, (954)246-8888 or (800)426-2734; www.mapei.com, will be acceptable, and subject to review by the Architect.

2.03 SPECIAL SHAPES

A. General: Provide special shapes, such as wall base materials, trim pieces, interior cove, corner bullnose, and exterior/interior corner units, to be used in their respective places as required by the Drawings and/or field conditions.

2.04 SETTING MATERIALS

A. Portland Cement Mortar: Unless otherwise specified, tile setting materials shall be LEED Approved products, as manufactured by Mapei Corporation, 1144 East Newport Center Drive, Deerfield Beach, FL 33442, (954)246-8888 or (800)426-2734; www.mapei.com. Materials shall be products licensed by the Tile Council of America, and bear TCA triangular hallmark on containers.

1. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

B. Grouting Mortar: Mortar for the various applications shall be as specified herein.

1. Grout shall be MAPEI, Ultra Color Plus, 14 Biscuit, 3/16” thick, unless otherwise noted in the Construction Documents. Verify with Architect if discrepancies arise.

2. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

C. Sand: Conform to ASTM Standard C144, clean, washed, sharp durable, uncoated aggregate free from all deleterious substances; uniformly graded from coarse to fine with 100% passing a No. 30 mesh screen and not more than 5% passing a No. 100 mesh screen.

D. Water: Potable water (suitable for drinking) shall be clean, free from oils, alkalies, acids, organic water, or other deleterious materials.

E. Epoxy Adhesive: Latapoxy® 310 Stone Adhesive, two-component, non-sag, high strength construction epoxy adhesive, meeting and exceeding ANSI A 118.3.

1. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2.05 METAL EDGE TRIM STRIPS

A. Manufacturer: Schluter Systems L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841, (800)472-4588; www.schluter.com, or comparable equivalent manufacturer's product subject to review by the Architect.

B. Product: Edge-protection trim "Schluter®-Schiene-A", mill-finished aluminum material, sizes as indicated on the Drawings and/or required by field conditions. Exposed finish surface width of the edge trim shall be not less than 1/8". Wall thickness for the perforated installation leg shall be 0.039" or 1mm.

2.06 SEALANTS

A. Floor Joint Sealant: Dynatred®, Non-Sag, Traffic-Grade Polyurethane Sealant, two-part, chemicallycuring, cold-applied elastomeric sealant, conforming to Federal Specification TT-S-00227E, as manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (215)723-6051 or (800)523-6688.

1. Primer: As recommended by the specified sealant manufacturer.

2. Colors: Sealant color shall match grout joint colors, and shall be subject to review and approval by the Architect and/or Owner.

3. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 INSPECTION

A. Surface Inspections: Carefully inspect all surfaces upon which materials will be applied, and report to the General Contractor in writing, any condition detrimental to the installation, for correction prior to proceeding with the Work. The installation of Tile Work will be considered an acceptance of the surfaces to be covered, and claims for failure of Tile and Countertop Work because of unsatisfactory sub-surfaces will not be allowed.

B. Concrete Floor Slab Tolerance Flatness/Levelness: Floor shall comply with ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and FL Floor Levelness Numbers; using the F-Number System.

1. If concrete floor slab surfaces exceed the maximum variation, Tile Contractor shall notify the General Contractor for correction of any defects. Starting Work shall imply acceptance of the job conditions, and an unsatisfactory surface condition for

the installation of the materials will not be considered valid in waiving any portion of the warranty.

3.02 PREPARATION

A. Prepare all surfaces upon which materials will be applied as required to receive Work. Remove all dirt, grease, oil, paint, and other surface contaminations that will prevent proper bonding from the substrate surfaces. Remove all ridges, fins, projections, high spots and other irregularities that would interfere with proper installation Work.

3.03 LAYOUT, CUTTING, AND FITTING

A. Layout all Tile Work to minimize cuts of less than one-half tile in size.

B. Locate cuts to be inconspicuous.

C. Align all floor joints to have straight, uniform grout lines parallel with adjacent walls and surfaces.

D. Whenever possible, align grout joints of wall tile and base tile with floor tile joints.

E. Neatly cut and accurately fit all Tile Work around piping and other installations which pierce the Tile Work; at irregular shaped places; and at the junction with other materials. The surface of the tile shall not be chipped or otherwise be damaged in cutting. Grind cut edges smooth and even.

3.04 WORKMANSHIP AND APPLICATION

A. General: Install tile as indicated on the Drawings and specified herein.

1. Select tile from the same shade and lot number.

2. Visually inspect the tile prior to installation.

3. Mix tiles from several boxes.

4. Rotate the tiles to ensure a non-repeat look.

B. Installations: Work shall be performed according to industry standards, manufacturer’s written specifications, and reference standards.

C. Porcelain Ceramic Floor Tile Applications - Thin Bed (Thin Set) Method:

1. Mixing requirements as per Mapei product requirements.

a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Apply the mortar with the flat side of the trowel, being sure to work the material into the surface of the concrete substrate. Comb the surface of the mortar with the notched side of the trowel. Use the proper size notched trowel for the size of tile to be installed.

3. Before placing tiles into the fresh mortar, wipe the back of each tile with a damp sponge or “Scotch Brite™” pad, to remove any dirt or dusty release agents on the tile backs to enhance the bonding strength.

4. Apply mortar to the back of the cleaned tiles to completely cover the back of the tile with a minimum 3/32" to 1/8" uniform thickness.

5. Place the tiles while the mortar is wet and tacky and beat the tile with a rubber mallet and beating block to firmly bed the tiles into the mortar. Occasionally lift a tile off the mortar bed to check for proper coverage of the mortar. Before hardening, excess mortar shall be cleaned with a damp sponge. Tiles may then be grouted when firmly set.

6. Grouting: Provide stain resistant, colorfast, epoxy grout “Mapei”. Exposed joint widths based on manufacturer's tiles as specified herein shall be typically 1/4" wide for nominal 6" x 6" tiles and 5/16" wide for nominal 12" x 12" tiles. Note:
Joint widths for use with other manufacturer’s products shall be verified with the Architect.

   a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

   b. Preparation: Before starting to grout, remove debris in grout joints and lightly sponge the tile surface to remove all dust and dirt. Water shall not be left standing in joints.

   c. Installation Method:

      1. Empty entire contents of packed liquid premeasured kit product jars into a clean pail/container using a clean mixing stick or margin trowel. Mix thoroughly for one minute. Add at least 3/4 of powder product, using more powder for wider joints, as recommended by the manufacturer.

2. Immediately pour entire content of pail/container onto working area. Use standard epoxy grouting techniques to work grout into grout joints. Insure that all grout joints are fully packed.

3. Clean-up by using a hard epoxy rubber grout float at 90° angle to remove as much excess material as possible before initial cleaning with nylon scrub pad. Do not leave excess grout on the face of tiles.

4. Wash the installation within 12 to 24 hours after grouting using a detergent solution such as “Spic n Span®”, Trisodium Phosphate, “Ajax®”, “Comet®”, or non-abrasive cleaner to remove any haze or residue. Do not allow grout film to remain on surface for more than 24 hours.

D. Metal Edge Trim Strips: Verify in field, height dimension of trim product in relation to thickness of the tile and/or mortar bed, and report to the General Contractor, in writing, any discrepancy detrimental to the proper installation of the product. Install specified metal edge trim angles where shown, and as detailed on the Drawings.

1. Installation: Press the perforated anchoring leg of the trim strip into the tile adhesive and align.
Trowel tile adhesive over the anchoring leg. Surface of the tile shall level with the top of the trim (the trim shall not be higher than the surface of tile, rather slightly lower – approximately 1/32"). The joint between the tile and the trim (approximately 1/32" - 1/8") shall be filled completely with grout.

E. Floor Joint Sealant: Provide control joints in floor Work where Tile Work abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes and where changes occur in backing materials as detailed on the Drawings and/or required by field conditions.

3.05 MARBLE THRESHOLD INSTALLATIONS

A. Install thresholds in white dry set mortar (with latex system) similar to setting of floor tile, and point joints between marble and tile flush.

3.06 COUNTERTOP INSTALLATION

A. Adhesive Applications: Provide Epoxy Adhesive product as specified herein for installation of granite on substrate, as indicated on the Drawings.

1. Preparation:

a. Before using, store resins at room temperature (70°F+21°C+) for 24 hours to ensure ease of mixing. All surfaces must be sound, clean, free of oil, waxes, or other bond inhibiting contaminants.

b. Clean and grind back of granite at areas to receive the Epoxy Adhesive spots using a mechanical wheel grinder with a diamond wheel/blade. Remove dust with a stiff brush, wipe entire surface. Using a damp sponge (not wet), wipe the granite to remove any particles or remaining dust to ensure a clean direct bond and that all ground material is removed. Wipe dry with a clean cloth, then apply Epoxy Adhesive. NOTE: Epoxy Adhesive should not be applied to saturated or wet
granite. If wetness or dampness is observed inside the granite after grinding off the top layer, the granite is saturated and must be allowed to dry out.

2. Mixing: Combine equal volumes of Epoxy Adhesive Part A and Part B (1:1 mix ratio by volume). Mix until uniform in color; no swirls. Small quantities may be mixed with a putty knife or margin trowel. Larger quantities may be mixed with an electric drill mixer (low speed).

3. Application:

a. Apply dabs evenly distributed on back of the granite as recommended by manufacturer. Finished dab thickness must be a minimum of 1/8" (3mm).

b. After installation of Epoxy Adhesive onto the substrate, install onto substrate and adjust for plumb and level.

4. Cleaning: Clean tools and Work while epoxy is fresh, using warm water. Detergent or soap may be added to the water for easier cleaning.

3.07 IMPERFECT TILE WORK

A. When directed by the Architect, and prior to final acceptance of the Work, remove all broken, chipped, loose or otherwise unsatisfactory installed Tile and Countertop Work.

B. Patch and restore imperfect tile materials and workmanship to good condition satisfactory to the Architect and/or Owner.

3.08 PROTECTION

A. Protect installed Work from damage at all times during the progress of the Work.

B. Properly protect all finished Work from damage that is in place at the time this Work is being done. Tile Contractor shall be responsible, and will be required to pay for all damage to other Work caused by the Contractor’s workmen.

C. Protective covering shall be non-staining multi-purpose building paper with compatible seam tape. Product shall be such as “SealTight® Red Rosin Paper” as manufactured by

W.R. Meadows, Inc., 300 Industrial Drive, P.O. Box 338, Hampshire, IL 60140-0338, (800)342-5976, (847)214-2100; www.wrmeadows.com, or comparable equivalent product subject to review by the Architect.

3.09 CLEANING

A. During progress of the Work, keep the premises free of all debris and waste materials resulting from the Work of this section. Remove all debris and rubbish from the site. Upon completion and before final acceptance of the Work, remove all debris, rubbish, unused materials, tools, and equipment from the site.

B. When directed by the Architect, after the Work of other trades is substantially completed, remove and dispose of protective coverings and thoroughly clean all Work installed under this section. Use of acid will not be permitted. Use clean water in initial cleaning. Remove all stains, excessive mortar, etc.

C. Cleaner shall be a neutral, general, all-purpose cleaner free of acids, alkalies and abrasives such as one of the following:

1. Mira Clean #1 by Miracle Sealants Company, 12318 Lower Azusa Road, Arcadia, CA 91006-5872, (800)350-1901 or (626)443-6433.

a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Super Shine-All® by Hillyard, Inc., 302 North 4th. Street, P.O. Box 909, St. Joseph, MO, 64501, (816)233-1321 or (800)365-1555.

a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

D. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 Description of Work

A. Related work specified elsewhere:
1. Section 09260/09 21 16 - Gypsum Board Assemblies

1.02 References

A. ASTM A653/A653m - Standard Specification for Sheet Steel, Zinc-coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
B. ASTM C423 - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
C. ASTM C635 - Manufacturing of Metal Suspension Systems
D. ASTM C636 - Installation of Metal Suspension Systems in Non-seismic Applications
E. ASTM D2486 - Standard Test Methods for Scrub Resistance
F. ASTM D3273 - Resistance to Growth of Mold of Interior Coatings in an Environmental Chamber
G. ASTM D3273-00 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
H. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation
I. ASTM D4828 - Standard Test Methods for Practical Washability
J. ASTM D5116-06 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/ Products
K. ASTM E84 - Surface Burning Characteristics of Building Materials
L. ASTM E119 - Fire Tests of Building Construction and Materials
M. ASTM E580 - Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
N. ASTM E1264 - Classification for Acoustical Ceiling Products
O. ASTM E1414 - Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
P. CISCA Ceiling Systems Installation Handbook.
Q. NFPA 70 - 2008 National Electrical Code (NEC) Section 410-36
R. Fire-response tests are performed by a testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
S. Fire-resistance-rated, acoustical tile ceilings are indicated by design designations listed in the UL "Fire Resistance Directory," in the Warnock Hersey "Certification Listings," or in the listing of another qualified testing and inspecting agency.
T. CHPS - Collaborative for High-Performance Schools Indoor air quality emission testing of materials.
U. COEHHA - The California Office of Environmental Health Hazard Assessment established exposure limits of chemicals.
V. High Recycled Content (HRC) - Classified as containing greater than fifty percent total recycled content. Total recycled content is based on product composition of post-consumer and pre-consumer (post-industrial) recycled content per FTC guidelines.

1.03 Submittals

A. Coordination drawings: Submit reflected ceiling plans that are coordinated with mechanical, electrical and security work at acoustical ceilings. Show ceiling suspension members, method of anchorage of hangers and ceiling mounted work including light fixtures and air grilles.
B. 6"x6" (min.) samples of each tile type, pattern, and color required.
C. Set of 12-inch- long samples of suspension system members.
D. Set of 12-inch- long samples of exposed moldings for each color and system type required.
E. Submit certificates from manufacturers of acoustical ceiling units and suspension systems attesting that their products comply with specification requirements and warranties.

1.04 Delivery, Storage and Handling of Materials

A. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements. B. Storage:
    1. Panels: Storage time of materials at the job site should be as short as possible, and environmental conditions should be as near as possible to those specified for occupancy (see no. 1.05 below). Excess humidity during storage can cause expansion of material and possible warp, sag, or poor fit after installation. Chemical changes in the mat and/or coatings can be aggravated by excess humidity and cause discoloration during storage, even in unopened cartons. Cartons should be removed from pallets and stringers to prevent distortion of material. Long-term (6- 12 months) storage under uncontrolled environmental conditions should be avoided.
    2. Suspension System: Store in manner that will prevent warping, scratches, or damage of any kind.
C. Handling: Handle in such manner to ensure against racking, distortion, or physical damage of any kind.
D. Damaged or deteriorated materials should be removed from the premises.
Immediately before installation, to stabilize tile and panels, store them at a
location where temperature and humidity conditions duplicate those ambient during installation and anticipated for occupancy.

1.05 Environmental Conditions

A. Installation of acoustical panels shall not begin until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete, or terrazzo work has dissipated.
B. Do not use ceiling panels in extreme or continuous high humidity, or areas exposed directly to weather or water. Ceiling panels are sized and designed for use within the standard occupancy range of temperature and humidity, 65-85 °F (18-29 °C), no more than 70% RH (relative humidity). Humidity can greatly affect product dimensional stability and sag resistance. Sag can become noticeable during periods of high humidity lasting only a few hours. CLIMAPLUS ceilings if used with DONN® Brand Suspension Systems, can withstand temperatures from 60-104 °F (32-40 °C) and relative humidity up to 95%-100% RH. See USG Interiors Inc. for specific warranty information.
C. Allow time for dimensional changes in ceiling panels stored at temperature/humidity conditions well outside of those recommended for service.
With increases in temperature/humidity, these products expand (up to 1/64 in./ft.

(4.3 mm/m) at 85 °F (29 °C)/90% RH) and may not fit into a fixed grid. Conversely, with decreases, these products will be undersize, but expand to normal when standard ambient conditions return.

D. Formaldehyde & VOC Classification, as tested per ASTM D5116 and according to standards established by the Collaborative for High-Performance Schools (CHPS), the California Office of Environmental Health Hazard Assessment (OEHHA), and the USGBC LEED for Schools.
    1. Products are classified as zero- or low-emitting for formaldehyde and VOC emissions as defined:
        a. “Zero-Emitting” - Materials producing concentration levels below the test-chamber background level specified by the "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 addendum. Section 3.8.4.3 states, " Background concentrations in the empty chamber ventilated at 1.0 air changes per hour shall not exceed 2 µg m-3 (1.6 ppb) for any individual VOC, including formaldehyde" and all VOCs with chronic inhalation Reference Exposure Levels adopted by California EPA COEHHA for Proposition 65 chemicals.
        b. ”Low-Emitting” - Materials passing CHPS requirements as established in the "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 addendum. In addition, these products produce formaldehyde concentration levels below 16.5 µg m-3 (13.5 ppb) & contribute no more than one-half of the chronic inhalation Reference Exposure Level adopted by California EPA COEHHA for all other VOCs identified by Proposition 65.
    2. Must be tested by independent lab per these standards along with product submittals.
        a. Documentation of laboratory test must indicate products and item number if test results differ for other facility manufacturing location for supplied products.
    3. Acceptable products must be listed on the Collaborative for High Performance Schools (CHPS) website found at http://www.chps.net/dev/Drupal/node/445.
    4. If only select item numbers within a product family or products formulated in select manufacturing facilities meet the CHPS requirements and are listed on the CHPS website, product literature and samples must clearly indicate that the product meets either zero- or low-emitting standards per the CHPS test protocol. In instances where only select items from a manufacturer meet the CHPS protocol, product packaging or labeling must clearly indicate the product meets the minimum requirements of the CHPS test standard for zero- or low-emitting Products as defined in Section 01350.

1.06 Quality Assurance

A. Single Source Responsibility: To obtain combined warranty for the Donn Brand suspension system and the acoustical panel, color match or ceiling panel and suspension system compatibility, all acoustical panel and suspension system components shall be produced and supplied by one manufacturer. Materials supplied by more than one manufacturer are not acceptable.
B. Subcontractor qualifications: Installer shall have successful experience in the installation of suspended ceiling systems on projects with requirements similar to requirements specified.
C. Requirements of regulatory agencies: Codes and regulations of authorities having jurisdiction.
D. Source quality control:
    1. Test reports: Manufacturer will provide test certification for minimum requirements as tested in accordance with applicable industry standards and/or to meet performance standards specified by various agencies.

2. Changes from system: System performance following any substitution of materials or change in assembly design must be certified by the manufacturer.
3. All ceiling panel cartons must contain UL label for acoustical compliance.
4. All suspension system cartons must contain UL label for load compliance per ASTM C635.

1.07 Project Conditions

A. Existing conditions: (include specific alteration work requirements for project).
1. Environmental requirements for interior installation: Building shall be enclosed with windows and exterior doors in place and glazed, and roof watertight before installation of ceiling system and related ceiling components. 1. Describe ClimaPlus condition C. Coordination with other work:
2. General: Coordinate with other work supported by or penetrating through the ceiling, including mechanical and electrical work and partition systems.
3. Mechanical work: Ductwork above ceiling shall be complete, and permanent heating and cooling systems operating to climate conditions prior to installation of ceiling components.
4. Electrical work: Installation of conduit above ceiling shall be complete before installation of ceiling components.
5. Fire protection work: Fire protection lines and/or equipment occurring above ceiling shall be completed and tested before ceiling components are installed. D. Protection:
1. Personnel: Follow good safety and industrial hygiene practices during handling and installing of all products and systems, with personnel to take necessary precautions and wear appropriate personal protective equipment as needed. Read material safety data sheets and related literature for important information on products before installation. Contractor to be solely responsible for all personal safety issues during and subsequent to installation; architect, specifier, owner, and manufacturer will rely on contractor's performance in such regard.
2. Protect completed work above ceiling system from damage during installation of ceiling components.

PART 2 - PRODUCTS

2.01 Materials

A. ACP-1 Spec 1. Acoustical Ceiling Panel
Product: Armstrong Mesa, Square Lay-in
c. Color Finish: White
d. Edge Detail: Reveal sized to fit flange of exposed suspension system members: Square Edge
e. Thickness: 3/4 in
j. Panel Size: 2 ft x 2 ft x 3/4 in
k. Antimicrobial Treatment: Coating based.
l. Panel Warranty: When used with a USG Donn Brand suspension system, this panel has a 30-year warranty that it shall be free from manufacturing defects. When used without a USG Donn Brand suspension system, the period of warranty is 10 years. Panel Warranty: When used with a USG Donn Brand suspension system, this panel has a 30 year warranty that it shall be free from manufacturing defects. When used without a USG Donn Brand suspension system, the period of warranty is 10 years.

A. ACP-2 Spec 1. Acoustical Ceiling Panel

Product: Armstrong Pebble, Square Lay-in

f. Color Finish: White

g. Edge Detail: Reveal sized to fit flange of exposed suspension system members: Square Edge

h. Thickness: 1 in

j. Panel Size: 2 ft x 2 ft x 1 in

m. Antimicrobial Treatment: Coating based.

n. Panel Warranty: When used with an Armstrong suspension system, this panel has a 30-year warranty that it shall be free from manufacturing defects. When used without a USG Donn Brand suspension system, the period of warranty is 10 years. Panel Warranty: When used with a USG Donn Brand suspension system, this panel has a 30 year warranty that it shall be free from manufacturing defects. When used without a USG Donn Brand suspension system, the period of warranty is 10 years.

2. Metal Suspension System for Acoustical Ceiling Panel

a. General: ASTM C635, commercial quality pretreated and painted hot-dipped galvanized cold-rolled steel, exposed surfaces prefinished in manufacturer's standard corrosion resistant enamel paint finish; color: Flat White #050 or as selected from manufacturer's standard colors. Flat White 050

b. Available Products/ Systems:

1. USG Corporation: USG DONN® Brand DX®/DXL™ 15/16" Acoustical Suspension System

c. Suspension System Components:

1. Fire Rated Main Tees: UL Classified Intermediate Duty Classification; double-web design; 1.64 in. high; rectangular top bulb; 15/16 in. exposed flange with roll-formed steel cap; cross tee holes and hanger wire holes at 6 in. o.c.; convenience holes at approximately 2 in. o.c.; integral reversible splices.

2. Cross tee: 1-1/2 in. high; roll-formed into double-web design with rectangular bulb; 15/16 in. exposed flange with prepainted steel cap; high tensile steel end clips clenched to web. 1 in. high; roll-formed into double-web design with rectangular bulb; 15/16 in. exposed flange with prepainted steel cap; high tensile steel end clips clenched to web. Main tees and cross tees shall be positively locked, yet shall be removable without the use of tools.

d. Accessories:

1. Wall Molding: Angle shape; 7/8 in. mounting flange by 7/8 in. face flange or 1 in. mounting flange by 2 in. face flange or 2 in. mounting flange or 2 in. face flange; hemmed edges; exposed surface pre-finished to match suspension system components.

I. Inside Corner: Field-mitered joints at wall molding; Prefabricated corner cap; formed to 90° angle; hemmed edge; size and finish to match wall molding.

II. Outside Corner: Prefabricated corner cap; formed to 90° angle; hemmed edge; size and finish to match wall molding.

2. Channel Molding: U-shape; hemmed edges; exposed surfaces pre-finished to match suspension system components; 1" or 1/2" exposed flange by depth as required for ceiling material

e. Suspension System Attachment devices

1. Hanger Wire: Galvanized carbon steel; soft temper; prestretched; yield stress load at least three times the design load but not less than 12-gauge.

f. Suspension System Warranty: When used with a USG acoustical ceiling panel, this suspension system has a Lifetime 30 year warranty that it shall be free from the occurrence of 50% red rust. When used without a USG acoustical ceiling panel, the period of warranty is 10 years.

2.02 Fabrication

A. Trim: Edges extruded to mate with attachment clips and provide positive mechanical lock with no visible fasteners. Factory finished to match approved samples.
B. Splice Plates: Formed to screw into and provide positive lock between abutting pans with no visible fasteners. Factory finished to match trim.
C. Mounting Clips: Formed to screw-attach to trim and provide positive mechanical lock with no visible fasteners while providing a variable angle, screw-fastened connection to suspension members which intersect the trim.

PART 3 - EXECUTION

3.01 General

A. Standard for Ceiling Suspension System Installations: Comply with ASTM C636.
B. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
C. CISCA Ceilings Systems Handbook.
D. NFPA 70 – 2008 National Electrical Code (NEC) Section 410-36.
E. All applicable local and state codes.

3.02 Inspection

A. Examine areas to receive ceiling panels for conditions that will adversely affect installation. Provide written report of discrepancies.
B. Do not start work until unsatisfactory conditions are corrected.
C. Work to be concealed: Verify work above ceiling is complete and installed in manner that will not affect layout and installation of ceiling panels.
D. Beginning of installation shall signify acceptance of conditions in areas to receive ceiling panels.
E. Fire-rating requirements: Construction above fire-rated assembly shall meet requirements of UL Design specified in *2: Products.*

3.03 Preparation

A. Field dimensions: Installer must verify actual field dimensions prior to installation.
B. Renovation work: Installing contractor shall verify that existing ceiling structure is adequate to support additional Compasso ceiling suspension requirement.
C. Coordination: Coordinate and schedule installation of ceiling system with work of other trades affected by this installation, with particular attention given to mechanical and electrical work required to be installed and operating before ceiling work can begin.

3.05 Field Quality Control

A. Deflection on installed system: Maximum deflection shall not exceed 1/360 of the span.

3.06 Cleaning

A. Suspension System: Remove panel material and perform any necessary cleaning maintenance with non-solvent based commercial cleaner
B. Immediately remove any corrosive substances or chemicals that would attack painted finishes (i.e. wallpaper adhesives)
C. Touch up all minor scratches and spots, as acceptable, or replace damaged sections when touch-up is not permitted
D. Painting: Repainting of suspension member shall be with a high-quality solvent base enamel paint and applied as recommended by paint manufacturer. Ceiling panels may be touched-up by spraying a thinned, non-bridging vinyl-acrylic flat wall paint. The type of paint selected and the method of application can alter the acoustical performance and fire ratings of any acoustical product. Therefore, USG Interiors, Inc. cannot guarantee that the field-painted panels will match the published performance.
E. Removal of debris: Remove all debris resulting from work of this section.

END OF SECTION

SECTION 09 62 80
STATIC CONTROL FLOORING
DUR-A-GARD ESD WITH ARMOR-STAT ESD TOPCOAT FLOOR SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Static control flooring system as shown on the drawings and in schedules.

B. Related sections include the following:

1. Cast-in-Place Concrete, section 03 30 00
2. Concrete Curing, section 03 39 00

1.3 SYSTEM DESCRIPTION

A. The work shall consist of preparation of the substrate, the furnishing and application of a pigmented 100 % solids epoxy/urethane-based static dissipative floor coating system. The system shall have the color and texture as specified in Room Finish Schedule with a nominal thickness of 28 mils. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.

1.4 SUBMITTALS

A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.
B. Manufacturer’s Safety Data Sheet (SDS) for each product being used.
C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

1.5 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.
B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.

C. No requests for substitutions shall be considered that would change the generic type of the specified System.
D. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.
E. System shall be in compliance with the Indoor Air Quality requirements of California section 01350 as verified by a qualified independent testing laboratory.

F. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a storage area for all components. The area shall be between 60 F and 90 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
2. Copies of Safety Data Sheets (SDS) for all components shall be kept on site for review by the Engineer or other personnel.

C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.7 PROJECT CONDITIONS

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The relative humidity in the specific location of the application shall be less than 80 % and the surface temperature shall be at least 5 F above the dew point.
3. The Applicator shall ensure that adequate ventilation is available for the work area.
4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with epoxy material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty
eight days in accordance with ACI-308 prior to the application of the coating system pending moisture
tests.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).
3. Sealers and curing agents should not to be used.
4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.

1.8 WARRANTY

A. Dur-A-Flex, Inc. warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
B. Dur-A-Flex, Inc. liability with respect to this warranty is strictly limited to the value of the material purchase.

PART 2 – PRODUCTS

2.1 FLOORING

A. Dur-A-Flex, Inc, Dur-A-Gard ESD, Epoxy-Based static dissipative seamless flooring system with Armor Stat ESD , Urethane-Based static dissipative topcoat.
1. System Materials:
a. Primer: Dur-A-Flex, Inc, Dur-A-Glaze #4 ESD Primer resin and hardener.
b. Base Coat: Dur-A-Flex, Inc, Dur-A-Gard ESD resin and hardener.
b. Topcoat: Dur-A-Flex, Inc, Armor-Stat ESD Topcoat resin, hardener and grit.

2. Patch Materials
a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Dur-A-Glaze Cove Rez with NoSag #2 or Elast-O-Coat with NoSag #1.
b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Dur-A-Crete.

2.2 MANUFACTURER

A. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802
B. Manufacturer of Approved System shall be single source and made in the USA.

2.3 PRODUCT REQUIREMENTS

A. Primer	Dur-A-Glaze #4 ESD Primer
1. Percent Solids	100 %
2. VOC	7.45 g/L
3. Surface Resistivity, ASTM D 257	10^6-10^9 ohm/Square
4. Static Decay, Mil-Std-3010, Method 4046	0.01 seconds
5. Voltage generation, ESD STM 97.2	14v
6. Compressive Strength, ASTM D 695	16,000 psi
ASTM C 579	10,500 psi
7. Tensile Strength, ASTM D 638	3,000 psi
ASTM C 307	1,950 psi
8. Tensile Elongation, ASTM D 638	7.5%
9. Flexural Strength, ASTM D 790	4,000 psi

ASTM C 580	2,900 psi
10. Hardness (Shore D), ASTM D 2240	70-80
11. Linear Shrinkage, ASTM D 2566	0.02%
12. Linear Expansion, ASTM D 696	$2x10^{-5}$
13. Bond Strength to Concrete, ASTM D 4541	400 psi, substrate fails
14. Indentation, MIL D-3134	0.025 Max
15. Impact Resistance, MIL D-3134	Pass
16. Water Absorption, ASTM D 570	0.04%
17. Heat Resistance Limitation	140 F to 200 F
18. Flammability, ASTM D 570	Self Extinguishing
19. Flame Spread/NFPA 101, ASTM E 84	Class A

B. Base Coat	Dur-A-Gard ESD
1. Percent Solids	100 %
2. VOC	7.45 g/L
3. Surface Resistivity, ASTM D 257	10^6-10^9 ohm/Square
4. Static Decay, Mil-Std-3010, Method 4046	0.01 Seconds
5. Compressive Strength, ASTM D 695	16,000 psi
ASTM C 579	10,500 psi
6. Tensile Strength, ASTM D 638	3,000 psi
ASTM C 307	1,950 psi
7. Tensile Elongation, ASTM D 638	7.5%
8. Flexural Strength, ASTM D 790	4,000 psi
ASTM C 580	2,900 psi
9. Abrasion Resistance, ASTM D 4060 C-10 Wheel, 1,000 gm load, 1,000 cycles	40 mg loss
10. Flame Spread/NFPA-101, ASTM E 84	Class A
11. Flammability, ASTM D 635	Self Extinguishing
12. Impact Resistance MIL D-3134	Pass
13. Water Absorption. MIL D-3134	0.04 %
14. Heat Resistance Limitation	140 F to 200 F

C. Topcoat	Armor-Stat ESD Topcoat
1. Percent Solids	69 %
2. VOC	57 g/L
3. Tensile Strength, ASTM D 2370	7,000 psi
4. Adhesion, ASTM 4541	Substrate Failure
5. Hardness, ASTM D 3363	>4H
6. 60^0 Gloss ASTM D 523	30 +/-10
7. Abrasion Resistance, ASTM D4060 CS 17 wheel (1,000 g load) 1,000 cycles	5 mg loss
8. Pot Life, 70 F, 50% RH	45 mins
9. Full Chemical Resistance	7 days

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss,
algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
.
   a. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
   b. If the relative humidity exceeds 75 % relative humidity then Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.
3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.
4. Mechanical surface preparation
   a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 3-4 as described by the International Concrete Repair Institute.
   b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, or other suitable equipment.
   c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch
   key cut shall be made to properly seat the system, providing a smooth transition between areas. The
   detail cut shall also apply to drain perimeters and expansion joint edges.
   d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer’s recommendations.
5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufacturer’s recommendations.

3.3 APPLICATION

A. General

1. The system shall be applied in five distinct steps as listed below:
   a. Substrate preparation
   b. Priming
   c. Install Copper foil tape
   d. Base coat application
   e. Topcoat application
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.

4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Primer

1. The primer shall be Dur-A-Glaze #4 ESD Primer that is mixed at the ratio of 2 parts resin to 1 part hardener per the manufacturer's instructions.
2. The primer shall be applied by notched squeegee and back rolled at the rate of 200 sf/gal, to yield a dry film thickness of 8 mils.

C. Copper Foil Tape

1. Install copper foil tape conductive adhesive to ground.
2. Use a minimum of ½ inch wide copper foil tape.
3. Copper foil tape is to be installed at one point per 1,000 SF.

D. Base coat

1. The base coat shall be comprised of a liquid resin and hardener that is mixed at the ratio of 3 parts resin to 1 part hardener per the manufacturer's instructions.
2. The base coat of Dur-A-Gard ESD shall be applied by notched squeegee and back rolled applied at the rate of 100 sf/gal to yield a dry film thickness of 16 mils.

E. Topcoat

1. The topcoat shall be a kit comprised of a liquid resin, hardener and grit mixed per the manufacturer's instructions.
2. The topcoat of Armor-Stat ESD shall be applied by notched squeegee and immediately back-rolled at the rate of 350 sf/kit to yield a dry film thickness of 3 to 4 mils.
3. The finished floor will have a nominal thickness of 28 mils.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
   a. Temperature
      1. Air, substrate temperatures and, if applicable, dew point.
   b. Coverage Rates
      1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.
   c. Surface resistance readings after 24 hour cure @ 70F
      1. Floor readings should be tested using OHM-STAT RT-1000 Megohmeter @ 100V and read between 10^6-10^9 OHM/square

3.5 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

8/2020/DUR-A-GARD ESD_ARMOR-STAT ESD

Please recycle - Thank you!

SECTION 09 65 13
RESILIENT BASES AND ACCESSORIES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Resilient Bases and Accessory Work indicated on the Drawings and specified herein. Work includes, but is not limited to the following:

1. Roppe Vinyl Transition Strips- (Colors to be selected by Architect refer to plans for color and location.)

2. Roppe Pinnacle butt-toe Rubber Wall Base- ASTM F-1861, Type TS, 4” and 6”in height (120’ coil) Straight and cove. (Refer to plans for location)

B. Color Selections: Refer to the Drawings.

C. Room Finish Schedule: Refer to the Drawings.

D. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Cast-in-Place Concrete - Section 03 30 00.

2. Rough Carpentry - Section 06 10 00.

3. Tile Work - Section 09 31 00.

1.02 QUALITY ASSURANCE

A. General: All material incorporated in the Work shall be subject to the Architect’s and Owner’s review. Methods of preparation, construction, and installation shall be in accordance with manufacturer’s printed specifications, unless otherwise directed by the Owner’s Representative.

B. Unacceptable Materials: Material containing asbestos fibers are prohibited.

1.03 SUBMITTALS

A. General: Submit Product Data and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. Samples: Submit Samples of all materials for approval PRIOR to installation. Installed materials shall match approved Samples.

1. Submit the following Samples of each type, color and pattern required:

a. Accessories: 12" long Samples of items such as reducer strips, transition strips, and wall bases.

1.04 DELIVERY AND STORAGE

A. Delivery: Deliver only approved materials to the site in original boxes, crates, wrappings, clearly labeled with pertinent information to facilitate checking.

B. Storage: Store the materials at the site off the ground and in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.05 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expenses any imperfections which may develop during the period specified, and damage to other Work caused by imperfections or repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

1.06 EXTRA MATERIAL

A. General: At completion of the Work, deliver to Owner's Representative, additional replacement materials, in unopened boxes, sealed, and clearly labeled for maintenance purposes, in the following amounts:

1. Rubber Wall Bases: Thirty-two (32) lineal feet of each base type, size and color installed. Bases shall be of equal lengths not less than 4'-0".

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Transition Strips: Roppe Brand

1. Colors: As indicated on drawings.

B. Rubber Wall Bases Types:

1. Roppe Vinyl Transition Strips- (Colors to be selected by Architect refer to plans for color and location.)

2. Roppe Pinnacle butt-toe Rubber Wall Base- ASTM F-1861, Type TS, 4" and 6" in height (120' coil) Straight and cove. (Colors to be selected by Architect refer to Room Finish Schedule sheet A6.11 for color and location.)

3. Provide pre-molded outside corner base units where required by Drawings or Project conditions.

C. Patching Compound: Fast patch compound brand name product of type recommended by the manufacturer of the resilient flooring material.

D. Adhesives: Cutback or clear thin spread type products recommended by the manufacturer of resilient flooring materials. Waterproof adhesives shall be used without adulteration. Floor tile adhesive shall not be used for wall bases, and wall base adhesive shall not be used for Floor Tile Work.

1. Volatile Organic Compounds (VOC) Content: Adhesives product specified herein shall have a VOC content of 50 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSPECTION AND PREPARATION

A. Inspection: Carefully inspect all surfaces upon which resilient flooring materials are to be applied. Notify the General Contractor for correction of any defects. Starting Work shall imply acceptance of the job conditions, and an unsatisfactory surface condition for the installation of the materials will not be considered valid in waiving any portion of the warranty.

1. Concrete floors to receive resilient flooring materials shall be smooth and of uniform steel trowel finish, free of curing or sealing compounds.

B. Preparation: Resilient bases and accessories shall not be laid on uncured or damp concrete. All concrete surfaces receiving resilient flooring materials shall be tested for dampness prior to installation of the flooring material. The following test may be used, or alternate methods as recommended by the resilient flooring manufacturer may be substituted.

1. Test Method for Dampness: Brush on floor primer in several areas approximately 3' x 3', preferably in area least subject to drying conditions. If after twenty-four (24) hours the primer can be scraped or peeled from the surface, the surface is unsuitable for installation of the resilient flooring material. Allow surface to dry further; retest until primer is well bonded to the surface, whereupon installation may proceed.

2. Concrete Floor Preparation: Concrete subflooring to receive resilient flooring materials shall be prepared in accordance with the manufacturer’s printed instructions and recommendations.

3.02 INSTALLATION

A. General: Install all resilient flooring materials specified herein and as indicated on the Drawings in accordance with the manufacturer’s printed specifications.

B. Vinyl Transition Strips: Provide transition strips as required by Drawings and/or field conditions.

C. Wall Bases: Install premoulded wall bases including external and internal corners, coped neat and sharp.

1. Carpeted Areas: Coordinate Work with Carpeting Contractor for wall bases required in carpeted areas.

2. Prefabricated Cabinet Toe Boards: Install wall bases for exposed toe bases of prefabricated base cabinets.

D. Bonding Assurance: After installation, floors shall be rolled with heavy roller as recommended by the manufacturer to insure proper bond. Roller surface shall be such as not to damage or otherwise mar finish surfaces of resilient flooring.

3.03 CLEANING PROTECTION

A. General: Soon after installation of resilient bases and accessories, wipe-off all surplus adhesive and leave surfaces clean and free of surface marks or blemishes. All Work shall be thoroughly cleaned at time of completion, at the final completion of the building areas, and prior to occupancy when directed by the Architect.

B. Washing: Resilient flooring materials shall not be washed until time period recommended by resilient flooring materials manufacturer has elapsed, to allow materials to become well-sealed in adhesive.

C. Cleaning, Rinsing, and Sweeping: Clean and rinse all resilient bases and accessories with 140°F. water, and dry. Sweep clean with untreated yarn broom.

D. Protection: Protect all traffic areas of resilient flooring with undyed, untreated building paper.

3.04 DAMAGED WORK

A. All damaged or Defective Work shall be replaced. All other Work which becomes damaged in replacing Defective Work shall be replaced by Resilient Flooring Materials Contractor. Patched Work will not be accepted.

3.05 CLEAN-UP

A. During progress of the Work the premises shall be kept free of all debris and waste materials resulting from the Work of this section. All debris and rubbish shall be removed from the site. Upon completion of Work and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

B. Waste Management: Collect field generated construction waste created during construction or final.

END OF SECTION

SECTION 09 65 19.19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
    1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.
B. Related Documents
    1. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.
C. Related Sections:
    1. Other Division 9 sections for floor finishes related to this section but not the work of this section

1.02 REFERENCES

A. Armstrong Flooring Technical Manuals
    1. Armstrong Flooring Guaranteed Installation Systems manual, F-5061
    2. Armstrong Flooring Maintenance Recommendations and Procedures, manual, F-8663
B. ASTM International:
    1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
    2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
    3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
    4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
    5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
    6. ASTM F 1861 Standard Specification for Resilient Wall Base
    7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
    8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
C. National Fire Protection Association (NFPA):
    1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
    2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.
B. Administrative Requirements
    1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and

manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

2. Pre-installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e. moisture tests, bond test, pH test, etc)

C. Test Installations/ Mock-ups: Install at the project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.
   1. Mock-Up Size: As recommended by Architect.
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into the final construction with Owner's approval.

D. Sequencing and Scheduling
   1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
   2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test. using an Armstrong high moisture adhesive.

1.04 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions (latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061) for flooring and accessories.

B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.

C. Submit Safety Data Sheets (SDS) available for adhesives, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.

D. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

E. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Warranty: Warranty documents specified herein

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.

B. Select an installer who is experienced and competent in the installation of Armstrong resilient vinyl composition tile flooring and the use of Armstrong Flooring subfloor preparation products.

1. Engage installers certified as Armstrong Commercial Flooring Certified Installers
2. Confirm installer's certification by requesting their credentials

C. Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:

1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
3. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested.

1.06 DELIVERY, STORAGE AND HANDLING

A. Comply with Division 1 Product Requirements Sections

B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.07 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF (18ºC) and a maximum temperature of 100ºF (38ºC) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55ºF (13ºC) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to the Armstrong Flooring Guaranteed Installations Systems manual, F-5061 for a complete guide on project conditions.

1.08 LIMITED WARRANTY

A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.

B. Limited Warranty Period: 5 years

C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

1.09 EXTENDED SYSTEM LIMITED WARRANTY

A. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.

B. Limited Warranty Period: 10 years on top of the Resilient Flooring Limited Warranty

C. [S-453 Level Strong™ cement based self-leveling compound] [S-456 Patch Strong™ flexible patching and smoothing compound] [S-454 Prime Strong™ acrylic primer for porous substrates] [S-455 Prime Strong™ acrylic primer for non-porous substrates] [S-452 Seal Strong™ two part moisture mitigation system]

D. The installation of an Armstrong Flooring product along with the recommended Armstrong Flooring adhesive, as well as any one of the Strong System subfloor preparation products listed above, provides 10 additional years of limited warranty coverage. The Strong System limited warranty covers the installation integrity for the length of the flooring product warranty plus 10 years. In order to qualify for the Strong System Warranty, any subfloor preparation product needed for an installation must be an Armstrong Flooring product.

E. For the System Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

F. When Armstrong Flooring Strong System subfloor preparation products are used with other manufacturers' floor coverings, adhesives, or other subfloor preparation products, Armstrong Flooring warrants our products to be free from manufacturing defects from the date of purchase through the limited warranty period of 15 years.

1.10 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Quantity: Furnish quantity of flooring units equal to [5] % of amount installed.
2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra material.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Resilient tile flooring, wall base, adhesives and subfloor preparation products and accessories:

Armstrong Flooring Inc., 2500 Columbia Avenue, Lancaster, PA 17604, www.armstrongflooring.com/commercial

1. Manufacturer must have a headquarters in the United States of America

2.02 RESILIENT TILE FLOORING MATERIALS

A. Provide Vinyl Composition Tile: Standard Excelon® Imperial® Texture Tile Flooring manufactured by Armstrong Flooring, Inc.

1. Description: Tile composed of polyvinyl chloride resin, plasticizers, fillers, stabilizers and pigments with colors and texture dispersed uniformly throughout its entire thickness.
2. Vinyl composition tile shall conform to the requirements of ASTM F 1066, “Standard Specification Vinyl Composition Floor Tile", Class 2, through-pattern
3. Pattern and Color: Selected from the range currently available from Armstrong Flooring, Inc. Refer Architects Room Finish Schedule sheet number A6.11 and floor pattern plan.
4. Size: 12 in. x 12 in. (305 mm x 305 mm)
5. Thickness: [1/8"/0.125 in. (3.2mm)] [3/32"/0.095 in. (2.4mm)]

2.03 PRODUCT SUBSTITUTION

A. Substitutions: No substitutions permitted because of the specific attributes listed in Section 2.02.

2.05 ADHESIVES

A. For Tile Installation System, Full Spread: Provide Armstrong [S-515 Floor Tile Adhesive] [S-525 BBT® Bio-Flooring Adhesive] [S-700 Floor Tile Adhesive Thin Spread] [S-750 Premium Floor Tile Adhesive] under the tile and Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.

B. For Tile Installation System, Tile On: Provide Armstrong [S-515 Floor Tile Adhesive] [S-525 BBT® Bio-Flooring Adhesive] [S-750 Floor Tile Adhesive Thin Spread] under the tile over smooth, completely bonded existing resilient flooring and Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.

C. For Tile High-Moisture Installation Warranty, Full Spread: Provide Armstrong [S-515 Floor Tile Adhesive] [S-525 BBT® Bio-Flooring Adhesive] under the tile and Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.

2.06 ACCESSORIES

A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong [S-184 Fast-Setting Cement-Based Patch and Underlayment] [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-453 Level Strong™ cement based self-leveling compound] [S-456 Patch Strong™ flexible patching and smoothing compound].

B. [For priming porous substrates to aid in adhesive bond strength and reducing subfloor porosity, provide S-454 Prime Strong™ acrylic primer for porous substrates. For non-porous substrates, provide S-455 Prime Strong™ acrylic primer for non-porous substrates].

C. [For creating a moisture barrier, provide S-452 Seal Strong™ two part moisture mitigation system].

D. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

E. Provide transition/reducing strips tapered to meet abutting materials.

F. Provide threshold of thickness and width as shown on the drawings.

G. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

H. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test, etc.).

B. Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.

C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.03 PREPARATION

A. [Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong Flooring [S-184 Fast-Setting Cement-Based Patch and Underlayment][S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-453 Level Strong™ cement based self-leveling compound] [S-456 Patch Strong™ flexible

patching and smoothing compound] [S-454 Prime Strong™ acrylic primer for porous substrates] [S-455 Prime Strong™ acrylic primer for non-porous substrates] as recommended by the flooring manufacturer. Refer to Armstrong Flooring Guaranteed Installation Systems manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.]

B. [Subfloor Preparation Moisture Mitigation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, mitigate moisture and other defects with Armstrong Flooring [S-184 Fast-Setting Cement-Based Patch and Underlayment][S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-453 Level Strong™ cement based self-leveling compound] [S-456 Patch Strong™ flexible patching and smoothing compound] [S-452 Seal Strong™ two part moisture mitigation system] [S-454 Prime Strong™ acrylic primer for porous substrates] [S-455 Prime Strong™ acrylic primer for non-porous substrates] as recommended by the flooring manufacturer. Refer to Armstrong Flooring Guaranteed Installation Systems manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.]

C. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material.. Refer to the Armstrong Flooring Guaranteed Installation Systems manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

D. For Tile Installation System, Full Spread when using S-700 or S-750 adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes”][ASTM F 1869,Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride] and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems manual, F-5061, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 80%.][MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained]

E. [For Tile High-Moisture Installation Warranty when using S-515 Adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes”][ASTM F 1869,“Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride”] and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems manual, F-5061, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 95%.][MVER shall not exceed 7 lbs./1000 sq. ft./24 hrs.]

On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained].

F. [For Tile High-Moisture Installation Warranty when using S-525 Adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes"][ASTM F 1869,"Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"] and Bond Tests as described in the Armstrong Flooring Guaranteed Installation Systems manual, F-5061, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Relative humidity shall not exceed 90%.][MVER shall not exceed 7 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

G. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

3.04 INSTALLATION OF FLOORING

A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061. Failure to comply may result in voiding the manufacturer's warranty listed in Section 1.08.

B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.05 INSTALLATION OF ACCESSORIES

A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

D. Apply [butt-type] [overlap] metal edge strips where shown on the drawings, [before] [after] flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.06 CLEANING

A. Perform initial and on-going maintenance according to the latest edition of the maintenance recommendations for Standard Excelon Imperial Texture.

3.07 PROTECTION

A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. (See Finishing The Job in the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061.)

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 – GENERAL

1. RELATED DOCUMENTS
    a. Division 01 Specification Sections

2. SUMMARY
    a. This section relates to carpet tile.

3. PREINSTALLATION MEETINGS
    a. Conducted at (insert time, location, and key contact).

4. SUBMITTALS
    a. Product Specification
    b. Specification for Adhesive
    c. Shop Drawings
    d. Samples
    e. Schedule
    f. Qualifications for Installer

5. CLOSEOUT SUBMITTALS
    a. Maintenance Instructions
    b. Warranty Documents

6. QUALITY ASSURANCE
    a. Environmental:
        i. Health Product Declaration
        ii. Declare Label, red list compliant
        iii. No PVC components
    b. Installer Qualifications: Installer who has been trained in the installation of carpet tile.
    c. Manufacturer Qualifications
        i. ISO 1400l
        ii. ISO 9001
        iii. Reclamation Program: Will recycle EcoWorx carpet tile free of charge for quantities of 500 SY (418 SM) or more within continental United States and Canada or 5000 SY (4180 SM) globally.
    d. Mockups at designated location for architect review and approval.

7. MATERIAL STORAGE AND HANDLING
    a. Store rolls on a flat surface, away from vents and direct sunlight.
    b. Store in protected dry conditions between 65 and 85 degrees.

8. SITE CONDITIONS
   The following conditions must be maintained for 24 hours prior to, during and permanently after installation:
   a. HVAC System must be operational.
   b. The installation site, carpet and adhesive must be between 50°F and 95°F.
   c. The installation site's ambient relative humidity must not fall below 40%.
   d. Conduct relative humidity or Anhydrous Calcium Chloride testing. Results must be within the proper range for Shaw 5000 adhesive:
      i. Calcium Chloride ASTM F-1869 5.0 lbs per 1000 SF /24 hours
      ii. Relative Humidity ASTM F-2170 85%
      iii. EcoLogix ES does not require moisture or pH testing.
   e. Conduct pH testing on the floor in several locations. A reading below 5.0 or above 9.0 requires corrective measures.

PART 2 – PRODUCTS

9. TESTING REQUIREMENTS
   a. Pill Test CPSC FF 1 70: Pass
   b. Radiant Panel ASTM E648: Class I
   c. NBS smoke ASTM E662 NF: <450
   d. Static AATCC 134: <3.5 kv
   e. Coefficient of Friction: 0.6 (Meets ADA requirements)

10. TILE CARPETING
   a. Manufacturer: Patcraft
   b. Collection: Infrastructure
   c. Product: Transverse, I0520
   d. Construction: Mulit-Level Pattern Loop
   e. Fiber: Eco Solution Q® Nylon
   f. Dye Method: 100% solution dyed
   g. Backing: EcoWorx® Tile
   h. Protective Treatment: SSP® Shaw Soil Protection
   i. Size: 24" x 24"
   j. Gauge: 1/10
   k. Stitches: 9.8
   l. Finished Pile Thickness: 0.068
   m. Average Density: 8,471
   n. Total Thickness: 0.216
   o. Tufted Weight: 16.0 oz

11. INSTALLATION MATERIALS
   a. Adhesives:
      i. For EcoWorx (fiberglass reinforced):
         1. Shaw 5000 pressure sensitive: 5 lbs. 85% RH pH 5-9
         2. Shaw 5100 pressure sensitive: 5 lbs. 85% RH pH 5-9
         3. Shaw 5036 with antimicrobial: 5 lbs. 85% RH pH 5-9

4. Shaw 5800 for high moisture: 10 lbs. 95% RH pH 10
5. Shaw 3800 indoor/outdoor 8 lbs. 90% RH pH 5-9
6. LokDots dry adhesive: No visible moisture pH 12
7. LokWorx tabs: 10 lbs. 85 RH pH 12
8. Mill-applied ES: No visible moisture

ii. For EcoLogix (attached cushion): All, excluding LokDots and LokWorx.

iii. For StrataWorx (light weight tile alternative to broadloom)

1. Shaw 5000 pressure sensitive: 5 lbs. 85% RH pH 5-9
2. Shaw 5036 with antimicrobial: 5 lbs. 85% RH pH 5-9
3. Shaw 5800 for high moisture: 10 lbs. 95% RH pH 10

b. Primer (if needed): 9050 is an acrylic solution made to neutralize excess alkali that is also recommend as a primer coat to prevent over absorption of adhesive and to ensure a better bond. Formulated with an antimicrobial agent, it provides protection against bacteria, fungi, and mildew in the wet or dry state. Contains no solvent, alcohol, or other hazardous materials per OSHA 29 CFR 1910.1200. Non-photo chemically reactive per rule #102. Available in 4-gallon pails.

c. Leveling and Patching Compounds: Use a cementitious patching/leveling compound that meets or exceeds the required moisture level and pH requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi are acceptable.

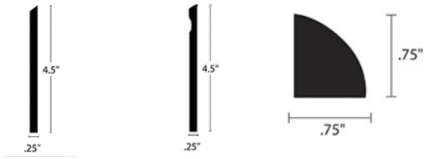
d. Transition Strips

e. Cove Base Accessories:

i. Angle Profile

ii. Detail Profile

iii. Quarter Round Profile



PART 3 – EXECUTION

12. EXAMINATION

a. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content, pH, smoothness and level.

b. If dusting or powdering exists, seal the floor with a latex primer such as Shaw 9050.

13. PREPARATION

a. Substrates shall be smooth, structurally sound, permanently dry, clean and free of all foreign material such as dust, wax, solvents, paint, grease, oils, old adhesive residue, curing and hardening/ curing compounds, sealers and other foreign material that might prevent adhesive bond.

b. Pre-existing Adhesive

i. Non-Active Multipurpose Adhesive: Remove ridges, sweep or vacuum debris.

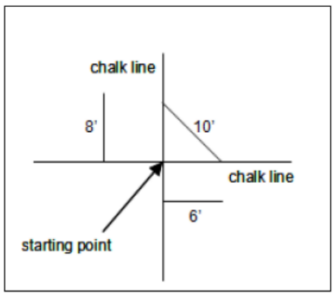
ii. Active Multipurpose Adhesive: Remove ridges then eliminate the adhesive tack with a product such as Shaw 6200.

iii. Pressure Sensitive Adhesive Affected by Plasticizer Migration: If the previous carpet tile had a PVC backing and the plasticizer in the backing has transferred to the adhesive, you must thoroughly remove adhesive by wet scrapping.

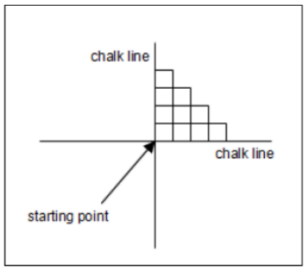
iv. Existing Pressure Sensitive Adhesive: Evaluate the tack level of the existing adhesive. If sufficient, the existing adhesive can be used to install Shaw's tile products. If insufficient, apply new adhesive over existing adhesive.
v. Active Cutback Adhesive: Wet scrape adhesive, reduce to a well-bonded residue and encapsulate with a product such as Shaw 9000.
vi. Non-active Cutback Adhesive: Wet scrape adhesive and reduce to a well-bonded residue.

c. Fill depressions or cracks with a cementitious patching/leveling compound that meets or exceeds the required moisture level and pH requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi are acceptable.
d. Flooring considerations:
    i. Installing over VCT and VAT: Tiles must be secure to the subfloor. Strip any wax from the surface.
    ii. Installing over wood subfloors: Prime with a liquid latex such as Shaw 9050.
    iii. Installing over raised access flooring: Must be smooth, level, secure and clean. Install carpet tile at an offset from panel seams. Gaps must not exceed 1/16" (1.6 mm).

14. LAYOUT AND INSTALLATION
    a. Start the tile installation as near to the center of the room as possible and position it to use the largest perimeter cut tile size.
    b. Snap a chalk line parallel to one major wall bisecting the starting point. It may be necessary to offset the center chalk line to assure perimeter tiles will be at least half size.
    c. Snap a second chalk line from the starting point at 90° to the first line. Use a 3-4-5, 6-8-10, or larger triangle depending on the room size. Meters or feet may be used to lay out the triangle in these proportions.



    d. Use a full spread of adhesive applied with a 3/8" foam paint roller or 1/16 x 1/32 x 5/64 u-notch trowel. The adhesive must be allowed to dry completely before installing the carpet. Installing into wet adhesive will result into a permanent bond and may cause the carpet to bubble. Trowel application of adhesive is recommended for EcoLogix. EcoWorx ES / EcoLogix ES no adhesive required. Approximate coverage rates are 35-40 yards per gallon when applied with a roller, and 28 -33* yards per gallon when applied with a trowel.
    e. Install each full carton and complete an entire pallet before starting another pallet to minimize product variation. Each tile has directional arrows on the back. These arrows allow for one-directional or multi-directional installation. Some styles may be large scale or linear in design and require quarter turning. If you are unsure about whether or not your product requires a quarter turned installation, please contact 1.877.502.7429. Numbers within the arrows are for manufacturing purposes and are not related to installation.



f. Begin installation at the intersection of two chalk lines. Continue until you complete one quadrant. Proceed to an adjoining quadrant until all four quadrants are completed. Larger areas may require chalk lines bisecting the original four quadrants.
g. Install tiles using the pyramid technique. This gives you multiple alignment checks. If the edges do not align and the misalignment increases with progression of the installation, find and correct the source of the problem.
h. Carpet tiles come in various sizes. All Shaw tiles have directional arrows on the back of the tile. Slide tiles into position to prevent yarn from being trapped between the tiles. Trapped yarn will adversely affect the appearance of the installation and will cause alignment problems.
i. EcoWorx ES /EcoLogix ES are manufactured with the adhesive already applied. Once the tile is ready to install, simply peel the liner from the back and position snugly to the adjacent tile.
j. Tiles must fit snugly, but not be compressed. Press the entire surface of the tile to ensure adhesion. Check for fit by measuring the length of ten full tiles after installation. The measurement must not be less than, or exceed by more than 1/4 inch, the length of the tiles being multiplied by ten. For example: if 24" X 24" tiles are being installed, the measurement should be between 240 and 240 1/4 inches.
k. Measure and cut tiles from the back using a straight edge. Be sure the arrows are pointing in the correct direction.
l. Roll the entire installation with a 75 lb. or greater roller to assure the proper adhesion to the substrate.

15. MAINTENANCE
    a. Post-installation Care
        i. Place plywood over the carpet when heavy objects will be moved within 24 hours after installation.
    b. Preventative Floor Care
        i. Use protective chair mats under chairs with casters.
        ii. Use soil removal mats at exterior entrances.
        iii. Use absorbent mats in areas where moisture, oil and grease are present.
    c. Routine Maintenance
        i. Set a schedule depending on traffic and vacuum regularly.
        ii. Remove spots with spot removers as soon as they occur.
        iii. Use encapsulation agents periodically.
        iv. Clean with hot water extraction periodically.

Traffic Level	Vacuum	Spot Removal	Interim Cleaning	Hot Water Extraction
Light	2/week	As needed	As needed	1/year
Moderate	1/day	As needed	As needed	1/year
Heavy	1/day	As needed	Monthly	4/year
Extra Heavy	1/day	As needed	Weekly	Monthly

END OF SECTION

SECTION 09 90 01
PAINTS AND COATINGS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.

B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available. Sherwin Williams Coatings listed at the end of this specification where used to establish the level of quality of the coating systems. The coating manufacturer shall match the colors identified in the finish schedule.

1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

1. Pre-finished items not to be painted include the following factory-finished components:

a. Acoustic materials.

b. Finished mechanical and electrical equipment.

c. Light fixtures.

d. Switchgear.

e. Distribution cabinets.

f. Plastic laminate wood doors.

g. Wood veneer doors

h. Metal lockers.

i. Plastic laminate covered architectural casework.

j. Wood veneer woodwork and casework.

k. Metal flashings.

l. Curtain wall system.

2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:

a. Furred areas.

b. Pipe spaces.

c. Ceiling plenums, with the following exception:

3. Finished metal surfaces not to be painted include:

a. Anodized aluminum.

b. Stainless steel.

c. Chromium plate.

d. Copper.

e. Bronze or brass.

4. Operating parts not to be painted include moving parts of operating equipment such as the following:

a. Valve and damper operators.

b. Linkages.

c. Sensing devices.

d. Motor and fan shafts.

5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 RELATED SECTIONS: The following items of related Work will be provided under other sections of the Specifications:

A. Section 01 35 45 - Sustainable Design Project Requirements.

B. Section 01 74 19 - Construction Waste Management

C. Section 05 12 00 - Structural Steel Framing: Shop Primed Items.

D. Section 05 21 00 - Steel Joist Framing: Shop Primed Items.

E. Section 05 50 00 - Metal Fabrications: Shop Primed Items.

F Section 05 51 00 - Metal Stairs: Shop Primed, Field Painted.

G. Section 08 12 14 - Standard Steel Frames: Shop Primed, Field Painted.

H. Section 08 13 14 - Standard Steel Doors: Shop Primed, Field Painted.

I. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

J. Section 23 05 53 - Identification for HVAC Piping and Equipment.

K. Section 26 05 53 - Identification for Electrical Systems.

L. Section 27 05 53 - Identification for Communication Systems.

M. Section 05 05 13 - Shop Applied Coatings for Metal

N. Section 06 01 40 - Architectural Woodwork Refinishing

O. Section 06 05 83 - Shop Applied Wood Coatings

P. Section 07 19 00 - Water Repellents.

Q. Section 09 67 00 - Fluid Applied Flooring for Concrete

R. Section 09 93 00 - Stains and Transparent Finishes

S. Section 09 96 00 - High-Performance Coatings

1.03 REFERENCES

A. SSPC-SP 1 - Solvent Cleaning

B. SSPC-SP 2 - Hand Tool Cleaning

C. SSPC-SP 3 - Power Tool Cleaning

D. SSPC-SP 13 / Nace No. 6 Surface Preparation for Concrete

E. EPA-Method 24

F. GS-11, GC-03

1.04 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Submit, in accordance with, Section 01 33 00 – Submittal Procedures.

C. Product Data: Manufacturer's technical information, label analysis, application instructions and MSDS sheets for each material proposed for use.

1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.

2. Provide Material Safety and Data Sheets on each product specified.

D. Samples: Upon selection of colors by the architect, submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1. On 12" x 12" hardboard, provide one sample of each paint color listed in the color schedule, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved. Samples shall be steeped to show primer, first coat, and second coat.

2. On actual wood surfaces, provide two 4" x 8" samples of stained wood finish.

3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples when requested by Architect. On at least 100 sq. ft. of surface as directed, provide full-coat finish samples until

required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work.

4. Do not proceed with painting until materials and finishes are approved by Architect.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of problems anticipated using the materials specified.

C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.

2. Federal Specifications establish a minimum quality level for paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.

3. Products that comply with qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to the Architect. Furnish material data and manufacturer's certificate of performance to Architect for proposed substitutions.

D. Interior coating type: Provide <u>interior</u> painting systems which are VOC compliant as per Green Seal Environmental Standard GS-11 for interior paint VOC thresholds:

1. Non-flat: VOC not more than 50 g/L.

2. Flat: VOC not more than 50 g/L.

E. Interior/Exterior coatings type: Provide <u>interior/exterior</u> coating systems which are VOC compliant as per Rule 1168 of the South Coast Air Quality Management District for coatings, primers, stains:

1. Primers, Sealers and Undercoaters: VOC not more than 200 g/L.

2. Clear Wood Finishes:

   a. Varnish: VOC not more than 350 g/L.

   b. Sanding Sealers: VOC not more than 350 g/L.

c. Lacquers: VOC not more than 275 g/L.

3. Stains, interior: VOC not more than 250 g/L.

4. Floor coatings: VOC not more than 100 g/L.

F. Exterior coating type: Provide exterior painting systems which are VOC compliant as per Green Seal Environmental Standard GS-11 for exterior paint VOC thresholds:

1. Non-flat: VOC not more than 200 g/L.

2. Flat: VOC not more than 100 g/L.

G. Interior/Exterior anti-corrosive and anti-rust coating types for ferrous metals: Provide interior/exterior painting systems for ferrous metals which are VOC compliant as per Green Seal Environmental Standard GC-03 for interior/exterior paint VOC thresholds:

1. Gloss: VOC not more than 250 g/L.

2. Semi-Gloss: VOC not more than 250 g/L.

3. Flat: VOC not more than 250 g/L.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.

2. Product description (generic classification or binder type).

3. Federal Specification number, if applicable.

4. Manufacturer's stock number and date of manufacture.

5. Contents by volume, for pigment and vehicle constituents.

6. Thinning instructions.

7. Application instructions.

8. Color name and number.

9. 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 (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. From freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.07 JOB CONDITIONS

A. Section 01 60 00 – Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint manufacturer.

C. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).

D. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).

E. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

F. Provide lighting level of 80 foot candle measured mid-height at substrate surface.

1.08 EXTRA MATERIAL

A. Provide one gallon of each different paint system, and color with manufacturers name and color clearly labeled on the top of each container.

1.09 PRE-PAINTING CONFERENCE

A. Prior to finish painting, exterior and interior, General Contractor shall schedule a "Pre-Painting Conference" to be attended by the Architect, Contractor, Painting Subcontractor and Manufacturer's Representative (Manufacturer's Rep. to attend when required for special finishes.)

B. Agenda to include submittal of color and finishes sample (RE: Article 1.04 "Submittals" and review of color schedule.

C. Contractor to record discussions of conference including agreements and/or disagreements and distribute a copy of record to each party in attendance.

PART 2 - PRODUCTS

2.01 SUBSTITUTION

A. Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MANUFACTURERS

A. Coating Manufacturer:

1. Sherwin-Williams (S-W).

a. Refer to "List of Finishes" located on the drawings for paint colors. Coating manufacturer shall computer match the colors selected.

B. Substitutions are permitted. Coating systems submitted from Benjamin Moore and Co. or Pratt and Lambert shall match the systems including VOC limits and ASTM numbers specified at the end of this section.

C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

1. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.

1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Refer to Section 01 31 00 – Project Management & Coordination

C. Refer to Section 01 73 00 - Execution

3.02 PREPARATION

A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.

2. 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 knob sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

b. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

c. When transparent finish is required, backprime with spar varnish.

d. Seal tops, bottoms, and cutouts of wood doors with a heavy coat of varnish or sealer immediately upon delivery.

3. Ferrous Metals: Clean non-galvanized 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 recommendations of the Steel Structures Painting Council.

a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Allow to weather a minimum of 6 months prior to coating. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner, then prime as required. When weathering is not possible or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 as necessary to remove these treatments.

5. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by solvent cleaning per SSPC-SP1, solvent cleaning.

6. Cementitious Materials: Prepare concrete, concrete masonry block, 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 where moisture content exceeds that permitted in manufacturer’s written instructions.

    c. Cementitious materials shall have cured for a minimum of 30 days prior to painting.

    d. Damaged areas shall be repaired using appropriate materials.

7. Drywall: Surface must be clean and dry. All nail or screw heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled fastener heads and tape joints must be sanded smooth and all dust removed prior to painting.

8. Previously coated surfaces: Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, rust, mold, mildew, mortar efflorescence and scalers. Glossy surfaces of old paint films shall be clean and dull before painting. Clean and dull surface either by washing with an abrasive cleaner, or by washing and sanding. Spot prime bare areas with appropriate primer. Check for compatibility by applying a test patch of the specified system, coating an area of 3 square feet. Allow to dry for one week before testing adhesion as per ASTM D3359. If coating is incompatible, prepare surface in conformance with ASTM D4259.

C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.

1. Maintain containers used in mixing and application of 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. Remove film and if necessary, strain material before using.

3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

3.03 APPLICATION

A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Non-zinc coated architectural metals, steel doors and steel frames shall have all coatings spray applied. Brush application is not acceptable.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

1. Paint colors, surface treatments, and finishes are indicated in "schedules."

2. Provide finish coats that are compatible with primers used.

3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.

4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.

10. Sand lightly between each succeeding enamel or varnish coat.

C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pre-treated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

F. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and 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 assure a finish coat with no burn through or other defects due to insufficient sealing.

G. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth 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.

H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

K. Stripple 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.

3.04 CLEANING

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.05 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates, as indicated:

B. Metals:

1. Ferrous Metal (Anti-Corrosive coating):

a. Sherwin Williams Acrolon 218 HS Polyurethane: 1 finish coat over primer on properly prepared surface:

b. Primer:

1) Sherwin-Williams Macropoxy 646 – One coat over prepared-cleaned surfaces

3. Stucco Surfaces and EIFS Substrates:

a. Primer:

1) Sherwin-Williams Loxon Concrete and Masonry Primer A24W8300 VOC: 97 g/L.

b. First and Second Coats:

1) Sherwin-Williams ConFlex XL High Build Elastomeric A05-450 Series (13.0 - 16.0 mils wet, 6.0 - 7.5 mils dry per coat)

4. Bollards

a. Primer:

1) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer B66W300 VOC: 97 g/L.

b. First and Second Coats:

1) Sherwin-Williams Pro Industrial Urethane Alkyd (Safety Yellow) B54-150 Series

5. Parking Striping/Curb Ramps

a. One Coat:

1) Sherwin-Williams Set Fast Acrylic Traffic Marking Paint (Yellow)

3.07 INTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates as indicated.

B. Drywall (walls and ceiling): Furnish sample on 2'x2' piece of drywall for architect to approve prior to application.

1. Gypsum Drywall Systems:

a. Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface:

b. Texture

1) USG Sheetrock Brand Wall and Ceiling Spray Texture (Multipurpose) (fine orange peel).

2) Texture Additive: Sheetrock Brand First Coat: Add at a rate of 1 gal. per bag of texture-substitute for 1 gal. of water.
VOC: 2 g/L.

c. Primer:

1) Sherwin-Williams Pro Mar 200 Zero VOC Primer B28W2600 (4 mils wet; 1.3 mils dry)
VOC: 43 g/L < 50 g/L

a. First and Second Coats:

1) Sherwin-Williams Pro Mar 200 Zero VOC Acrylic Semi-Gloss (B31W2600) (4 mils wet, 1.4 mils dry per coat).
VOC: 0 g/L < 50 g/L.

2. Gypsum Drywall Systems:

a. Egg-Shell Acrylic Enamel: 2 finish coats over primer on properly prepared surface:

b. Texture

1) USG Sheetrock Brand Wall and Ceiling Spray Texture (Multipurpose) (fine orange peel).

2) Texture Additive: Sheetrock Brand First Coat: Add at a rate of 1 gal. per bag of texture-substitute for 1 gal. of water.
VOC: 2 g/L.

c. Primer:

1) Sherwin-Williams Pro Mar 200 Zero VOC Primer B28W2600 (4 mils wet; 1.3 mils dry)
VOC: 43 g/L < 50 g/L

d. First and Second Coats:

1) Sherwin-Williams Pro Mar 200 Zero VOC Interior Latex Eg-Shel B20W2600 (4 mils wet, 1.7 mils dry per coat).
VOC: 41 g/L < 50 g/L.

C. Metals

1. Ferrous Metals:

a. Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface:

b. Primer:

1) Sherwin-Williams Pro-Cryl Universal Water Based Primer (B66-310 Series) (5.0-10.0 mils wet, 2.0-4.0 mils dry).
VOC: Unreduced 89 g/L < 250 g/L.

c. First and Second Coats:

1) Sherwin-Williams Pro Industrial 0 VOC Acrylic Semi-Gloss (B31 Series) (4 mils wet, 1.4 mils dry per coat).
VOC: 0 g/L < 50 g/L.

2. Zinc Coated Metals:

a. Semi-Gloss Acrylic Enamel: 2 coats on properly prepared surface:

b. Primer

1) Sherwin-Williams Pro-Cryl Universal Water Based Primer (B66-310 Series) (5.0-10.0 mils wet, 2.0-4.0 mils dry).
VOC: Unreduced 89 g/L < 250 g/L.

c. First and Second Coats:

1) Sherwin-Williams Pro Industrial 0 VOC Acrylic Semi-Gloss (B66 W611) (4 mils wet, 1.4 mils dry per coat).
VOC: 0 g/L < 50 g/L.

3. Ferrous Metal Handrails and Guardrails:

a. Handrails:

1) Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface.

2) Primer:

a) Sherwin-Williams Pro-Cryl Universal Water Based Primer (B66–310 Series) (5.0-10.0 mils wet, 2.0-4.0 mils dry). VOC: Unreduced 110 g/L < 200 g/L.

3) First and Second Coats:

a) Sherwin-Williams Pro Industrial 0 VOC Acrylic Semi-Gloss (B66W611) (4 mils wet, 1.4 mils dry per coat).
VOC: 0 g/L < 50 g/L.

D. Wood (Trim) Painted

1. Semi-Gloss Acrylic Enamel: 2 coats over primer on properly prepared surface: Verify all fasteners are set below the surface of the wood. Apply wood filler, compatible with paint, to all exposed indentations. Sand smooth.

2. Primer:

a. Sherwin-Williams Premium Wood and Wall Primer (B28W08111) (3 mils wet, 1.3 mils dry)

b. Sand prime coats with 220 grit sand paper.
VOC: 36 g/L < 200 g/L.

3. First and Second Coats:

a. Sherwin-Williams ProClassic Waterborne Acrylic Semi-Gloss (B31 Series) (4.0 mils wet, 1.4 mils dry per coat).
VOC: 144 g/L < 150 g/L.

E. Wood (Trim) Clear wood finish:

1. Polyurethane, Satin: 2 coats. Verify all fasteners are set below the surface of the wood. Apply wood filler to all exposed indentations. Sand smooth.

2. First and Second Coats:

a. Sherwin-Williams Wood Classics Waterborne Polyurethane Varnish (A68 Series) (3.2 -4 mils wet; 0.8-1.0 mils dry per coat)
VOC: Satin 309 g/L < 350 g/L.

F. Wood (Stained) with clear polyurethane varnish

1. Stain: One coat of MINWAX Low VOC Wood Finish. Stain color as selected by Architect. VOC: 250 g/L = 250 g/L.

2. First and Second Coats:

a. MinWax 250 Waterbased Varnish (3.2 -4 mils wet; 0.8-1.0 mils dry per coat) VOC: Satin 309 g/L < 350 g/L.

G. Exposed Concrete Floors and Curbs in HVAC rooms:

1. Waterbased Urethane Finish: 2 coats over primer on properly prepared surface with anti-slip additive. Prepare concrete surfaces in accordance with SSPC-SP13/NACE 6.

2. Primer:
   a. Sherwin-Williams ArmorSeal Water Based Epoxy Primer (B70AQ11, B60VQ11) (6.0-8.0 mils wet; 5.0-7.0 dry).
      VOC: <20 g/L < 200 g/L.

3. First and Second Coats:

   a. Sherwin-Williams ArmorSeal Armor-Plex Water Based Urethane (B65-750, B65V750), (3.5-5.0 mils wet, 2.0-3.0 mils dry per coat).

   b. Anti-slip additive: H&C SharkGrip added to the coating.
      VOC: Unreduced < 50 g/L < 150 g/L.

H. Masonry

1. Concrete Masonry Units:

   a. Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface:

   b. Primer:

      1) Sherwin-Williams PrepRite Block Filler (B25W25) (16 mils wet, 8 mils dry) VOC: 45 g/L.

   c. First and Second Coats:

      1) Sherwin-Williams ProClassic Waterborne Acrylic Semi-Gloss (B31 Series) (4 mils wet, 1.4 mils dry per coat).
         VOC: 144 g/L < 150 g/L.

3.08 CONSTRUCTION WASTE

A. Comply with Section 01 74 19-Construction Waste for management for reuse, salvage or recycle non-hazardous waste material.

3.09 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 10 14 00
SIGNAGE

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Signage Work, as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Building Identification Signage.

2. Entrances Door Signage.

3. Interior-Room Identification Signage.

4. Barrier Free Signs.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Cast-In-Place Concrete Work - Section 03 30 00.

2. Unit Structural Masonry - Section 04 23 00.

3. Finish Carpentry - Section 06 20 00.

4. Aluminum Framed Entrance and Storefronts - Section 08 41 13.

5. Paints and Coatings - Section 09 90 00.

6. Toilet Compartments - Section 10 21 13.

1.02 REFERENCE SPECIFICATIONS, CODES, AND APPLICABLE STANDARDS

A. Requirements of Regulatory Agencies: Furnish all signs in accordance with the laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

1.03 QUALITY ASSURANCE

A. General: All materials, articles, accessories incorporated in the Work shall be type and quality specified herein, and subject to the Architect's review. Methods of preparation, construction and installation of such materials, articles and accessories shall be strictly in accordance with the accepted standard practices, manufacturer's printed specifications and/or instructions, the Architect's Drawings and Specifications, and as directed by the Architect.

B. Single Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

C. Design Criteria: The Drawings indicate size, profiles, dimensional requirements and graphics layout of signs and are based on the specific type and/or model indicated. Signs by other manufacturers may be considered provided that 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.

1.04 SUBMITTALS

A. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

B. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

C. Shop Drawings: Prepare and submit fully detailed drawings of all items specified herein.

D. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

E. Samples: Submit 4" x 4" color Samples on materials to be used for fabrication. Written approval shall be secured from the Architect. Installed materials shall match approved Samples.

1.05 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes, and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Materials shall be stored at the site off the ground and in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 BUILDING IDENTIFICATION SIGNAGE

A. Manufacturer: Signage specified herein shall be as manufactured by Allen Markings, 1130 Elmwood Avenue, Kansas City, MO 64127, (816)842-0963, (800)825-0150; www.allendiv.com, or other comparable manufacturer and equivalent product subject to review by the Architect.

B. General: Provide complete and coordinated signage with maximum flexibility and use of manufacturer's standards. Design effect shall maintain overall continuity of color, letter style, and shape as specified herein.

C. Graphic System: Allenite-Architectural Sign Systems, "System 1700 - Vinyl Lettered Signs & Vinyl Letters", computer-cut, pressure sensitive and pre-spaced strips. System shall be forward or reverse cut as selected by the Architect.

1. Sign Address Numbers or Letters: 4" high (unless otherwise directed by local authorities), "Helvetica Medium" Style; as noted on drawings.

2. Colors: As selected by Owner and to comply with the Texas Accessibility Standards.

3. Mounting: Pressure sensitive material with manufacturer's adhesive.

4. Address Numbers: Suitable for mounting above building's aluminum front entrance doors.

D. Exterior Signs Required: Sign titles and quantities include, but are not necessarily limited to the following.

1. Building Fronts: Addresses as required by the Fire Marshall.
2. As noted on the drawings.

2.03 ALUMINUM/GLASS ENTRANCE DOOR SIGNAGE

A. Manufacturer: Allen Markings, 1130 Elmwood Avenue, Kansas City, MO 64127, (816)842-0963, (800)825-0150; www.allendiv.com, or other comparable manufacturer and equivalent products subject to review by the Architect.

B. Graphic System: Allenite-Architectural Sign Systems, “System 1700 - Vinyl Lettered Signs & Vinyl Letters”, computer-cut, pressure sensitive and pre-spaced strips.

C. Door Signage:

1. International Symbol of Accessibility Signs: 3" square, contrasting blue background and white graphics, with matte non-glare finish.

2. Egress Signage: Each storefront door sign shall have “Helvetica Medium Style” white letters not less than 1 inch high on a contrasting black background.
   a. Wording: Sign shall read “THIS DOOR MUST REMAIN UNLOCKED DURING NORMAL BUSINESS HOURS”.

2.04 INTERIOR-ROOM IDENTIFICATION SIGNAGE

A. Manufacturer: Signage specified herein shall be signs as manufactured by Innerface Architectural Signage, Inc., 5320 Webb Parkway, Lilburn, GA 30247, (770)921-5566, **www.interface-signage.com.**

B. Comparable Products: Manufacturers with comparable equivalent signage may be acceptable, subject to conformance with these Specifications and review by the Architect and/or Owner.

C. Sign Type: Engraved Plate Signage. Signs shall be Plaque Modules, suitable for wall mounting or hung from the ceiling. Verify mounting condition and location with Tenant.

1. Construction: Signs shall have raised graphic symbols and letters and ADA-compliant Grade 2 Braille as an integral part of the material. Signs shall be contrasting two-color, scratch-resistant, non-static, fire-retardant, washable material with a non-glare matte finish surface, unframed, with finished edges and round corners.

2. Colors: Royal Blue background with White lettering. Color to be verified with Tenant.

3. Sizing: For “bidding purposes”, verify final size with Tenant.

4. Room Signs: 7" x 7", module 4.0 with insert.

5. Mounting: Factory prepared with 1/16" thick vinyl foam tape or mounting holes for use with mechanical fasteners, subject to review by the Architect and/or Owner. General area signs may be hung from ceiling as determined by Tenant.

D. Room Signs Required: Sign titles and quantities include but are not necessarily limited to the following. Verify final number of signs, titles, and room numbers with the Tenant.

1. Classroom (4 required).

2. IT Room (1 required).

3. Riser Room (1 required).

4. Server Room (1 required).

5. Computer Lab (1 required).

6. Laboratory (1 required).

7. Storage (2 required).

8. Electrical Room (2 required).

9. Prep Room (1 required).

10. Boys Restroom (1 required)..

11. Girls Restroom (1 required).

12. Janitors Closet (1 required).

13. First Aid (1 required).

14. Nurse (1 required).

15. Conference Room (1 required).

16. Women’s Restroom (1 required).

17. Men’s Restroom (1 required).

18. Family Restroom (1 required).

19. Office (5 required)

20. Work Room (1 required)

21. Special Education (1 required)

22. Reception (1 required)

23. Lobby (1 required)

24. Breakroom (1 required)

25. Kitchen (1 required)

E. Lettering Style: Raised 1/32 inch upper case Helvetica medium

F. Accessibility Requirements: Facilities and elements required to be identified as accessible shall include the International Symbol of Accessibility pictogram with verbal description, and Grade 2 Braille. Signage shall comply with applicable provisions of Title III of ADA, Article 4.30 within Appendix A to Part 36 of 28 CFR. Field area size shall be in accordance with governing code requirements for accessibility and use by persons with disabilities.

2.05 BARRIER FREE SIGNS

A. Manufacturer: Signage specified herein shall be as manufactured by Seton Identification Products, 20 Thompson Road, P.O. Box 819, Branford, CT 06405-0819, (800)571-2596 or (203)488-8059; www.seton.com.

B. Comparable Products: Comparable equivalent signage by the following company or other comparable manufacturer's product may be acceptable, subject to conformance with these Specifications and the Architect's review.

1. Allen Markings, 1130 Elmwwod Avenue, Kansas City, MO 64127, (816)842-0963 or (800)825-0150; www.allendiv.com.

C. Decal Signs: Barrier free signs at toilet partitions designated for individuals with a disability shall be Seton "Handicap Symbol Decal", Item #35839, tear-resistant, self-adhesive vinyl single sided decal.

1. Graphics: International Symbol Accessibility sign shall have contrasting blue background and white graphics, with matte non-glare finish.

2. Size: 4" x 4".

2.06 VINYL LETTERED SIGNAGE

A. Manufacturer: Allen Markings, 1130 Elmwood Avenue, Kansas City, MO 64127, (816)842-0963, (800)825-0150; www.allendiv.com, or other comparable manufacturer and equivalent products subject to review by the Architect.
   - Refer Interior Elevations and Construction Documents for additional vinyl signage to be applied at the front door for Hours of Operation, etc.

B. Graphic System: Allenite-Architectural Sign Systems, “System 1700 - Vinyl Lettered Signs & Vinyl Letters”, computer-cut, pressure sensitive adhesive and pre-spaced strips.

C. Front Doors:

   1. Letters: 2" high, for Hours of Operation. Refer drawings. Coordinate color and locations with the tenant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 – Execution

3.02 INSTALLATION

A. General: Furnish and install products as shown on the Drawings and specified herein. Special attention shall be given to, but not necessarily limited to the following:

   1. Exterior Building Identification Signage: Install signs as indicated and/or shown on the Drawings.

   2. Aluminum/Glass Entrance Door Signage: All accessible public entrance doors shall be provided with “International Symbol of Accessibility Signs” and “Egress Signage” as specified herein.

      a. International Symbol of Accessibility Signs: Graphics shall be readable from exterior side of door.

      b. Egress Signage: Apply signage so that wording is readable from interior face side of storefront door.

c. Surface Conditions: Apply signage on clean surfaces, flat and smooth without ripples or air bubbles.

d. Compliance with Local Authorities: Signage shall be located as required by local authorities.

3. Interior-Room Identification Signage: Install signs as indicated and/or shown on the Drawings.

4. Barrier Free Signs: Install signs for toilet compartment/partition stall doors where indicated on the Drawings for individuals with a disability.

5. General Area Sign: Install signs in locations as directed by Tenant.

6. Vinyl Lettered Signage: Install numbers and letters in locations as directed by Tenant.

B. Accessory Materials: Provide all accessory materials required and necessary for complete and finished installations.

C. ADA Accessibility Guidelines: Signage required to be with accessible designation shall comply with “Mounting Location and Height” specified within the provisions of Article 4.30 of the ADA Accessibility Guidelines.

D. Protection: Protective covers provided by the manufacturer to protect the finishes shall not be removed until final cleaning.

3.03 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

1. Coordinate color and locations with the tenant.

END OF SECTION

SECTION 10 21 13.13
FLOOR MOUNTED TOILET PARTITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
Furnish, deliver and install all Toilet Partitions as indicated on the drawings and as required by actual conditions at the building. The Toilet Partitions shall include the furnishing of all necessary screws, special screws, bolts, special bolts, expansion shields and all other devices necessary for the proper installation and application of the Toilet Partitions.

B. Related Sections
Section: 10500 Lockers
Section: 10800 Washroom Accessories

1.02 REFERENCES

A. Standard
All Toilet Partitions must be scheduled, supplied and installed in accordance with: Local Building Code, CGSB (Canadian Government Specifications Board), CSA (Canadian Standards Association), ANSI (American National Standards Institute), ADA (Americans with Disabilities Act). In all cases the above references shall be taken to mean the latest edition of that particular standard including all revisions.

1.03 SUBMITTALS

A. General Requirements
Make all submittals in accordance with Section: 01 30 00

B. Schedules
1. Submit (4) copies of detailed shop drawings and in PDF Format for the Consultant's/Owner's review within (2) weeks of being awarded this subcontract.

C. Product Data
1. Submit (2) copies of product sheets and/or catalogue cuts and in PDF format, of all products listed in the shop drawings.

D. Samples

1. Upon request, a returnable sample of the Toilet Partitions shall be submitted to the Consultant/Owner for approval not later than (10) days after requested. All samples must be properly identified including: name of supplier, and name of manufacturer.

E. Operations and Maintenance Data

1. At completion of the job, furnish to the owner (2) copies of an Owners Operation and Maintenance Manual. The Manual shall consist of a hard cover three ring binder with the project name in the front. Include in the manual the following information: Maintenance instructions, Catalogue pages for each product, Name/Address and phone number of the Manufacturer and their Sales Agent, Copy of the final shop drawings.

1.04 QUALITY ASSURANCE

A. Substitutions

1. Manufacturers and model number listed are to establish a standard of quality. Similar items by approved manufacturers that are equal in design, function, quality and finish may be accepted upon prior written approval from the Architect/Owner.

2. All requests for acceptable substitutions must be made in writing and submitted to the Architect at least 14 days prior to tender closing. If requested, all requests for substitutions must be accompanied by product literature and actual product samples.

B. Supplier Qualifications

1. Toilet Partition shop drawings and Toilet Partitions shall be procured from a source of supply approved by the Consultant/Owner/Architect. Supplier is responsible for the complete Toilet Partition subcontract.

1.05 DELIVERY, STORAGE AND HANDLING

A. Marking and Packaging

1. Toilet Partitions must be delivered to the job site in the manufacturers' original packages and marked to correspond with the approved shop drawings.

B. Delivery

1. Toilet Partitions must be delivered in an amount of time deemed appropriate by the Consultant/Owner.

1.06 WARRANTY

A. Written Guarantee

1. The Toilet Partition manufacturer shall guarantee all Toilet Partitions by written certification, for a period of (3) years from date of receipt by customer, against any defects in design, materials and workmanship.

1.07 MAINTENANCE

A. Maintenance

1. Upon request, at completion of the project, the Toilet Partition supplier may be required to brief Owner's maintenance staff regarding proper care of Toilet Partitions, such as: required lubrications, adjustments, cleaning, etc...

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers

Only those manufacturers names and product numbers listed herein, are approved for use on this project. All other manufacturers must request approval as per section (1.04 - A - Substitutions). Absolutely no variations from listed and pre-approved items will be permitted.

Approved manufacturer(s):
1. Hadrian Manufacturing, Inc.

2.02 MATERIALS

A. Construction: Doors, Panels and Pilasters shall be constructed of two sheets of panel flatness zinc-coated steel, Galvanneal ASTM A653 GR33, laminated under pressure to a honeycomb core for sound deadening and rigidity. Formed edges to be welded together and inter-locked under tension with a roll-formed oval crown locking bar, mit14red, welded and ground smooth at the corners. Honeycomb to have a maximum 25mm (1") cell size.

B. Doors: Shall be 25mm (1") thick with cover sheets not less than 22-gauge (0.8mm).

C. Panels: Shall be 25mm (1") thick with cover sheets not less than 22-gauge (0.8mm).

D. Pilasters: Shall be 32mm (1.25") thick with cover sheets not less than 18-gauge (1.2mm).

E. Hardware and Fittings: All panel and pilaster brackets and all door hardware shall be chrome plated zinc die castings. Fasteners are zinc plated 12 x 1-3/4” and 12 x 5/8” TR-27 6-lobe security screws. Doors shall be equipped with a gravity type hinge mounted on the lower pilaster hinge bracket. Door hinges shall be fully concealed within the thickness of the door and adjustable to permit the door to come to rest at any position when not latched. Each door to be fitted with a combined coat hook and bumper and a concealed latch, with face mortised flush with edge strip of door. Barrier-free doors shall include thumbturn lever to activate latch without fingertip grip application. Both standard and barrier-free latches shall have a turn slot designed to allow emergency access from exterior. The combined stop and keeper shall have a 19mm (0.75") diameter bumper locked in place. Threaded upper hinge pin shall have a metal core and self-lubricating nylon sleeve to ensure smooth, quiet operation. Pilaster shoes shall be a welded one-piece design made from polished stainless steel. Two-piece shoes that can disassemble when kicked are unacceptable.

2.03 FINISH

A. All sheet metal to be thoroughly cleaned, phosphated and finished with a high-performance powder coating, electrostatically applied and oven cured to provide a uniform, smooth protective finish. Color shall be as selected from Hadrian’s color card.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Preparation
1. The contractor must examine all site conditions that would prevent the proper application and installation of Toilet Partitions. Any defect must be immediately identified and corrected, prior to the installation of the Toilet Partitions.

3.02 INSTALLATION

A. Mounting Locations
1. All Toilet Partitions must be mounted according to Manufacturers standard locations and those specified on the drawings.

3.03 FIELD QUALITY CONTROL

A. Inspection
1. After installation has been completed, provide for a site inspection of all Toilet Partitions to determine that all items have been supplied and installed as per the enclosed details. Also, check the operation and adjustment of all Toilet Partitions. Any discrepancies, or malfunctioning product, must be reported to the Architect immediately.

3.04 ADJUSTMENT AND CLEANING

A. Final Preparation
1. At final completion, Toilet Partitions shall be left clean and free from disfigurement. Make all final adjustments. Where Toilet Partitions are found defective, repair or replace or otherwise correct as directed.

3.05 PROTECTION

A. Site Protection
1. The Contractor must provide for the proper protection of all Toilet Partitions until the owner accepts the project as complete.

3.06 TOILET PARTITION SCHEDULE

A. Schedule
1. Provide Toilet Partitions as specified in all above sections and as per the detailed Architectural Drawings.

END OF DOCUMENT

SECTION 10 28 13
TOILET ACCESSORIES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide Toilet Accessories Work as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Grab Bars.
2. Tissue Dispenser.
3. Framed Mirrors.
4. Sanitary Napkin/Tampon Dispensers.
5. Sanitary Napkin Disposals.
6. Electric Hand Dryer
7. Wall Mounted Recessed Soap Dispensers.
8. Counter Mounted Soap Dispensers.
9. Paper Towel Dispenser and Waste Receptacle Units.
10. Disposable Seat Cover Dispensers.
11. Insulation Kits for Lavatories with Exposed Piping.
12. Mop – Hook.
13. Diaper Changing Station
14. Clothes/Towel Hook.
15. Shower Compartment Seat.
16. Shower Curtain and Rod.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Rough Carpentry - Section 06 10 00.

2. Finish Carpentry - Section 06 20 00.

3. Gypsum Wallboard - Section 09 29 00.

4. Thin-Set Tile Work - Section 09 31 00.

5. Solid Plastic Toilet Compartments - Section 10 21 16.

1.02 REFERENCE SPECIFICATIONS, CODES, AND APPLICABLE STANDARDS

A. Requirements of Regulatory Agencies: Furnish toilet accessories in accordance with laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans With Disabilities Act (ADA), Public Law 101-336 and the Texas Accessibility Standards.

1.03 QUALITY ASSURANCE

A. Heavy Duty Construction: Provide where applicable, product and material accommodations with reinforcements suitable for obesity clinic patients weighing 400 pounds.

1.04 SUBMITTALS

A. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Shop Drawings: Submit fully detailed layout and setting drawings, illustrative plates or drawings, and Supplementary Shop Drawings of all items.

C. Samples: Submit 4" x 4" Samples of colors and/or finishes specified herein, for approval PRIOR to installation. Written approval shall be secured from the Architect, and installed materials shall match approved Samples.

1.05 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes, crates, and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Materials shall be stored at the site, off the ground in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Lead Time: When phenolic and plastic laminated products are specified, allow not less than six (6) weeks lead time.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and any damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

B. Stainless Steel Framed Mirrors: In addition to the above warranty, the stainless steel framed mirror manufacturer shall provide industry standard of not less than a fifteen (15) year written guarantee against glass mirror silver spoilage.

PART 2 - PRODUCTS

2.01 TOILET ROOM ACCESSORIES - GENERAL

A. Manufacturer: Unless otherwise noted, items specified herein represent commercial quality products manufactured by the following manufacturer, and illustrate the type, function, size, operation, material, finish and constructions required.

1. Bobrick Washroom Equipment, Inc., 11611 Hart Street, North Hollywood, CA 91605-5882, (800)553-1600, (818)982-9600 or (818)764-1000; ww.bobrick.com.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

C. Material and Finish: Unless otherwise specified, all items shall be of Type 304 stainless steel with satin finish.

D. Supplementary Hardware: Furnish each item complete with non-corrosive fasteners, anchorage, trim, and back-up plates as required for securing to walls (masonry and/or drywall). Furnish all incidental parts.

E. Fasteners: Provide vandal-resistant fasteners wherever exposed fasteners are required.

F. Locks: Toilet room accessories equipped with tumbler locks shall be keyed alike with all other locked toilet room accessories, with the exception of coin boxes in vending equipment. All tumbler locks shall be fastened to accessories with lock nuts. Fastening locks to units with spring clips is not acceptable.

G. Product Identification Labels: Products shall have either a printed waterproof label or stamped nameplate indicating manufacturer's name and product model number. Identification labels shall not be on the exposed finish surface of the product.

2.02 TOILET ROOM ACCESSORIES

A. Grab Bars: BOBRICK 5806 (Refer to dwgs for length required) 1-1/2" diameter, knurled finish, concealed mounting.

B. Toilet Paper Dispensers: Owner Provided, Contractor Installed.

C. Wall mounted Framed Mirrors: Bobrick B-165 series, stainless steel, framed. (Refer to dwgs for required sizes).

D. Sanitary Napkin/Tampon Dispensers: Refer drawings for mounting heights. Owner Provided.

E. Surface-mounted Sanitary Napkin Disposals: Bobrick Contura Series B-270

F. Soap Dispensers: Mounted Soap Dispenser Model #B-822.

G. Paper Towel Dispensers. Refer drawings for mounting heights. Owner Provided, Contractor Installed.

H. Waste Receptacle Units. Refer drawings for mounting heights. Owner Provided.

I. Toilet Seat Cover Dispensers: All welded construction. Dispensers shall be suitable for dispensing standard single-fold or half-fold paper toilet seat covers from beveled opening.

1. Surface-Mounted Dispensers: Bobrick model B-221

J. Surface-Mounted Dryer: Saniflow Machflow Model No.: M09-UL and KT009CS ADA Recessed Kit.

K. Vertical Wall-Mounted Baby changing station: Bobrick model KB101-00.

L. Insulation Kits: Lavatories with exposed piping shall be provided with Protective Undersink Piping Covers, specified herein, complete with all accessories required and as required by TAS. Comparable equivalent manufacturer's product, subject to review by the Architect.

1. Manufacturer: IPS® Corporation, 500 Distribution Parkway, Collierville, TN 38017, (800)888-8312 or (901)853-5001; www.truebro.com.

2. Undersink Protective Pipe Covers: ADA-compliant (Article 4.19.4), wheelchair accessible lavatory P-trap and angle valve assemblies shall be covered with molded vinyl, antimicrobial. TRUEBRO® - LAV GUARD® 2 E-Z Series waste and supply piping undersink pipe covers. Cover shall have internal trim feature for square and clean trimming, internal rib fasteners, and built-in, concealed fasteners (cable-tie fasteners shall not be permitted).

   a. Material: Soft, resilient molded vinyl.

   b. Nominal Wall: 1/8" constant with internal ribs.

   c. Trimming (E-Z Series): Internal E-Z Tear-To-Fit trim feature for installation without tools.

   d. Fasteners (E-Z Series): Internal E-Z Grip fasteners, reusable.

   e. Paintability: Material shall be paintable with latex paint where required by Drawings and/or field conditions to match adjacent material colors.

   f. Burning Characteristics: Self extinguished 0 sec (ATB) mm (AEB), in accordance with ASTM D635 - Standard Test Methodd for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

   g. Bacteria/Fungus Resistance: In accordance with ASTM G21 - Standard Practice for Determing Resistance of Synthethic Polymeric Materials to Fungi. Result: 0 growth.

   h. Color: Manufacturer's standard "China White", subject to approval by the Tenant, Architect and/or Owner.

3. Compatibility: Contractor shall coordinate with Plumbing Contractor for compatible complete design kit series required to fit piping assemblies.

M. Mop Hangers/Hook: Bobrick Stainless steel, 48 inches long with 4 holder. Mop-Broom Holder Model No. B-223.

N. Paper Tower Dispensers (for break room area and kitchen): Bobrick Classic Series Surface Mounted Paper Towel Dispenser, Model No. B-262

P. Coat Hook with Bumper: Bobrick Model No. B-212

Q. Towel Pin: Bright-polished stainless steel Towel Pin Bobrick B-677.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSPECTION

A. Check wall openings for dimensions, plumbness of blocking or frames that would affect installation of recessed accessories. For surface mounted accessories check condition of wall and confirm installation of backing within wall.

B. Verify spacing of plumbing fixtures and toilet compartments that affect installation of toilet room accessories.

3.03 INSTALLATION

A. General:

1. Comply with ADA and code requirements for facilities for individuals with a disability. Should governing code requirements differ from any specified herein, the more stringent requirement shall be met.

2. Protective covers installed by manufacturers to protect the finishes, shall not be removed until final cleaning.

B. Locations and Methods of Installation: Install accessories at locations and heights indicated on the Drawings, straight, plumb and level and in accordance with manufacturer's installation instructions. Install items with non-corrosive anchoring devices. Installation methods shall conform to manufacturer's recommendations for backing and proper support. Conceal evidence of drilling, cutting, and fitting to room finish. Fit flanges of accessories snugly to wall surfaces.

C. Grab Bars: Mount grab bars to walls and partitions with supplied flanges and fasteners. Installed grab bars shall be anchored so as to withstand a force of not less than 300 pounds for five (5) minutes in any direction.

D. Lavatory Insulation Kits: Install on exposed piping at each lavatory.

3.04 FIELD INSPECTION

A. Toilet Room Accessories: Engage the services of the approved manufacturer's inspection service, to inspect the installation of all Toilet Room accessories specified herein, and report any installation adjustments required to place all accessories in perfect working order, at no cost to the Owner.

3.05 MAINTENANCE INSTRUCTIONS

A. Furnish the Owner with all manufacturer's printed data, including service and parts manual, necessary for proper cleaning and maintenance of the products specified herein.

3.06 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Fire Protection Specialties Work, as indicated on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Portable Fire Extinguishers and Accessories.

1.02 REFERENCE SPECIFICATIONS, CODES, AND APPLICABLE STANDARDS

A. Requirements of Regulatory Agencies: Furnish miscellaneous accessories in accordance with laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

1.03 QUALITY ASSURANCE

A. General: All materials, articles, accessories incorporated in the Work shall be type and quality specified herein, and subject to the Architect’s review. Methods of preparation, construction and installation of such materials, articles and accessories shall be strictly in accordance with the accepted standard practices, manufacturer’s printed specifications and/or instructions, the rchitect’s Drawings and Specifications, and as directed by the Architect.

B. UL-Listed Products: Fire extinguishers shall meet Underwriters Laboratories Inc., UL 299 UL Standard for Safety Dry Chemical Fire Extinguishers.

1.04 SUBMITTALS

A. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

B. General: Submit Shop Drawings, Product Data and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

C. Shop Drawings: Submit fully detailed layout and setting drawings, illustrative plates or drawings, and Supplementary Shop Drawings of all items.

D. Samples: Submit 4" x 4" Samples of fire extinguisher cabinets colors and/or finishes specified herein, for approval PRIOR to installation. Written approval shall be secured from the Architect, and installed materials shall match approved Samples.

1.05 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes, crates, and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Materials shall be stored at the site, off the ground in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and any damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

B. Fire Extinguishers: In addition to the above warranty, the fire extinguisher manufacturer shall provide industry standard of not less than a six (6) year written warranty covering materials and workmanship, at no charge to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer: Fire Extinguishers and Accessories and Fire Extinguisher Cabinets specified herein shall be as manufactured by Larsen's® Manufacturing Company, 7421 Commerce Lane N.E., Minneapolis, MN 55432, (763)571-1181 or (800)527-7367; www.larsensmfg.com.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 PORTABLE FIRE EXTINGUISHERS

A. Fire Extinguishers: Larsen's®, HT Series, Halotron I, Model Number HT11 extinguishers.

1. Type: Extinguishers as specified herein shall be portable, hand-carried type, pressurized EPA approved clean agent fire extinguishers, 5-pound nominal capacity, with self-closing hand valve, discharge hose, pressure gauge, in manufacturer's standard container with corrosion and impact resistant polyester/epoxy "red" paint finish. UL Rating 4A-80B: C for Class A, B, and C fires. Units shall contain Halotran I.

2. Miscellaneous Requirements: Furnish test, refill schedules, procedures, and recertification requirements in accordance with National Fire Protection Association, NFPA 10 - Standard for Portable Fire Extinguishers, latest edition.

B. Fire Marshal's Approval: Size, type, and quantities of fire extinguishers as indicated on the Drawings and/or specified herein shall be subject to review and approval by the Fire Marshal.

C. Accessories:

1. Mounting Brackets: Provide manufacturer's recommended and compatible standard mounting extinguisher brackets and anchors. Brackets shall be of size and design to accommodate the accepted manufacturer's fire extinguishers.

2. Signage: Provide signs identifying the locations of fire extinguishers as required by local authorities.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSTALLATION

A. General: Provide products specified herein for installations, as indicated on the Drawings or required.

1. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

2. Comply with ADA and code requirements for facilities for individuals with a disability. Should governing code requirements differ from any specified herein, the more stringent requirement shall be met.

3. Fire extinguisher cabinets and mounting brackets for wall hung fire extinguishers shall be securely fastened to structure, square and plumb, and in compliance with manufacturer's instructions.

4. Protective covers installed by manufacturers to protect the finishes, shall not be removed until final cleaning.

B. Fire Extinguishers: Provide portable fire extinguishers for wall mounted installations on mounting brackets, in quantities as required by the Fire Marshal.

1. General: Install fire extinguishers and identifying signs in accordance with local authorities, ADA guidelines, and manufacturer's recommendations, at locations designated by the Fire Marshal.

2. Inspection: Verify servicing, charging and tagging of all fire extinguishers.

3.03 MAINTENANCE INSTRUCTIONS

A. Furnish the Owner with all manufacturer's printed data, including service and parts manual, necessary for proper maintenance of the products specified herein.

3.04 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 12 32 00
MANUFACTURED WOOD CASEWORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Prefabricated Cabinet Work, as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Base Cabinets.

2. Wall Cabinets.

B. Related Sections: The following items of related Work will be provided for under other sections of the Specifications, as indicated:

1. Finish Carpentry - Section 06 20 00.

2. Resilient Wall Bases - Section 09 65 13.

3. Plastic Laminate-Clad Countertops - Section 12 36 23.13.

4. Plumbing Fixtures - Division 22.

1.02 CODES, REFERENCE SPECIFICATIONS, AND APPLICABLE STANDARDS

A. Codes and Reference Specifications: Except as otherwise specified herein, materials and workmanship shall conform to applicable Local Building Codes and Ordinances.

B. Requirements of Regulatory Agencies: Prefabricated cabinets shall comply with the laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

1.03 QUALITY ASSURANCE

A. NKCA Certification: Provide prefabricated cabinets with Kitchen Cabinet Manufacturers Association (KCMA), 1899 Preston White Drive, Reston, VA, 20191-5435, (703)264-1690, “Certified Cabinet” seal affixed in a semi-concealed location of each unit, evidencing compliance with American National Standards Institute (ANSI) ANSI/KCMA A161.1.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSCAccredited Certification Body.

1.04 SUBMITTALS

A. General: Submit Shop Drawings, Product Data and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. Shop Drawings: Submit Shop Drawings to the Architect for review, indicating location and specifically calling out each cabinet nomenclature and size of each type of cabinet, accessories, materials, finishes, hardware types and locations, and fillers. Include fully dimensioned floor plans and elevations for the cabinets and indicate details of anchorage required for countertop and to walls.

D. Product Data: Submit manufacturer's technical product data and installation instructions indicating materials, hardware, and finishes used in fabrication of prefabricated cabinets, as required to show compliance with Specifications.

E. Samples: Submit to the Architect, fully finished Samples of the following items required for prefabricated cabinets:

1. Provide Samples with manufacturer's range of interior and exterior finishes and colors for selection and/or review by the Architect.

2. Exposed hardware, one (1) unit of each type of manufacturer's standard and finish.

1.05 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes, crates, and wrappings, clearly labeled with all pertinent information, to facilitate checking.

B. Storage: Materials shall be stored at the site off the ground in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 SUBSTITUTION:

A. Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 PREFABRICATED CABINETS

A. Manufacturer: Prefabricated cabinets and accessories specified herein shall be as manufactured by Merillat Industries, LLC, 5353 W. US 223, P.O. Box 1946, Adrian, MI 49221, (517)263-0771.

1. Product Line and Style: Merillat Classic™.

2. Door Style: Spring Valley Square, verify with Owner and/or Tenant.

3. Finish: Refer to ROOM FINISH SCHEDULE & INTERIOR ELEVATION sheets for Plastic Laminate or other approved surface finishes.

B. Comparable Products: Prefabricated cabinets such as manufactured by the following manufacturer may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review.

1. KraftMaid Cabinetry, Inc., P.O. Box 1055, 15535 South State Ave., Middlefield, OH 44062, (440)632-5333 or (888)562-7744.

2. LaFata Cabinets, 50905 Hayes Road, Shelby Twp., MI 48315, (800)523-2821 or (586)247-1140.

C. Sizes and Types: Cabinet sizes and types as identified and noted on the Drawings shall be as required to meet configurations indicated, and shall include where/if required special cabinets with design in accordance with the governing code requirements for facilities for the handicapped.

D. Miscellaneous Materials: Furnish cabinets complete with hardware, fasteners, anchorage, trim, and back-up plates as required for securing to walls (masonry and/or drywall). Furnish all other incidental parts.

2.03 BASIC MATERIALS

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSCaccredited certification body to comply with FSC STD-01-001, ‘FSC Principles and Criteria for Forest Stewardship”.

B. Low-Emitting Materials: Fabricate manufactured wood casework, including countertops, with adhesives and composite wood products containing no urea formaldehyde.

C. Particleboard: ANSI A208.1 mat-formed particleboard, Industrial Grade with minimum density of 45 lbs. per cu. ft. (unless otherwise specified), internal bond of 60 psi; and minimum screw holding capacity of 225 lbs. on faces and 200 lbs. on edges.

D. Hardwood Lumber: Clear, dry, sound, solid, and free of defects selected from First Grade lumber (NHLA), of red oak specie. No similar wood species such as ash or maple shall be substituted.

E. Reverse Printed Vinyl Laminate: Water and household chemical resistant 2 mil rigid reverse printed vinyl (unless otherwise specified).

F. Plastic Laminate. Refer to ROOM FINISH SCHEDULE Architectural sheet.

2.04 CASE CONSTRUCTION MATERIALS

A. Cabinet Frames: 3/4" thick x 1-5/8" wide solid hardwood rail and stile members. Center stiles shall be 3/4" thick x 3-1/4" or 6-1/4" wide solid hardwood. All frame joints shall be reinforced and precisely aligned with two (2) 3/8" diameter birch dowels bonded with adhesive.

B. End Panels: 3/8" thick, 48 lb. industrial grade particleboard laminated inside and out with a reverse printed vinyl. End panels shall be machined to accept tops, bottoms, and backs and on double door wall cabinets where/if indicated, and shall also be machined to accept shelves.

C. Wall Cabinet Tops and Bottoms: 1/2" thick, 48 lb. industrial grade particleboard. These components shall be laminated on two sides with a reverse printed vinyl. A dado joint and adhesive shall be used to join the tops and bottoms to the end panels.

D. Base Cabinet Bottoms: 3/8" thick, 48 lb. industrial grade particleboard laminated with a reverse printed vinyl on the interior side. The bottoms shall be joined to the end panels with dado joints and adhesive. Glue blocks and gussets shall be used to reinforce the

bottoms of cabinets 27" or wider. The upper portion of base cabinets shall be strengthened with 1/2" thick gussets to maintain squareness.

E. Backs: All backs shall be 1/4" thick, 50 lb. density particleboard with a rigid reverse printed vinyl laminated to the interior side. Wall cabinet backs shall be reinforced with 1/4" thick particleboard screw rails at the top and bottom. Wall cabinet backs shall be retained by a groove in the end panels; and glued and stapled to the tops and bottoms and to the shelves on 27" wide and larger sizes. Base cabinet backs shall be attached in the same manner, but the top of the cabinet shall have an 11/16" x 2-1/4" pine screw rail securing the back to the top of the cabinet.

F. Wall Cabinets: All 30" high wall cabinets 24" wide and under shall have adjustable shelves made of 1/2" thick particleboard. The shelf surfaces and front edges shall be laminated with a rigid reverse printed vinyl. Cabinet sides shall be drilled for durable locking shelf supports which shall be adjustable on 3 inch increments.

G. Double Door Wall Cabinets: All double door wall cabinets 24" and over in height shall have fixed shelves. These 1/2" thick shelves shall be the same as specified for the adjustable shelves, but they shall be fixed to the end panels with dado joints and glue, and on all 27" wide or larger shelves they shall be stapled through the back to assure rigidity.

H. Base Cabinets: ADA compliant base cabinets shall have half depth fixed shelves of 1/2" thick particleboard with reverse printed vinyl laminated to the top surface, supported on the ends with shelf clips. The backs of the shelves shall be supported with staples driven thru the cabinet backs. All shelves in base cabinets 27" or wider shall have a support apron under the shelf for additional strength.

I. Toe Boards: Toeboards backer shall be 3/8" thick, 48 lb. density industrial grade particleboard and extend from the floor to the cabinet bottom.

1. The toe board backer shall be covered with manufacturer’s standard 3/8" thick particleboard strip covered with or wall base furnished and installed by Carpentry/Flooring Contractor.

2.05 DRAWER CONSTRUCTION

A. Drawers: Drawers shall have 3/8" thick particleboard drawer sides, which shall be rabbited to accept 1/2" thick fronts and backs. All drawer components shall be laminated on the exterior side with a water and household chemical resistant 2 mil rigid designed vinyl. The interior faces of the drawer sides shall be laminated with a water and household chemical resistant 4 mil semi-rigid reverse printed vinyl and the ends shall be wrapped around radiused edges of the drawer components.

B. Fronts and Backs: 1/2" thick particleboard with a reverse printed vinyl on the inside of the outside face and water and household chemical resistant 4 mil semi-rigid reverse printed vinyl on the inside face. Top edges shall be raised and wrapped with vinyl. Drawer boxes shall be assembled with white glue and staples at each corner. The drawer core shall be secured to the drawer front with not less than two to four screws.

C. Drawer Bottoms: 1/4" thick 50 lb. density particleboard with a reverse printed vinyl laminated to the interior side. Bottom shall be retained in the side panels by a 1/4" groove, and secured with a bead of resin based hot melt adhesive. The drawer bottom shall be secured at the front and back with adhesive and staples.

D. Drawer Slides: Dual captive, steel, epoxy coated, side mounted roller drawer system consisting of a pair of steel slides which roll on close tolerance nylon rollers, to produce a capacity rating of 75 lbs.

2.06 DOOR AND DRAWER FRONT CONSTRUCTION

A. Doors: 5/8" thick, 48 lb. density industrial grade particleboard laminated on two sides with Platic Laminate finish as requested by Architect on both sides for balanced construction to prevent warpage. Three edges of the doors shall be edge banded with a 0.018" thick PVC edge banding.

1. Rubber Bumpers: Doors shall have pliable rubber bumpers to dampen closure noise.

B. Drawer Fronts: Construction shall be the same as the doors.

2.07 HINGES

A. Doors shall be mounted on manufacturer’s standard self-closing, concealed hinges capable of providing horizontal and vertical adjustment.

2.08 ACCESSORIES

A. Wire Pulls: Provide wire style pulls for each cabinet door and drawer. Wire pulls shall be satin clear anodized aluminum 6063-T5, 3-1/2" C.C., 5/16" O.D., with 1-5/16" projection, unless otherwise required by governing code requirements for facilities for the handicapped. EPCO® Product Number MC402-A shall be as manufactured by The Engineered Products Company, P.O. Box 108, Flint, MI 48501, (888)414-3726, (810)767-2050, or comparable product subject to review by the Architect.

2.09 FIRE RESISTANCE

A. Overlaid particleboard for cabinet construction shall comply with ASTM Standard E162 – Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

2.10 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. Assemble units in shop in as large components as practicable to minimize field cutting and jointing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSTALLATION

A. Protective covers installed by manufacturer to protect the finishes, shall not be removed until final cleaning.

B. Install prefabricated base and wall cabinets where and as indicated on the Drawings.

1. Contractor shall verify all on-site dimensions and notify supplier of any variances or changes.

2. Install cabinets plumb and level with all joints tight, in accordance with manufacturer's instructions shipped with cabinets.

3. Shim cabinets as required and trim with molding to match cabinets.

4. Secure to walls with screws embedded not less than one inch in solid wood framing or blocking.

5. Install miscellaneous hardware and accessories as indicated on the Drawings.

6. Clean cabinets and leave in perfect operating order with all doors, shelves and drawers aligned and plumb.

C. Sink and plumbing fixtures will be furnished and installed by the Plumbing Contractor.

D. Wall base for toe board will be furnished and installed by the Resilient Flooring Materials Contractor.

3.03 CLEAN-UP

A. Work Required: Clean-up or repair adjacent finish Work which is soiled, marred, or damaged by the Work of this section, at Contractor's expense.

B. Debris and Waste Materials: During progress of the Work, the premises shall be kept free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site and dispose of legally. Upon completion and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

C. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 12 36 23.13
PLASTIC LAMINATE-CLAD COUNTERTOPS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials, equipment, and services necessary for Plastic Laminate- Clad Countertops Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Moisture-Resistant Plastic Laminate-Clad Countertops.

2. Standard Plastic Laminate-Clad Window Sills.

B. Related Sections: The following items of related Work will be performed under other sections of the Specifications:

1. Unit Structural Masonry - Section 04 23 00.

2. Rough Carpentry - Section 06 10 00.

3. Finish Carpentry - Section 06 20 00.

4. Board Insulation - Section 07 21 2.

5. Gypsum Wallboard - Section 09 29 00.

6. Manufactured Wood Casework - Section 12 32 00.

7. Plumbing Fixture - Division 22.

1.02 REFERENCES

A. American National Standards Institute (ANSI):

1. A208.1 - American National Standard for Particleboard.

2. A208.2 - American National Standard for Medium Density Fiberboard.

B. ASTM International Standard Specifications:

1. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.

2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

3. ASTM E1333 - Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.

C. American Woodwork Institute (AWI): Architectural Woodwork Quality Standards Illustrated (QSI).

D. Composite Panel Association (CPA): Applicable listings.

E. National Electrical Manufacturers Association (NEMA): LD 3 - High-Pressure Decorative Laminates.

F. Underwriters Laboratories Inc: UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Engage an experienced fabricator with not less than five (5) years experience who is certified in writing by system manufacturer, as qualified to fabricate manufacturer's system.

B. Installer Qualifications: Engage an experienced installer with not less than five (5) years experience who is certified in writing by system manufacturer, as qualified to install manufacturer's system.

C. Overall Standards:

1. Perform Work in accordance with the AWI "Architectural Woodwork Quality Standards Illustrated" except as modified herein.

2. Provide AWI Quality Certification Program indicating that countertops window sills comply with the requirements of grades specified.

3. Countertop and Window Sill Material and Installation: Custom Grade except as modified herein.

D. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-Accredited Certification Body.

1.04 SUBMITTALS

A. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein. Work shall not begin until Shop Drawings have been reviewed by the Architect.

1. Shop Drawings: Prepare complete Shop Drawings, showing dimensions, sections, details of materials, fabrication, and installation of materials and products.

2. Product Data: Submit Product Data for each type of product specified.

3. Samples: Provide for initial selection purposes in the form of manufacturer's standard color charts and small-scale samples indicating required textural choices.

4. Samples for Verification Purposes: Provide in the form of 8 by 10 inch Samples for each finish, color, and texture required.

5. Qualification Data: Provide data on firms and persons as specified herein under Article "QUALITY ASSURANCE" to demonstrate capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.

6. Installer Certificates: Provide certificates signed by manufacturer certifying that Installers comply with requirements as specified herein under Article "QUALITY ASSURANCE".

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver all materials to the site in protective crates and wrappings clearly labeled with pertinent information to facilitate checking. Unload in areas designated by the General Contractor.

B. Protection: Protect all materials from the weather during transit and during storage at the site. Store materials above the ground, in properly protected dry storage facilities, until ready for use. Do not deliver materials to the job site until required for installation. Take all precautions to avoid absorption of moisture by countertops and window sills.

C. Do not deliver countertops and window sills until HVAC system is operating.

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Operate HVAC system to maintain occupancy level temperature and relative humidity conditions from 24 hours prior to delivery of materials through remainder of construction period.

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Plastic Laminate:

1. Brand Name Products and Manufacturers:

a. Formica.

b. Refer to ROOM FINISH SCHEDULE Architectural sheet for selected color and line.

2. Plastic Laminate Sheets: Surfaces shown on the Drawings as plastic laminate covered shall be finished with nominal 1/16" thick high pressure plastic laminate sheets as specified herein.

a. Standards and Grade: Plastic laminate sheets shall conform to NEMA Standards, General Purpose Grade 10, meeting or exceeding performance standards of NEMA Standards Publication, NEMA LD-3 - High Pressure Decorative Laminates.

3. Balanced Back Construction: Wherever possible shop apply plastic laminate under pressure to approved back-up specified herein.

a. All panels (except as otherwise indicated) shall have "balanced back" construction, using manufacturer approved backing sheet.

b. Provide self-edging surfaces.

4. Quality Assurance: All plastic laminate Work shall be performed by experienced plastic laminate skilled workers.

5. Protection: Deliver the Work to the job site wrapped and protected from abrasion and moisture.

6. Colors, Patterns, and Finishes: As noted on the Drawings.

B. Particleboard:

1. Engineered Wood Products: Products shall contain no urea formaldehyde.

2. Standard Particleboard: Duraflake® Plus Particleboard as manufactured Equal to: Flakeboard, 515 River Crossing Drive, Suite 110, Fort Mill, SC 29715, (877)273-7680, www.flakeboard.com. Manufacturer with equivalent products shall be subject to review by the Architect.

a. Particleboard shall comply with ANSI A208.1, 3/8" to 1-3/16" inch thick Grade M-3.

b. Certification: Meeting CPA 3-08 EPPS, including the following:

1) Formaldehyde Emission Requirements: ANSI A208.1, Table A and HUD 24 CFR Part 3280.308.

4. Moisture Resistant Particleboard: Duraflake® MR Particleboard as manufactured Equal to: Flakeboard, 515 River Crossing Drive, Suite 110, Fort Mill, SC 29715, (877)273-7680, www.flakeboard.com. Manufacturer with equivalent products shall be subject to review by the Architect.

a. Compliance: Moisture resistant particleboard shall comply with ANSI A208.1, Grade M-3.

b. Thickness Swell: ASTM Standard D1037, 3/4 inch (19 mm) panel thickness: 5 percent maximum.

c. Absorption: ASTM Standard D1037, 3/4 inch (19 mm) panel thickness: 10 percent maximum.

d. Certification: Meeting CPA 3-08 EPPS, including the following:

1) Formaldehyde Emission Requirements: ANSI A208.2, Table A and HUD 24 CFR Part 3280.308.

C. Adhesive: Provide non-flammable brush-on grade application contact adhesive such as Formica® (Partner with Choice Brand Adhesives) F106G Contact Adhesive, or comparable equivalent product as recommended by the plastic laminate manufacturers specified herein, subject to review by the Architect.

1. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 80 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

C. Examine casework or other support upon which counters window sills will be installed. Verify adequacy of support.

D. Coordinate with responsible entity to perform corrective Work on unsatisfactory casework or support.

E. Commencement of Work by installer shall be considered as acceptance of substrate conditions.

3.02 PREPARATION

A. Condition counters and window sills to occupancy level environmental conditions for minimum 72 hours prior to installation.

B. Verify location of required cutouts and obtain templates for cutouts.

3.03 INSTALLATION

A. Particleboard: Provide and install particleboard in compliance with recommendations of the Composite Panel Association (CPA) for the types of installations indicated and/or noted on the Drawings.

B. Plastic Laminate: Fabricate, fit, and install plastic laminate finished surface, on countertops, vanity tops, window sills, and walls, where shown and as detailed on the Drawings, all in accordance with manufacturer's recommendations and the best practices of the trade.

C. Countertops, Backsplashes and Window Sills: Fabricate and install all countertops, backsplashes and window sills as detailed on the Drawings. Shop or mill fabricate wherever possible.

1. Fabrication and Installation: The fabrication and installation of all plastic laminate materials as detailed and/or shown on the Drawings shall be performed by an Accredited Fabrication shop in accordance with the manufacturer's printed instructions and final Shop Drawings. Sheet material shall be cut to size, seamed and detailed in accordance with approved Shop Drawings.

2. Field Measure: Prior to fabrication, verify sizes by field measurement.

3. Cutouts: Obtain templates and make cutouts for fixtures and appliances as indicated; drill pilot holes at corners before making cutouts. Smooth cut edges and coat with waterproof coating or adhesive.

4. Plastic Laminate Top Standards: ANSI A161.2 - “Performance Standards for Fabricated High Pressure Decorative Laminate Tops”. Where joints are required, spline and glue joints and provide concealed mechanical clamping of joints.

5. Attachments: Securely attach countertops and window sills to wall as detailed on the Drawings.

D. Sealant joint between backsplash and wall with sealant specified in Section 07 90 00.

3.04 CLEAN-UP

A. Work Required: Clean-up or repair adjacent finish Work which is soiled, marred, or damaged by the Work of this section, at Contractor’s expense.

B. Debris and Waste Materials: During progress of the Work, the premises shall be kept free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site and dispose of legally. Upon completion and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

3.05 PROTECTION

A. Provide temporary protection to the Work of this section from damage by other construction operations until Substantial Completion.

END OF SECTION

END OF DOCUMENT

SECTION 21 13 13
PIPES, VALVES AND FITTINGS FOR FIRE PROTECTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Scope of work:
   1. All areas as indicated on the drawings are to be protected by an automatic suppression system, of type as indicated.
   2. Wet pipe.

B. Contractor shall be responsible for designing the distribution systems and sizing of the systems by hydraulic calculation; and shall provide the necessary engineering drawings and calculations to obtain acceptance of all authorities having jurisdiction.

1.2 RELATED SECTIONS

A. Section 079200 - Firestopping.

B. Section 083113 - Access Doors and Panels.

C. Section 220515- Methods and Materials.

D. Section 220529 - Hangers and Supports.

1.3 REFERENCES

A. ASTM International (ASTM) A536 - Standard Specification for Ductile Iron Castings.

B. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) SP-127 Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

C. NFPA 13 - Installation of sprinkler systems.

D. NFPA 72 - Installation, maintenance and use of protective signaling devices.

1.4 SYSTEM DESCRIPTION

A. System components to be UL listed/FM approved and labeled.

B. System components to be to be rated for minimum operating pressure of 175 psig.

C. Pipe, Valves, and Fittings - Grooved products for steel and copper fire protection systems shall be used. Refer to Section 220515 - Materials and Methods.

D. Products shall be UL/ULC listed and FM approved. Materials shall be installed in accordance with current NFPA Standards, local Rating Bureau and/or local Fire Marshall requirements.

E. Incorporate in construction pipe hangers and supports to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies. Refer to Section 220529 - Hangers and Supports.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Installation methods.

C. Certifications:
   1. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements. Certificates shall be furnished only as required by specific codes, upon request.

D. Shop Drawings:
   1. Submit shop drawings grouped to include complete submittals of related systems, products, and accessories in a single submittal.

E. Closeout Submittals:
   1. Warranty: Warranty documents.
   2. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Fire Protection Contractor shall be licensed by the State in which the project is located authorized to furnish and install fire protection systems.
   2. Contractor shall obtain all necessary permits and licenses pertaining to this Division (expense borne by the Contractor) and comply with Municipal and State Codes, Laws, Ordinances and Regulations, and the requirements of the National Fire protection Association, and pay all fees and sales taxes as required, and post all bonds incident thereto.

B. Conduct pre-installation meeting to verify project requirements, coordinate with other trades, and establish condition and completeness of substrate. Review manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 DEFINITION

A. "Piping" includes all pipe, fittings, valves, hangers, and other supports and accessories related to such piping.

B. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.

C. "Exposed" means not installed underground or "concealed" as defined above.

D. "Fire Protection Work" is all of the work Indicated or required by the Contract Documents.

E. "Or equivalent" means to possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity.

F. "Provide" means the Contractor shall "furnish and install" work and/or equipment.

G. "FPC" means the Fire Protection Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. Contractor shall guarantee, in writing, that all work installed shall be free from any and all defects in workmanship and materials; that all apparatus shall develop capacities and characteristics specified; and that if, during the period of one year, or as otherwise specified, from the date of substantial completion, any defects in workmanship, material or performance appear, the Contractor shall, without cost to the Owner, remedy such defects within a reasonable time as specified in notice from the Owner's Representative. In default thereof, the Owner's Representative shall have the work done and charge the cost of the work to the Contractor.

B. Furnish manufacturers written warranties for all equipment, stating effective date of Warranty, to the Owner's Representative.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Manufacturers shall meet or exceed NFPA and local authority requirements.

2.2 MANUFACTURED UNITS

A. Grooved Butterfly Valve: Gruvlok Figure AE-7722-3A, 2 to 10 inches (51 mm to 254 mm). 300 PSI (2.1 MPa) rated UL/FM approved grooved-end with two (2) switches; one is a supervisory switch and the other is an auxiliary switch. Tamper resistant screws shall be provided to attach the cover of the actuator. Or Equal.

B. Check Valves: Gruvlok Figure 78FP, 2 to 12 inches (51 to 305 mm): 300 PSI (2.1 MPa) rated, UL/ULC listed and FM approved grooved-end.

C. Couplings for Fire Protections Systems - Gruvlok UL/ULC listed and/or FM approved. Figure 7000 (Flexible) and 7400 (Rigidlok) Grade "E" EPDM Type A, "C" Style Gaskets (DRI-SEAL), Type E EPDM, or Flush Gap Gasket. Or Equal.

D. Grooved Fittings for Fire Protection Piping Systems: Gruvlok Fire-Rite short pattern fittings, 90 degree elbows and tees in 2 to 8 inches (51 mm to 203 mm) or Gruvlok standard pattern fittings, 2 to 12 inches (51 to 305 mm). Cast ductile conforms to ASTM A-536 Ductile Iron to Grade 65-45-12. Fittings are painted to industry specification and are available galvanized. Fire-RiteSYMBOL 212 fittings are UL/ULC listed and FM approved. Or Equal.

2.3 SPRINKLER HEADS

A. Manufacturer:
1. Viking, Central, Reliable, Tyco or equal.
2. Type: Concealed fire sprinkler heads only (Shall be approved by architect for coordination of ceiling construction types).

2.4 PIPING

A. Steel Piping:
1. Refer to Section 220515 for fire protection piping material.

2.5 ACCESS PANELS

A. Provide access panels as required by Section 083113 - Access Doors and Panels.

2.6 FIRESTOPPING MATERIALS

A. Provide fire stopping assemblies as required by Section 078413 - Firestopping.

2.7 EQUIPMENT SUPPORTS

A. Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 055000 Structural Steel. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

A. Provide templates to ensure accurate location of anchor bolts.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Contractor shall verify and obtain fire flow test data required for design.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Provide openings as necessary to permit installation of piping or any other part of work under this Section.

D. Provide sleeves for piping penetrating floor and masonry walls.

E. This Contractor shall be responsible for establishing sizes and locations of all openings and lintels in new work and to transmit this information to the Contractor whose work is involved at such time as to avoid cutting and patching.

F. All patching shall match adjacent surfaces.

G. Contractor shall inspect and take note of existing conditions along with the Owner's Representative to avoid disputes regarding the condition of existing surface before work began.

H. Openings through existing concrete shall be core-drilled or saw cut.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access panels for access to equipment, valves, or other specialties installed behind wall or above ceiling surfaces.

C. Lay-in acoustical tee bar ceilings and snap-in removable metal pan ceilings shall be considered adequate for access.

D. Fire Protection Contractor shall sublet installation work to subcontractors specifically skilled in the construction of the surfaces involved.

E. Contractor shall confer with the other Project Contractors with respect to access panel locations and shall, wherever practicable, group devices in such a manner so as to eliminate as many panels as possible.

F. Contractor shall remove all markings and labels from access panels.

G. Cutting or drilling thru structural beams or joists is not permitted.

H. Provide all openings and set all sleeves in cooperation with Contractors whose work is affected thereby.

I. Caulk opening between pipe and sleeve with fire barrier sealant.

J. In event holes must be provided through reinforced concrete, they shall be carefully drilled so as to avoid spalling and unnecessary damage of weakening of any structural member; chopping or breaking out will not be permitted.

K. Obtain Architect's approval before providing openings through concrete or masonry in place and then proceed as directed.

L. Contractor shall be responsible for damage to finished work resulting from cutting or drilling required because of neglect of Contractor to provide accurate and sufficient information.

M. Penetrations through fire and/or smoke rated construction shall be sealed to maintain the rating of the construction in which they occur.

N. Comply with the manufacturer's requirements for proper installation of fire stop materials to obtain the required fire and/or smoke rating.

3.4 SPRINKLER HEADS

A. Locate sprinkler heads, main piping and valves as indicated on the drawings.

B. Install sprinkler heads to coordinate with all lights, grilles and any other obstructions in ceiling.

C. Center sprinkler heads in ceiling tile and provide piping offsets as required.

D. Where ceiling is to be painted or sprayed, apply paper cover over sprinkler heads to ensure the head and escutcheons do not get coated. Remove protective paper cover after painting or spraying is completed.

E. Provide mountable metal box of spare heads with proper wrench for head replacement.

3.5 TESTS AND INSPECTIONS

A. Contractor shall be responsible for testing and certification of systems and ordering inspections as required by authorities having jurisdiction.

B. All tests shall be conducted in the presence of and to the satisfaction of the Owner or an authorized representative.

C. Inspections shall be made by the Owner's authorized representative and inspectors having jurisdiction.

3.6 PROTECTION

A. After all tests have been made and the systems pronounced to be satisfactory, the Contractor shall go over all work and clean equipment, fixtures, and related appurtenances and piping, and leave them clean and in complete working order at final completion of the project.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 21 13 13

SECTION 22 05 10
PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification Section apply to this and other sections of Division 22.

B. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, visit the site(s) of the proposed project, and become fully informed of the extent and character of the work required.

1.2 REFERENCE STANDARDS

A. Perform all Division 22 work in strict accordance with the Laws and Regulations of the State of Texas, and County and City codes/ordinances having jurisdiction over the project.

1.3 COORDINATION

A. Coordinate work under this Division to avoid conflicts and to attain satisfactory and complementary systems.

B. Coordinate work under this Division with work under other Divisions to avoid conflicts and to allow for adequate installation, maintenance, and operating space. Obtain the Architect's approval for penetrations of other parts of the Work prior to affecting them.

C. Prepare coordination drawings in accordance with Division 1 to a scale of ¼"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow if the work.

1.4 DEFINITIONS

Specific meanings used in Division 22 (variant forms are inferred):

A. Work: This project, or the reference part.

B. Provide:

1. Furnish and install, complete with necessary appurtenances.
2. "Provide" is implied throughout this Division unless language is specific.

C. Required: Required by the contract Documents.

D. Necessary: Necessary in order to obtain a finished system in satisfactory operating condition, and meeting all requirements.

E. Furnish: Procure and deliver, ready for installation, necessary and/or required.

F. Install: Receive, place securely, ready for connection to work specified elsewhere, and bring into satisfactory operating condition, as necessary and/or required.

G. Connect: Connect properly to mechanical work. This includes non-physical “connections” such as indirect waste drains.

H. Architect, Project Architect or Architect/Engineer Team.

1.5 SCOPE OF WORK

A. The work under this Division includes providing complete mechanical systems for the project.

B. All items of labor, material or equipment not required in detail by the specifications or plans, but incidental to, or necessary for the complete installation and proper operation of all phases of work described herein, or reasonably implied in connection therewith, shall be furnished as if called for in detail by the Contract Documents.

1.6 WORKMANSHIP

A. All labor shall be performed in a workmanlike manner by mechanics skilled in their particular trades. All installations shall be complete in both effectiveness and appearance whether finally enclosed or left exposed. The architect reserves the right to direct the removal or replacement of any item which in his opinion shall not present a reasonable neat or workmanlike appearance, providing that same can be properly installed in an orderly way.

1.7 MANUFACTURER’S INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the plans and specifications, manufacturer’s instructions and applicable codes. Contractor shall obtain written recommendations of installation and start-up instructions from material vendors and comply, unless otherwise required. Bring discrepancies between these instructions and project requirements to the attention of the Architect, and resolve prior to construction. Provide signed inspection report by manufacturer’s representative at system start-up to verify all is in compliant for product warranty.

1.8 WARRANTY

A. The contractor shall warranty his work against defective materials and workmanship for a period of 1-year from date of acceptance of the job.

1.9 TRAINING

A. Upon completion of the work and at a time designated by the Owner’s representative, provide a formal training session for the Owner’s operating personnel to include location, operation, and maintenance of all equipment and systems.

1.10 PERMITS AND FEES

A. Permits: Obtain special permits necessary for this portion of the Work.

B. Fees: Pay any fees associated with permits, required inspections, and permanent utility connections to this part of the work.

1.11 LICENSES

A. Work under this Division shall be performed by organizations and individuals holding a current license to perform such type of work by the authority having jurisdiction. “License” in this sense means any process, regardless of its appellation, which is normally mandated by the authority in order to perform such type of work within its jurisdiction. The stipulation of this paragraph applies even if the work is located physically on property owned or controlled by a higher authority. E.G., to work within the city limits of Corpus Christi, Texas, on a Federal project, State of Texas and City of Corpus Christi licenses which would be mandated to work on a private project shall be required even though the City and State may have no jurisdiction over the higher government.

B. In the event that the licensed organization loses its license or is unable to obtain one, or the licensed individual performing the work becomes unlicensed or deports the organization, notify Architect immediately in writing.

1.12 UTILITY COORDINATION

A. Permanent: Provide all ancillary work necessary to obtain utility connections. Pay connection fees. Arrange for connection in a timely manner. Coordinate time and arrangement of other work with the serving utility, and comply with utility standards.

B. Temporary: Refer to Division 1.

C. General: The contractor shall verify to his own satisfaction the location, elevation and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work. The contractor shall also verify location, conduct all necessary tests, inspections, coordinate with owner’s representatives and utilities, and check or existing underground utilities and lines before ditching. Repair of any cut or damaged lines or utilities shall be the sole responsibility of the contractor.

1.13 LISTING AND LABELING

Materials required to be listed shall be listed and labeled for the particular service if a listing is available. Obtain and comply with the terms of listings. Listed material include.

A. NSF: Potable water and sanitary waste systems components.

B. UL: Electrical materials.

C. AMCA: Air moving devices and related accessory items.

D. ARI: HVAC equipment.

E. FM or UL: Hazardous fluid and fire protection system components.

F. FIA, FM or AGA: Fuel gas system components.

1.14 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new. Products shall be currently manufactured.

B. All materials and equipment shall be clearly marked, stamped or labeled for identification. Do not obscure nameplates. Where manufactures nameplates do not meet the requirements of the identification specification provide nameplates in accordance with the specification.

C. All products of similar type shall be provided by a single manufacturer throughout the project.

1.15 SUBMITTALS AND REVIEW

A. Contractor shall furnish to the Architect, within a reasonable time after award of contract, and prior to commencing any work, complete brochures in quadruplicate (plus quantity required by the Contractor) of all materials and equipment which the contractor proposes to furnish on the project. Data shall include descriptive literature, performance data, diagrams, capacity information, etc., to substantiate that proposed equipment will meet all of the requirements of the plans and specifications.

B. All data must be checked and any required changes noted thereon by the contractor, signed and dated prior to furnishing same to the Architect for approval. Contractor's attention is directed that it is mandatory that he thoroughly review data prior to furnishing same to assure that equipment is in accordance with plans and specifications and to assure prompt return of the data.

C. Deviations: Specifically call to the attention of the Architect every proposed deviation from the Contract Document requirements. Failure to identify deviations as such constitutes a representation that all requirements are not met.

D. Review: Review of submittals shall not be constructed as releasing the Contractor from responsibility, but rather as a means to facilitate coordination of the work and the proper selection and installation of the products. All work shall be subject to final acceptance by the Architect at the completion of the project.

E. If above information is not provided complete as specified above and within the allocated time, all equipment shall be furnished exactly as specified without any substitutions.

1.16 SUBSTITUTIONS

A. Refer to the Conditions of the Contract.

B. Where one vendor is indicated for a product, it is to establish a level of quality and performance; provide a product equal to that product in all respects from a vendor of equivalent performance.

C. Where multiple vendors are indicated for a product, any of those vendors meeting the requirements may be submitted.

D. Some product specifications in this Division are of the Acceptable Manufacturer type. Vendors listed as Acceptable Manufacturers are acceptable as vendors. However, the product submitted is subject to review as being fully equivalent in detail to the basis of design.

E. Where multiple vendors are listed with product model numbers, each model and vendor is acceptable, provide all requirements are met. Model numbers are indicated to the extent believe necessary to identify a type and are not necessary completely.

F. The architectural/engineering team has designed the facility using requirements of the Basis of Design equipment. Any substitutions from the basis of design, which will require additional A/E design and/or coordination, shall include the cost of necessary redesign by professionals licensed in the respective disciplines and the approval of the professional of record.

1.17 DRAWINGS AND SPECIFICATIONS

A. These specifications are accompanied by Drawings. The Drawings and Specifications are complementary each to the other, and what is called for by one shall be as binding as if called for by both.

B. The Drawings are generally diagrammatic. Lay out work at the site to conform to existing conditions; architectural, structural, mechanical, and electrical conditions; to avoid all obstructions; and to conform to details of installation as required. Provide an integrated satisfactorily operating installation. All necessary offsets in piping, fittings, duct, etc., required to avoid interferences between piping, equipment, architectural, and structural elements shall be provided by the Contractor. Provide all necessary routing and offsets to avoid conflict.

C. Verify and arrange that sufficient space is provided for the installation of proposed products and that adequate access will exist for service and maintenance of equipment. For this work, adequate access shall be defined as meaning that service personnel can access and maintain a piece of equipment without having to alter permanent construction. Further, for equipment located above ceilings, access shall be available within 3 feet pf ceiling opening or lay-in ceiling.

1.18 COMPLEMENTARY DOCUMENTS

A. Contract documents are complementary; requirements are not necessarily repetitively stated at each possible subject; consider that a requirement applies wherever applicable.

B. In the event of conflicting requirements in different parts of the Documents, the more expensive shall be presumed to apply, unless the Architect clarifies the requirement in a less expensive manner and waives the more expensive requirement in writing.

Since codes and standards are incorporated by reference, a particular conflict may appear in that a reference may use language that implies that a particular requirement in the Construction Documents is waived under the reference. This is not the case, unless specifically so clarified by the Architect. Generally, the specific Drawings and Specifications take precedence over waivers in multi-purpose reference documents.

C. Because of licensure and workmanship requirements, persons performing the work are presumed to be familiar with applicable codes, ordinances, laws, regulations and standards. Therefore, details of materials, methods, arrangements and size contained in such publications

are not necessarily replicated in the Contract Documents. This in no way deletes the requirement of the Contractor to comply. In the event of an apparent conflict between such publications and the Contract Documents, request clarification from the Architect prior to construction.

1.19 PROTECTION

A. All work, equipment and materials shall be protected at all times to prevent damage or breakage either in transit, storage, installation or testing. All openings shall be closed with caps or plugs during installation. All materials and equipment shall be covered and protected against dirt, water, chemicals or mechanical injury.

1.20 CUTTING AND PATCHING

A. All subcontractors shall notify the General Contractor sufficiently ahead of construction of any floor, walls, ceiling, roof, etc., of any openings that will be required for his work. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor's expense in a neat and workmanlike manner.

1.21 DEMOLITION

A. It shall be the responsibility of the contractor to see that all demolition and remodeling work involving his trade is accomplished in a manner and completeness to provide the appearance of new construction work.

B. Coordinate with other divisions before commencing work.

C. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.

1.22 RECORD DOCUMENTS

A. Drawings: The Contractor shall maintain and update daily a set of "blueline" prints in the Field Office for the sole purpose of recording "installed" conditions. Revise the drawings to reflect as-built conditions, including all addenda, change orders, final shop drawing reviews, and field routing. Underground utilities shall be dimensionally located relative to readily accessible and identifiable permanent reference points, with accurate slope and elevation indicated. Submit prints for review. Revise, certify accuracy, and provide two final sets to the Architect.

B. Owner's Manual: Prior to final acceptance, provide two bound volumes to the Architect. Index by subject. Include corrected submittals and shop drawings that reflect final review comments; installation, operation and maintenance instructions, parts lists, wiring diagrams, and piping diagrams; warranties.

1.23 INSPECTION, OBSERVATION, AND TESTING

A. Cooperate with Architect's representative and authorities having jurisdiction. Provide complete access to the work at reasonable times.

B. Cover-up: Prior to covering up work, or conducting observed tests, request observation as appropriate. Provide adequate advance notice defined as a minimum of five working days. In some cases the Architect's representative may waive observation; otherwise arrange for observed construction and testing prior to cover-up. Should minimize required notice not to be provided and the contractor covers up work requiring observation, such work shall be uncovered at contractor's expense.

C. Pre-Testing: Self-inspect, pre-test, and remedy work prior to performing observed test.

D. Sectional Work: In circumstances where a requirement for phased construction or other considerations dictate sectional construction and/or testing, notify the Architect when construction begins on the first section of a system, and when the first section will be ready for observed testing, as well as subsequent sections. Test in the largest practical sections.

1.24 WORK PERFORMED UNDER OTHER DIVISIONS

A. Refer to Division 2 for piped utilities beyond 5 feet from the building.

B. Refer to Division 26 for power wiring systems external to equipment and control panels; starters in motor centers; safety switches not integral to equipment or starters provided under Division 23.

1.25 TESTING SERVICES

A. Additional Testing: In addition to any specified testing, the Architect may cause additional testing to be performed by an independent testing laboratory or any other qualified party. If such testing reveals deficient work by the Contractor, the Contractor shall pay for both the testing and remedial work. If such testing does not reveal deficient work by the Contractor, the Owner shall pay for the testing and the cost of repairing any damage caused by such testing.

B. Specified Testing Services: If independent testing services are specified regarding work under this Division, cooperate fully with the testing agency. Provide access to the work. Provide test holes and taps necessary. Remove work that is not tested on site, deliver to testing agency, and reinstall if undamaged; replace if damaged. Provide utilities, operational capability, and facilities for on-site testing as necessary.

END OF SECTION 220510

SECTION 22 05 15
MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following materials and methods to complement other Division 22 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Labeling and identifying mechanical systems and equipment is specified in Division 22 Section "Plumbing Identification."
9. Nonshrink grout for equipment installations.
10. Field-fabricated metal and wood equipment supports.
11. Installation requirements common to equipment specification sections.
12. Mechanical demolition.
13. Cutting and patching.
14. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 22 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data Book: Submit product data for all Division 22 items in a single reinforced 3-ring binder. Organize product data by specification section number. Provide table of contents showing the following:
1. Specification Section
2. Description of item
3. Submission number (1st submission, 2nd submission, etc.)
4. Submittal status (Approved, Revise and Resubmit, etc.)

B. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Coordination Drawings: For access panel and door locations.

E. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

F. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Eclipse, Inc.; Rockford-Eclipse Div.
   d. Epco Sales Inc.
   e. Hart Industries International, Inc.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Epco Sales Inc.
   d. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

   a. Calpico, Inc.
   b. Central Plastics Co.

4. Dielectric Couplings:

   a. Calpico, Inc.
   b. Lochinvar Corp.

5. Dielectric Nipples:

   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Perfection Corp.
   c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

    a. ANAMET Industrial, Inc.
    b. Central Sprink, Inc.
    c. Flexicraft Industries.
    d. Flex-Weld, Inc.
    e. Grinnell Corp.; Grinnell Supply Sales Co.
    f. Hyspan Precision Products, Inc.
    g. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
    h. Mercer Rubber Co.
    i. Metraflex Co.
    j. Proco Products, Inc.
    k. Uniflex, Inc.

7. Rubber, Flexible Connectors:

    a. General Rubber Corp.
    b. Mercer Rubber Co.
    c. Metraflex Co.
    d. Proco Products, Inc.
    e. Red Valve Co., Inc.
    f. Uniflex, Inc.

8. Mechanical Sleeve Seals:

    a. Calpico, Inc.
    b. Metraflex Co.
    c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 22 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2-Inch NPS and Smaller: Threaded.
2. 2-1/2-Inch NPS and Larger: Flanged.
3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

    a. Underdeck Clamp: Clamping ring with set screws.

5. PVC: Manufactured, permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. PE: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome-plate.

4. Cast Brass: Split casting, with concealed hinge and set screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome-plate.

5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
9. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
11. Cast-Iron Floor Plate: One-piece casting.

2.8 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch- high letters for ductwork and not less than 3/4-inch- high letters for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Material: Brass.
3. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.

F. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/16 inch, unless otherwise indicated.
5. Thickness: 1/8 inch, unless otherwise indicated.
6. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches long; 1/8 inch for larger units.
7. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

G. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.9 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 22 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE removable sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. PVC Pipe Sleeves: For pipes smaller than 6-inch NPS.
   b. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
   c. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
   d. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

      1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
5. Soldered Joints: Construct joints according to CDA's "Copper Tube Handbook."
6. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

8. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
9. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
10. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

    a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. ABS Piping: ASTM D 2235 and ASTM D 2661.
    c. CPVC Piping: ASTM D 2846 and ASTM F 493.
    d. PVC Pressure Piping: ASTM D 2672.
    e. PVC Nonpressure Piping: ASTM D 2855.

f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

11. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.

    a. Plain-End Pipe and Fittings: Use butt fusion.
    b. Plain-End Pipe and Socket Fittings: Use socket fusion.

X. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.

3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
    c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
    d. At access doors, manholes, and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Spaced at maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.
    g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4-inch- high lettering for name of unit if viewing distance is less than 24 inches, 1/2-inch- high lettering for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.4 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 22 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.10 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 220515

SECTION 22 05 29
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1**, "**Structural Welding Code—Steel**"**

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers: Similar to MSS Type 1, steel pipe hanger except hanger is made of fiberglass and continuous-thread rod and nuts are made of polyurethane or stainless steel.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Champion Fiberglass, Inc.
c. Cope, T. J., Inc.; Tyco International, Ltd.
d. Seasafe, Inc.
e. Unistrut Corp.; Tyco International, Ltd.
f. Wesanco, Inc.

B. Strap-Type, Fiberglass Pipe Hangers: Made of fiberglass loop with stainless-steel continuous-thread rod, nuts, and support hook.

1. Available Manufacturers:

a. Plasti-Fab, Inc.

2.5 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 FIBERGLASS STRUT SYSTEMS

A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Champion Fiberglass, Inc.
3. Cope, T. J., Inc.; Tyco International Ltd.
4. Seasafe, Inc.

2.7 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.8 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.9 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Available Manufacturers:

a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Portable Pipe Hangers.

2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Available Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.10 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.11 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include

auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 7 Section "Roof Accessories" for curbs.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2 (DN 65)**] and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Stencils.
4. Valve tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

END OF SECTION 220553

SECTION 22 07 13
PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:

1. Insulation Materials:

   a. Phenolic Foam.
   b. Cellular glass.
   c. Flexible elastomeric.
   d. Mineral fiber.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied fabric-reinforcing mesh.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.
14. Corner angles.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. FSP: Foil, scrim, polyethylene.

D. PVDC: Polyvinylidene chloride.

E. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Application at linkages of control devices.
7. Field application for each equipment type.

C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control inspection reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

   a. ACS.
   b. Pittsburgh Corning Corporation; Foamglas Super K.
2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
3. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Available Products:

   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

   a. CertainTeed Corp.; Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Duct Wrap.
   d. Owens Corning; All-Service Duct Wrap.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

   a. CertainTeed Corp.; Commercial Board.
   b. Johns Manville; 800 Series Spin-Glas.
   c. Knauf Insulation; Insulation Board.
   d. Owens Corning; Fiberglas 700 Series.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Available Products:
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000(Pipe Insulation.

c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 1 or 2-hour fire rating, as required.

1. Products:

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Thermal Ceramics; FireMaster Duct Wrap.
d. 3M; Fire Barrier Wrap Products.

2.4 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.5 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:

2.6 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

2.7 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
2. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
3. Color: White.

2.8 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Products:

a. Childers Products, Division of ITW; CP-76.
b. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.9 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.10 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

2.12 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness 20 mil; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Thickness: 0.020” Smooth.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.13 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.14 SECUREMENTS

A. Bands:
1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

2.15 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.11 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections. Paint only those items in exposed, public areas.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent inspecting agency to perform field inspections and prepare inspection reports.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.

C. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

3.13 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Domestic hot-water storage tank insulation shall be the following:

1. Mineral-Fiber Board: 4 inches thick and 2-lb/cu. ft. nominal density.

3.14 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Fire-suppression piping.
2. Drainage piping located in crawl spaces.
3. Below-grade piping.
4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

C. Domestic Chilled Water (Potable):

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

D. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.
2. Insulation required on horizontal and vertical runs.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

F. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 3/4 inch thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inches thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
   1. ASJ – factory.

D. Piping, Exposed:
   1. PVC: 20 mils thick.

3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:
   1. PVC: 20 mils thick.

D. Equipment, Exposed:

1. Aluminum, Smooth: 0.020 inch thick.

E. Piping, Concealed:
   1. PVC: 20 mils thick.

F. Piping, Exposed:
   1. Aluminum, Smooth: 0.020 inch thick.

3.19 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220713

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections include the following:

1. Division 22 Section "Chemical-Waste Piping" for chemical-waste and vent piping systems.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. PE: Polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:
1. Sovent Drainage System: Include plans, elevations, sections, and details.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Lead and Oakum: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall schedule 40 PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.5 SPECIAL PIPE FITTINGS

A. Sovent Drainage System Fittings: ASME B16.45 or ASSE 1043, cast-iron aerator and deaerator fittings.

B. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

F. Tubular Fittings: ASTM F 409, PVC drainage-pattern tube and tubular fittings with ends as required for application.

2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.

B. Form: tube.

C. Color: Black.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Piping installed in building plenums shall meet requirements of materials within ducts or plenums (ceiling spaces used as supply or return air plenums) and shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Materials.

C. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

D. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

E. Aboveground, vent piping all sizes shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

F. Underground, soil, waste, and vent piping all sizes shall be any of the following:
1. Solid wall schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Section "Sanitary Sewerage."

B. Basic piping installation requirements are specified in Division 22 Section "Materials and Methods."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

F. 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.

G. 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.

H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

L. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

F. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "Valves."

B. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valve are specified in Division 22 Section "Plumbing Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

H. Install supports for vertical PVC piping every 48 inches (1200 mm).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

SECTION 22 14 13
FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Division 33 Section "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, **provide products by one of the following**:

   a. ANACO-Husky.
   b. Dallas Specialty & Mfg. Co.
   c. Fernco Inc.
   d. Matco-Norca, Inc.
   e. MIFAB, Inc.
   f. Mission Rubber Company; a division of MCP Industries, Inc.
   g. Stant.
   h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, **provide products by one of the following**:

   a. ANACO-Husky.
   b. Clamp-All Corp.
   c. Dallas Specialty & Mfg. Co.
   d. MIFAB, Inc.
   e. Mission Rubber Company; a division of MCP Industries, Inc.
   f. Stant.
   g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall schedule 40 PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Solvent Cement: ASTM D 2564.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings:

   a. Manufacturers: Subject to compliance with requirements, **provide products by one of the following**:

      1) Dallas Specialty & Mfg. Co.
      2) Fernco Inc.
      3) Mission Rubber Company; a division of MCP Industries, Inc.
      4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

   b. Standard: ASTM C 1173.
   c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. Sleeve Materials:

      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

   a. Manufacturers: Subject to compliance with requirements, **provide products by one of the following**:

      1) Cascade Waterworks Mfg. Co.
      2) Mission Rubber Company; a division of MCP Industries, Inc.

   b. Standard: ASTM C 1460.
   c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. 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.

J. Lay buried building storm 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.

K. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: **2 percent** downward in direction of flow for piping NPS 3 (DN 80) and smaller; **2 percent** downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Storm-Drainage Piping: **2 percent** downward in direction of flow.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

M. Install aboveground PVC piping according to ASTM D 2665.

N. Install underground **PVC** piping according to ASTM D 2321.

O. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Storm Drainage Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

C. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: **Shielded**, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Division 22 Section "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install **carbon-steel** pipe hangers for horizontal piping in noncorrosive environments.
2. Install **stainless-steel** pipe hangers for horizontal piping in corrosive environments.
3. Install **carbon-steel** pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.

2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. Spacing for 10-foot (3-m) pipe lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for **PVC** piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

I. Install supports for vertical **PVC** piping every 48 inches (1200 mm).

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves **with cleanout cover flush with floor**.
3. Comply with requirements for **cleanouts** specified in Division 22 Section "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping[**, except outside leaders,**] on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping **NPS 6 (DN 150) and smaller** shall be the following:
   1. Hubless, cast-iron soil pipe and fittings; **CISPI,** hubless-piping couplings; and coupled joints.

C. Aboveground, storm drainage piping **NPS 8 (DN 200) and larger** shall be the following:
   1. Hubless, cast-iron soil pipe and fittings; **CISPI,** hubless-piping couplings; and coupled joints.

D. Underground storm drainage piping **NPS 6 (DN 150) and smaller** shall be the following:
   1. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Underground, storm drainage piping **NPS 8 (DN 200) and larger** shall be the following:
   1. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221413

SECTION 22 42 50
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Backflow preventers.
2. Dishwasher air-gap fittings.
3. Water regulators.
4. Balancing valves.
5. Thermostatic water mixing valves.
6. Water tempering valves.
7. Strainers.
8. Outlet boxes.
9. Washer-supply outlets.
10. Hose stations.
11. Key-operation hydrants.
12. Wheel-handle wall hydrants.
13. Nondraining nonfreeze post hydrants.
14. Trap seal primer valves.
15. Drain valves.
16. Backwater valves.
17. Miscellaneous piping specialties.
18. Sleeve penetration systems.
19. Flashing materials.
20. Cleanouts.
21. Floor drains.
22. Trench drains.
23. Roof drains.
24. Grease interceptors.
25. Oil interceptors.
26. Solids interceptors.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.
4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig (860 kPa).
2. Sanitary Waste and Vent Piping: 10-foot head of water (30 kPa).
3. Storm Drainage Piping: 10-foot head of water (30 kPa).

1.5 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers and water regulators.
2. Balancing valves and strainers.
3. Thermostatic water mixing valves and water tempering valves.
4. Water hammer arresters, air vents, and trap seal primer valves and systems.
5. Drain valves, hose bibbs, hydrants, and hose stations.
6. Outlet boxes and washer-supply outlets.
7. Backwater valves, cleanouts, floor drains, open receptors, trench drains, and roof drains.
8. Air-admittance valves, vent caps, vent terminals, and roof flashing assemblies.
9. Grease interceptors, oil interceptors, and solids interceptors.
10. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field test reports.

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators.
2. Thermostatic water mixing valves and water tempering valves.
3. Trap seal primer valves and systems.
4. Hose stations and hydrants.
5. Grease interceptors, oil interceptors, and solids interceptors.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

A. Available Manufacturers:

B. Manufacturers:
1. B & K Industries, Inc.
2. Cla-Val Co.
3. Conbraco Industries, Inc.
4. Mueller Co.; Hersey Meters Div.
5. Park Equipment.
6. Watts Industries, Inc.; Water Products Div.
7. Zurn Industries, Inc.; Wilkins Div.

C. General: ASSE standard, backflow preventers.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

D. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

E. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

F. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

G. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.

H. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

I. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

J. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves.

K. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, NPS 3/8 (DN 10).

L. Laboratory Faucet Vacuum Breakers: ASSE 1035, suitable for continuous pressure application and chrome plated; consisting of primary and secondary checks; intermediate vacuum breaker; and threaded ends, NPS 1/4 or NPS 3/8 (DN 8 or DN 10) as required.

M. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves;

and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

1. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.

N. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

O. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm (0.19-L/s) flow and applications with up to 10-foot head of water (30-kPa) back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.

P. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 DISHWASHER AIR-GAP FITTINGS

A. Description: ASSE 1021, fitting suitable for use with domestic dishwashers and for deck mounting; with plastic body, chrome-plated brass cover; and capacity of at least 5 gpm (0.32 L/s); and inlet pressure of at least 5 psig (35 kPa) at temperature of at least 140 deg F (60 deg C). Include 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet hose connections.

B. Hoses: Rubber and suitable for temperature of at least 140 deg F (60 deg C).

1. Inlet Hose: 5/8-inch- (16-mm-) ID and 48 inches long.
2. Outlet Hose: 7/8-inch- (22-mm-) ID and 48 inches long.

2.4 WATER REGULATORS

A. Available Manufacturers:
1. Cla-Val Co.
2. Conbraco Industries, Inc.
3. Watts Industries, Inc.; Water Products Div.
4. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig (1035 kPa) minimum. Include integral factory-installed or separate field-installed, Y-pattern strainer.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.

2. NPS 2-1/2 (DN 65) and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved, interior epoxy coating for regulators with cast-iron body.

a. Type: Single-seated, direct operated.
b. Type: Pilot-operated, single- or double-seated, cast-iron-body main valve, with bronze-body pilot valve.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.

2.5 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

1. Available Manufacturers:

a. Amtrol, Inc.
b. Flow Design, Inc.
c. ITT Industries; Bell & Gossett Div.
d. Watts Industries, Inc.; Water Products Div.

2. NPS 2 (DN 50) and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
3. NPS 2 (DN 50) and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
4. NPS 2-1/2 (DN 65) and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

B. Memory-Stop Balancing Valves, NPS 2 (DN 50) and Smaller: MSS SP-110, ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include two-piece, copper-alloy body with standard or full-port, chrome-plated brass ball, replaceable seats and seals, threaded or solder-joint ends, and vinyl-covered steel handle with memory-stop device.

1. Available Manufacturers:

a. Conbraco Industries, Inc.
b. Crane Co.
c. Grinnell Corporation.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corp.

2.6 THERMOSTATIC WATER MIXING VALVES

A. Manufacturers:
1. Bradley.
2. Lawler Manufacturing Company, Inc.
3. Leonard Valve Company.
4. Powers.
5. Symmons Industries, Inc.
6. T & S Brass and Bronze Works, Inc.

B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer. Refer to plumbing schedules for further information.

2.7 WATER TEMPERING VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Heat-Timer Corporation.
2. Holby Valve Co., Inc.
3. Sparco, Inc.
4. Watts Industries, Inc.; Water Products Div.

C. General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.

D. System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited antiscald protection. Include threaded inlets and outlet.

1. Finish: [**Rough bronze**] [**Chrome plated**].

E. Limited-Volume, Water Tempering Valves: Solder-joint inlets and NPS 3/4 (DN 20) maximum outlet.

2.8 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.
3. NPS 2-1/2 (DN 65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.

   a. Drain: Factory- or field-installed, hose-end drain valve.

2.9 OUTLET BOXES

A. Available Manufacturers:

1. Acorn Engineering Company.
2. Gray, Guy Manufacturing Co., Inc.
3. Oatey.
4. Symmons Industries, Inc.
5. Zurn Industries, Inc.; Jonespec Div.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

C. Clothes Washer Outlet Boxes: With hot- and cold-water hose connections and drain. Refer to plumbing schedules for further information.

D. Icemaker Outlet Boxes: With hose connection. Refer to plumbing schedules for further information.

E. Reinforcement: 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking between studs. Fire-retardant-treated-wood blocking is specified in Section "Rough Carpentry."

2.10 HOSE STATIONS

A. Available Manufacturers:
1. Leonard Valve Company.
2. Strahman Valves, Inc.
3. T & S Brass and Bronze Works, Inc.

B. General: Assembly with fitting complying with ASME A112.18.1M and hose-connection outlet with threads complying with ASME B1.20.7. Refer to plumbing schedules for further information.

2.11 KEY-OPERATION HYDRANTS

A. Available Manufacturers:

1. Josam Co.
2. Simmons Manufacturing Co.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Industries, Inc.
6. Woodford Manufacturing Co.
7. Zurn Industries.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig (860 kPa). Refer to plumbing schedule for further information.

2.12 WHEEL-HANDLE WALL HYDRANTS

A. Available Manufacturers:
1. B & K Industries, Inc.
2. NIBCO INC.
3. Sioux Chief Manufacturing Co., Inc.
4. Watts Industries, Inc.; Water Products Div.
5. Woodford Manufacturing Co.
6. Zurn Industries, Inc.; Jonespec Div.

B. Refer to plumbing schedule for further information.

2.13 NONDRAINING NONFREEZE POST HYDRANTS

A. General: All-metal lever operation with nondraining water-storage reservoir, designed without drain and to be freezeproof with components of at least length required for burial of valve and water storage reservoir below frost line. Refer to plumbing schedule for further information.

2.14 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

1. Available Manufacturers:
   a. Josam Co.
   b. MIFAB Manufacturing, Inc.
   c. Precision Plumbing Products, Inc.
   d. Smith.
   e. Wade.
   f. Watts Industries, Inc.
   g. Zurn Industries.

2. 125-psig (860-kPa) minimum working pressure.
3. Bronze body with atmospheric-vented drain chamber.
4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type Trap Seal Primer Valves: ASSE 1044, fixture-trap, waste-drainage-fed type, with the following characteristics:

1. Chrome-plated, cast-brass, NPS 1-1/4 (DN 32) minimum, lavatory P-trap with NPS 3/8 (DN 10) minimum, trap makeup connection.

C. Trap Seal Primer System: Factory-fabricated, automatic-operation assembly for wall mounting with the following:

1. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water tubing inlet and manifold with number of NPS 1/2 (DN 15) outlets as indicated.
2. Cabinet: Steel box with stainless-steel cover.
3. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
4. Water Hammer Arrester: ASSE 1010.
5. Vacuum Breaker: ASSE 1001.

2.15 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 (DN 20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Hose-End Drain Valve: MSS SP-80, gate valve, Class 125, ASTM B 62 bronze body, with NPS 3/4 (DN 20) threaded or solder-joint inlet and ASME B1.20.7, garden-hose threads on outlet and cap. Hose bibbs are prohibited for this application.

C. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig (1380-kPa) minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 (DN 6) side drain outlet and cap.

2.16 BACKWATER VALVES

A. Available Manufacturers:

1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Watts Industries, Inc.; Drainage Products Div.
4. Zurn Industries, Inc.; Specification Drainage Operation.

B. Horizontal Backwater Valves: ASME A112.14.1, cast-iron body, with removable bronze swing-check valve and threaded or bolted cover.

1. Closed-Position Check Valve: Factory assembled or field modified to hang closed unless subject to backflow condition.
2. Open-Position Check Valve: Factory assembled or field modified to hang open for airflow.
3. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor, instead of cover.

C. Drain Outlet Backwater Valves: Cast-iron or bronze body, with removable ball float, threaded inlet, and threaded or spigot outlet for installation in bottom outlet of floor drain.

2.17 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

1. Available Manufacturers:

a. Josam Co.
b. Smith, Jay R. Mfg. Co.
c. Tyler Pipe; Wade Div.
d. Zurn Industries, Inc.; Specification Drainage Operation.

B. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Available Manufacturers:
a. Josam Co.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.

d. Watts Industries, Inc.
e. Zurn Industries, Inc.

C. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig (860 kPa); integral nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
2. Finish for Service Areas: Rough bronze.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Wheel handle or operating key.
5. Operation for Service Areas: Operating key.
6. Operation for Finished Rooms: Operating key.
7. Include operating key with each operating-key hose bibb.
8. Include wall flange with each chrome- or nickel-plated hose bibb.

D. Air Vents: Float type for automatic air venting.

1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 3/8 (DN 10) minimum inlet; 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C); and threaded vent outlet.
2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 (DN 10) minimum inlet, 150-psig (1035-kPa) minimum pressure rating, and threaded vent outlet.

E. Air-Admittance Valves: Plastic housing with mechanical-operation sealing diaphragm, designed to admit air into drainage and vent piping and to prevent transmission of sewer gas into building.

1. Available Manufacturers:

a. B & K Industries, Inc.
b. IPS Corporation.
c. J & B Products.
d. Oatey.
e. Sioux Chief Manufacturing Co., Inc.

2. Stack Vent Valve: ASSE 1050, designed for installation as terminal on soil, waste, and vent stacks, instead of stack vent extending through roof, in NPS 2 to NPS 4 (DN 50 to DN 100).
3. Fixture Vent Valve: ASSE 1051, designed for installation on waste piping, instead of vent connection, for single fixture, in NPS 1-1/4 to NPS 2 (DN 32 to DN 50).

F. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

1. Available Manufacturers:
2. Manufacturers:

a. Acorn Engineering Company; Elmdor/Stoneman Div.

3. Open-Top Vent Cap: Without cap.
4. Low-Silhouette Vent Cap: With vandal-proof vent cap.
5. Extended Vent Cap: With field-installed, vandal-proof vent cap.

G. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.

H. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.

1. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
2. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

I. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

J. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

K. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

L. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

M. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

N. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

O. Downspout Boots: ASTM A 48 (ASTM A 48M), gray-iron casting, with NPS 4 (DN 100) outlet; shop-applied bituminous coating; and inlet size to match downspout.

P. Downspout Boots: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.

Q. Conductor Nozzles: Bronze body with threaded inlet for connected conductor size, and bronze wall flange with mounting holes.

1. Finish: Nickel bronze.

2.18 SLEEVE PENETRATION SYSTEMS

A. Available Manufacturers:

1. ProSet Systems, Inc.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.19 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152 (ASTM B 152M), of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.20 CLEANOUTS

A. Cleanouts,: Comply with ASME A112.3.1.

1. Application: Floor cleanout and wall cleanout.
2. Manufacturer:

a. Josam Co.

b. Smith.
c. Wade.
d. Zurn.
3. Refer to Plumbing Schedule for Specification Standards.

2.21 FLOOR DRAINS

A. Floor Drains,: Comply with ASME A112.3.1.

1. Application: Floor drain.
2. Manufacturer:

a. Josam Co.
b. MiFab.
c. Smith.
d. Wade Div.
e. Zurn Industries.
3. Refer to Plumbing Schedule for Specification Standards.

2.22 TRENCH DRAINS

A. Trench Drains: Comply with ASME A112.3.1.
1. Manufacturer:

a. Josam Co.
b. Smith.
c. Wade Div.
d. Zurn Industries.
2. Refer to Plumbing Schedule for Specification Standards.

2.23 ROOF DRAINS

A. Roof Drains,: Comply with ASME A112.3.1.

1. Application: Roof drain.
2. Manufacturer:

a. Josam Co.
b. Smith.
c. Wade Div.
d. Zurn Industries.
3. Refer to Plumbing Schedule for Specification Standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

D. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

E. Install draining-type ground and ground post hydrants with 1 cu. yd. of crushed gravel around drain hole.

1. Set ground hydrants with box flush with grade.
2. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

F. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

G. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

H. Install expansion joints on vertical risers, stacks, and conductors if indicated.

I. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

J. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

K. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

L. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

M. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

N. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
   b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
   c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

O. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

P. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
5. Coordinate oil-interceptor storage tank and gravity drain with Section "Fuel-Oil Distribution."

Q. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

R. Fasten recessed-type plumbing specialties to reinforcement built into walls.

S. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

T. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

U. Install air vents at piping high points. Include ball, gate, or globe valve in inlet.

V. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

W. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

G. Interceptor Connections: Connect piping, flow-control fittings, and accessories.

1. Grease Interceptors: Connect inlet and outlet to unit, and flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
2. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.
3. Solids Interceptors: Connect inlet and outlet.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer thermostatic water mixing valve water tempering valve grease interceptor and oil interceptor.

1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
2. Refer to Division 22 Section "Basic Mechanical Materials and Methods Mechanical Identification" for nameplates and signs.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 224250

Section 23 05 10
MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification Section apply to this and other sections of Division 23.

B. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, visit the site(s) of the proposed project, and become fully informed of the extent and character of the work required.

1.2 REFERENCE STANDARDS

A. Perform all Division 23 work in strict accordance with the Laws and Regulations of the State of Texas, and County and City codes/ordinances having jurisdiction over the project.

1.3 COORDINATION

A. Coordinate work under this Division to avoid conflicts and to attain satisfactory and complementary systems.

B. Coordinate work under this Division with work under other Divisions to avoid conflicts and to allow for adequate installation, maintenance, and operating space. Obtain the Architect's approval for penetrations of other parts of the Work prior to affecting them.

C. Prepare coordination drawings in accordance with Division 1 to a scale of ¼"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow if the work.

1.4 DEFINITIONS

Specific meanings used in Division 23 (variant forms are inferred):

A. Work: This project, or the reference part.

B. Provide:

1. Furnish and install, complete with necessary appurtenances.
2. "Provide" is implied throughout this Division unless language is specific.

C. Required: Required by the contract Documents.

D. Necessary: Necessary in order to obtain a finished system in satisfactory operating condition, and meeting all requirements.

E. Furnish: Procure and deliver, ready for installation, necessary and/or required.

F. Install: Receive, place securely, ready for connection to work specified elsewhere, and bring into satisfactory operating condition, as necessary and/or required.

G. Connect: Connect properly to mechanical work. This includes non-physical “connections” such as indirect waste drains.

H. Architect, Project Architect or Architect/Engineer Team.

1.5 SCOPE OF WORK

A. The work under this Division includes providing complete mechanical systems for the project.

B. All items of labor, material or equipment not required in detail by the specifications or plans, but incidental to, or necessary for the complete installation and proper operation of all phases of work described herein, or reasonably implied in connection therewith, shall be furnished as if called for in detail by the Contract Documents.

1.6 WORKMANSHIP

A. All labor shall be performed in a workmanlike manner by mechanics skilled in their particular trades. All installations shall be complete in both effectiveness and appearance whether finally enclosed or left exposed. The architect reserves the right to direct the removal or replacement of any item which in his opinion shall not present a reasonable neat or workmanlike appearance, providing that same can be properly installed in an orderly way.

1.7 MANUFACTURER’S INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the plans and specifications, manufacturer’s instructions and applicable codes. Contractor shall obtain written recommendations of installation and start-up instructions from material vendors and comply, unless otherwise required. Bring discrepancies between these instructions and project requirements to the attention of the Architect, and resolve prior to construction. Provide signed inspection report by manufacturer’s representative at system start-up to verify all is in compliant for product warranty.

1.8 WARRANTY

A. The contractor shall warranty his work against defective materials and workmanship for a period of 1-year from date of acceptance of the job.

1.9 TRAINING

A. Upon completion of the work and at a time designated by the Owner’s representative, provide a formal training session for the Owner’s operating personnel to include location, operation, and maintenance of all mechanical equipment and systems.

1.10 PERMITS AND FEES

A. Permits: Obtain special permits necessary for this portion of the Work.

B. Fees: Pay any fees associated with permits, required inspections, and permanent utility connections to this part of the work.

1.11 LICENSES

A. Work under this Division shall be performed by organizations and individuals holding a current license to perform such type of work by the authority having jurisdiction. “License” in this sense means any process, regardless of its appellation, which is normally mandated by the authority in order to perform such type of work within its jurisdiction. The stipulation of this paragraph applies even if the work is located physically on property owned or controlled by a higher authority. E.G., to work within the city limits of Corpus Christi, Texas, on a Federal project, State of Texas and City of Corpus Christi licenses which would be mandated to work on a private project shall be required even though the City and State may have no jurisdiction over the higher government.

B. In the event that the licensed organization loses its license or is unable to obtain one, or the licensed individual performing the work becomes unlicensed or deports the organization, notify Architect immediately in writing.

1.12 UTILITY COORDINATION

A. Permanent: Provide all ancillary work necessary to obtain utility connections. Pay connection fees. Arrange for connection in a timely manner. Coordinate time and arrangement of other work with the serving utility, and comply with utility standards.

B. Temporary: Refer to Division 1.

C. General: The contractor shall verify to his own satisfaction the location, elevation and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work. The contractor shall also verify location, conduct all necessary tests, inspections, coordinate with owner’s representatives and utilities, and check or existing underground utilities and lines before ditching. Repair of any cut or damaged lines or utilities shall be the sole responsibility of the contractor.

1.13 LISTING AND LABELING

Materials required to be listed shall be listed and labeled for the particular service if a listing is available. Obtain and comply with the terms of listings. Listed material include.

A. NSF: Potable water and sanitary waste systems components.

B. UL: Electrical materials.

C. AMCA: Air moving devices and related accessory items.

D. ARI: HVAC equipment.

E. FM or UL: Hazardous fluid and fire protection system components.

F. FIA, FM or AGA: Fuel gas system components.

1.14 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new. Products shall be currently manufactured.

B. All materials and equipment shall be clearly marked, stamped or labeled for identification. Do not obscure nameplates. Where manufactures nameplates do not meet the requirements of the mechanical identification specification provide nameplates in accordance with the specification.

C. All products of similar type shall be provided by a single manufacturer throughout the project.

1.15 SUBMITTALS AND REVIEW

A. Contractor shall furnish to the Architect, within a reasonable time after award of contract, and prior to commencing any work, complete brochures in quadruplicate (plus quantity required by the Contractor) of all materials and equipment which the contractor proposes to furnish on the project. Data shall include descriptive literature, performance data, diagrams, capacity information, etc., to substantiate that proposed equipment will meet all of the requirements of the plans and specifications.

B. All data must be checked and any required changes noted thereon by the contractor, signed and dated prior to furnishing same to the Architect for approval. Contractor's attention is directed that it is mandatory that he thoroughly review data prior to furnishing same to assure that equipment is in accordance with plans and specifications and to assure prompt return of the data.

C. Deviations: Specifically call to the attention of the Architect every proposed deviation from the Contract Document requirements. Failure to identify deviations as such constitutes a representation that all requirements are not met.

D. Review: Review of submittals shall not be constructed as releasing the Contractor from responsibility, but rather as a means to facilitate coordination of the work and the proper selection and installation of the products. All work shall be subject to final acceptance by the Architect at the completion of the project.

E. If above information is not provided complete as specified above and within the allocated time, all equipment shall be furnished exactly as specified without any substitutions.

1.16 SUBSTITUTIONS

A. Refer to the Conditions of the Contract.

B. Where one vendor is indicated for a product, it is to establish a level of quality and performance; provide a product equal to that product in all respects from a vendor of equivalent performance.

C. Where multiple vendors are indicated for a product, any of those vendors meeting the requirements may be submitted.

D. Some product specifications in this Division are of the Acceptable Manufacturer type. Vendors listed as Acceptable Manufacturers are acceptable as vendors. However, the product submitted is subject to review as being fully equivalent in detail to the basis of design.

E. Where multiple vendors are listed with product model numbers, each model and vendor is acceptable, provide all requirements are met. Model numbers are indicated to the extent believe necessary to identify a type and are not necessary completely.

F. The architectural/engineering team has designed the facility using requirements of the Basis of Design equipment. Any substitutions from the basis of design, which will require additional A/E design and/or coordination, shall include the cost of necessary redesign by professionals licensed in the respective disciplines and the approval of the professional of record.

1.17 DRAWINGS AND SPECIFICATIONS

A. These specifications are accompanied by Drawings. The Drawings and Specifications are complementary each to the other, and what is called for by one shall be as binding as if called for by both.

B. The Drawings are generally diagrammatic. Lay out work at the site to conform to existing conditions; architectural, structural, mechanical, and electrical conditions; to avoid all obstructions; and to conform to details of installation as required. Provide an integrated satisfactorily operating installation. All necessary offsets in piping, fittings, duct, etc., required to avoid interferences between piping, equipment, architectural, and structural elements shall be provided by the Contractor. Provide all necessary routing and offsets to avoid conflict.

C. Verify and arrange that sufficient space is provided for the installation of proposed products and that adequate access will exist for service and maintenance of equipment. For this work, adequate access shall be defined as meaning that service personnel can access and maintain a piece of equipment without having to alter permanent construction. Further, for equipment located above ceilings, access shall be available within 3 feet pf ceiling opening or lay-in ceiling.

1.18 COMPLEMENTARY DOCUMENTS

A. Contract documents are complementary; requirements are not necessarily repetitively stated at each possible subject; consider that a requirement applies wherever applicable.

B. In the event of conflicting requirements in different parts of the Documents, the more expensive shall be presumed to apply, unless the Architect clarifies the requirement in a less expensive manner and waives the more expensive requirement in writing.

Since codes and standards are incorporated by reference, a particular conflict may appear in that a reference may use language that implies that a particular requirement in the Construction Documents is waived under the reference. This is not the case, unless specifically so clarified by the Architect. Generally, the specific Drawings and Specifications take precedence over waivers in multi-purpose reference documents.

C. Because of licensure and workmanship requirements, persons performing the work are presumed to be familiar with applicable codes, ordinances, laws, regulations and standards. Therefore, details of materials, methods, arrangements and size contained in such publications

are not necessarily replicated in the Contract Documents. This in no way deletes the requirement of the Contractor to comply. In the event of an apparent conflict between such publications and the Contract Documents, request clarification from the Architect prior to construction.

1.19 PROTECTION

A. All work, equipment and materials shall be protected at all times to prevent damage or breakage either in transit, storage, installation or testing. All openings shall be closed with caps or plugs during installation. All materials and equipment shall be covered and protected against dirt, water, chemicals or mechanical injury.

1.20 CUTTING AND PATCHING

A. All subcontractors shall notify the General Contractor sufficiently ahead of construction of any floor, walls, ceiling, roof, etc., of any openings that will be required for his work. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor's expense in a neat and workmanlike manner.

1.21 DEMOLITION

A. It shall be the responsibility of the contractor to see that all demolition and remodeling work involving his trade is accomplished in a manner and completeness to provide the appearance of new construction work.

B. Coordinate with other divisions before commencing work.

C. Abandoned air conditioning units shall be removed and disposed of off site in a legal manner.

D. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.

1.22 RECORD DOCUMENTS

A. Drawings: The Contractor shall maintain and update daily a set of "blueline" prints in the Field Office for the sole purpose of recording "installed" conditions. Revise the drawings to reflect as-built conditions, including all addenda, change orders, final shop drawing reviews, and field routing. Underground utilities shall be dimensionally located relative to readily accessible and identifiable permanent reference points, with accurate slope and elevation indicated. Submit prints for review. Revise, certify accuracy, and provide two final sets to the Architect.

B. Owner's Manual: Prior to final acceptance, provide two bound volumes to the Architect. Index by subject. Include corrected submittals and shop drawings that reflect final review comments; installation, operation and maintenance instructions, parts lists, wiring diagrams, and piping diagrams; warranties.

1.23 INSPECTION, OBSERVATION, AND TESTING

A. Cooperate with Architect's representative and authorities having jurisdiction. Provide complete access to the work at reasonable times.

B. Cover-up: Prior to covering up work, or conducting observed tests, request observation as appropriate. Provide adequate advance notice defined as a minimum of five working days. In some cases the Architect's representative may waive observation; otherwise arrange for observed construction and testing prior to cover-up. Should minimize required notice not to be provided and the contractor covers up work requiring observation, such work shall be uncovered at contractor's expense.

C. Pre-Testing: Self-inspect, pre-test, and remedy work prior to performing observed test.

D. Sectional Work: In circumstances where a requirement for phased construction or other considerations dictate sectional construction and/or testing, notify the Architect when construction begins on the first section of a system, and when the first section will be ready for observed testing, as well as subsequent sections. Test in the largest practical sections.

1.24 REFERENCE TO OTHER DIVISIONS

A. Refer to Division 26 for additional material requirements of electrical components provided under Division 23, such as loose starters, wiring and devices integral to equipment.

B. Refer to Division 2 for additional requirements governing excavation and backfill, supplemental to the requirements stated in this Division 23.

C. Comply with all requirements applicable to work required under this Division.

1.25 TESTING SERVICES

A. Additional Testing: In addition to any specified testing, the Architect may cause additional testing to be performed by an independent testing laboratory or any other qualified party. If such testing reveals deficient work by the Contractor, the Contractor shall pay for both the testing and remedial work. If such testing does not reveal deficient work by the Contractor, the Owner shall pay for the testing and the cost of repairing any damage caused by such testing.

B. Specified Testing Services: If independent testing services are specified regarding work under this Division, cooperate fully with the testing agency. Provide access to the work. Provide test holes and taps necessary. Remove work that is not tested on site, deliver to testing agency, and reinstall if undamaged; replace if damaged. Provide utilities, operational capability, and facilities for on-site testing as necessary.

END OF SECTION 230510

SECTION 23 05 15
MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Mechanical Identification."
9. Nonshrink grout for equipment installations.
10. Field-fabricated metal and wood equipment supports.
11. Installation requirements common to equipment specification sections.
12. Mechanical demolition.
13. Cutting and patching.
14. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 23 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data Book: Submit product data for all Division 23 items in a single reinforced 3-ring binder. Organize product data by specification section number. Provide table of contents showing the following:
1. Specification Section
2. Description of item
3. Submission number (1st submission, 2nd submission, etc.)
4. Submittal status (Approved, Revise and Resubmit, etc.)

B. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Coordination Drawings: For access panel and door locations.

E. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

F. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Eclipse, Inc.; Rockford-Eclipse Div.
   d. Epco Sales Inc.
   e. Hart Industries International, Inc.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Epco Sales Inc.
   d. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

   a. Calpico, Inc.
   b. Central Plastics Co.

4. Dielectric Couplings:

   a. Calpico, Inc.
   b. Lochinvar Corp.

5. Dielectric Nipples:

   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Perfection Corp.
   c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

    a. ANAMET Industrial, Inc.
    b. Central Sprink, Inc.
    c. Flexicraft Industries.
    d. Flex-Weld, Inc.
    e. Grinnell Corp.; Grinnell Supply Sales Co.
    f. Hyspan Precision Products, Inc.
    g. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
    h. Mercer Rubber Co.
    i. Metraflex Co.
    j. Proco Products, Inc.
    k. Uniflex, Inc.

7. Rubber, Flexible Connectors:

    a. General Rubber Corp.
    b. Mercer Rubber Co.
    c. Metraflex Co.
    d. Proco Products, Inc.
    e. Red Valve Co., Inc.
    f. Uniflex, Inc.

8. Mechanical Sleeve Seals:

    a. Calpico, Inc.
    b. Metraflex Co.
    c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2-Inch NPS and Smaller: Threaded.
2. 2-1/2-Inch NPS and Larger: Flanged.
3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

    a. Underdeck Clamp: Clamping ring with set screws.

5. PVC: Manufactured, permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. PE: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome-plate.

4. Cast Brass: Split casting, with concealed hinge and set screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome-plate.

5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
9. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
11. Cast-Iron Floor Plate: One-piece casting.

2.8 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch- high letters for ductwork and not less than 3/4-inch- high letters for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Material: Brass.
3. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.

F. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:

1. Green: Cold air.
2. Yellow: Hot air.
3. Yellow/Green or Green: Supply air.
4. Blue: Exhaust, outside, return, and mixed air.
5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
6. Nomenclature: Include the following:

a. Direction of airflow.
b. Duct service.
c. Duct origin.
d. Duct destination.
e. Design cubic feet per meter.

G. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/16 inch, unless otherwise indicated.
5. Thickness: 1/8 inch, unless otherwise indicated.
6. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches long; 1/8 inch for larger units.
7. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

H. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any criteria above.
6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
7. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.

8. Size: Approximate 2-1/2 by 4 inches for control devices, dampers, and valves; and 4-1/2 by 6 inches for equipment.

I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.9 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE removable sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. PVC Pipe Sleeves: For pipes smaller than 6-inch NPS.
b. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
c. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
d. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."

4. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
5. Soldered Joints: Construct joints according to CDA's "Copper Tube Handbook."
6. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

8. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
9. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
10. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

    a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. ABS Piping: ASTM D 2235 and ASTM D 2661.
    c. CPVC Piping: ASTM D 2846 and ASTM F 493.
    d. PVC Pressure Piping: ASTM D 2672.
    e. PVC Nonpressure Piping: ASTM D 2855.
    f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

11. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.

    a. Plain-End Pipe and Fittings: Use butt fusion.
    b. Plain-End Pipe and Socket Fittings: Use socket fusion.

X. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
    c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
    d. At access doors, manholes, and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Spaced at maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.
    g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4-inch- high lettering for name of unit if viewing distance is less than 24 inches, 1/2-inch- high lettering for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.

1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet.

D. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.4 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 23 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.10 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 230515

SECTION 23 05 23
VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following general-duty valves:

1. Bronze angle valves.
2. Cast-iron angle valves.
3. Copper-alloy ball valves.
4. Ferrous-alloy ball valves.
5. Ferrous-alloy butterfly valves.
6. Bronze check valves.
7. Gray-iron swing check valves.
8. Ferrous-alloy wafer check valves.
9. Spring-loaded, lift-disc check valves.
10. Bronze gate valves.
11. Cast-iron gate valves.
12. Bronze globe valves.
13. Cast-iron globe valves.
14. Chainwheel actuators.

B. Related Sections include the following:

1. Division 2 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 15 Section "Mechanical Identification" for valve tags and charts.
3. Division 15 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.1 for power piping valves andASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water, sanitary waste, and storm drainage piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

A. Manufacturers:

1. Type 2, Bronze Angle Valves with Nonmetallic Disc:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.

d. NIBCO INC.

B. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 2, Class 150, Bronze Angle Valves: Bronze body with nonmetallic PTFE or TFE disc.

2.4 CAST-IRON ANGLE VALVES

A. Manufacturers:

1. Type II, Cast-Iron Angle Valves with Metal Seats:

a. Crane Co.
b. NIBCO INC.

B. Cast-Iron Angle Valves, General: MSS SP-85, Type II.

C. Class 125, Cast-Iron Angle Valves: Bronze mounted with gray-iron body and bronze seats.

2.5 COPPER-ALLOY BALL VALVES

A. Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Crane Co.
c. Grinnell Corporation.
d. Hammond Valve.
e. Jamesbury, Inc.
f. Kitz Corporation of America.
g. Legend Valve & Fitting, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Red-White Valve Corp.
k. Watts Industries, Inc.; Water Products Div.

2. Safety-Exhaust, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Grinnell Corporation.
c. Hammond Valve.
d. Jamesbury, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

D. Safety-Exhaust, Copper-Alloy Ball Valves: Two-piece bronze body with exhaust vent opening, chrome-plated ball with vent, blowout-proof stem, locking handle, and working pressure rating of 600-psig CWP.

2.6 FERROUS-ALLOY BALL VALVES

A. Manufacturers:
1. Conbraco Industries, Inc.; Apollo Div.
2. Crane Co.
3. Hammond Valve.
4. Jamesbury, Inc.
5. Kitz Corporation of America.
6. Milwaukee Valve Company.
7. NIBCO INC.

B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous-Alloy Ball Valves: Class 150, full port.

2.7 FERROUS-ALLOY BUTTERFLY VALVES

A. Manufacturers:

1. Single-Flange, Ferrous-Alloy Butterfly Valves:
   a. Bray International, Inc.
   b. Crane Co.
   c. Grinnell Corporation.
   d. Hammond Valve.
   e. Kitz Corporation of America.
   f. Legend Valve & Fitting, Inc.
   g. Metraflex Co.
   h. Milwaukee Valve Company.
   i. Mueller.
   j. NIBCO INC.
   k. Red-White Valve Corp.
   l. Tyco International.
   m. Watts Industries.

2. Grooved-End, Ductile-Iron Butterfly Valves:
   a. Grinnell Corporation.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. Mueller.
   e. NIBCO INC.
   f. Victaulic Co. of America.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

C. Single-Flange, 150-psig (1035-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.

D. Grooved-End, 175-psig (1207-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.

2.8 BRONZE CHECK VALVES

A. Manufacturers:

1. Type 2, Bronze, Horizontal Lift Check Valves with Nonmetallic Disc:
   a. Crane Co.

2. Type 2, Bronze, Vertical Lift Check Valves with Nonmetallic Disc:

   a. Grinnell Corporation.
   b. Kitz Corporation of America.
   c. Milwaukee Valve Company.

3. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Red-White Valve Corp.
   g. Watts Industries.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

D. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

E. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.9 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:

1. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:

   a. Crane Co.
   b. Mueller Co.
   c. Watts Industries.

2. Grooved-End, Ductile-Iron Swing Check Valves:

   a. Grinnell Corporation.
   b. Mueller Co.
   c. Victaulic Co. of America.

B. Gray-Iron Swing Check Valves, General: MSS SP-71.

C. Type II, Class 125, gray-iron, swing check valves with composition to metal seats.

D. 175-psig (1207-kPa) CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.10 FERROUS-ALLOY WAFER CHECK VALVES

A. Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:

a. Crane Co.
b. Grinnell Corporation.
c. Metraflex Co.
d. Mueller.
e. NIBCO INC.
f. Red-White Valve Corp.
g. Watts Industries.

B. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

C. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

2.11 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Manufacturers:

1. Type II, Compact-Wafer, Lift-Disc Check Valves:
a. Grinnell Corporation.
b. Hammond Valve.
c. Metraflex Co.
d. Milwaukee Valve Company.
e. Mueller.
f. NIBCO INC.

2. Type IV, Threaded Lift-Disc Check Valves:
a. Grinnell Corporation.
b. Legend Valve & Fitting, Inc.
c. Metraflex Co.
d. Milwaukee Valve Company.
e. Mueller.
f. NIBCO INC.
g. Watts Industries.

B. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

D. Type IV, Class 150, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.12 BRONZE GATE VALVES

A. Manufacturers:

1. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Red-White Valve Corp.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 2, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge.

2.13 CAST-IRON GATE VALVES

A. Manufacturers:

1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Legend Valve & Fitting, Inc.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corp.
   i. Watts Industries.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

C. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.

2.14 BRONZE GLOBE VALVES

A. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Legend Valve & Fitting, Inc.

f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corp.

2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
a. Crane Co.
b. Grinnell Corporation.
c. Hammond Valve.
d. Kitz Corporation of America.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corp.

B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 125, Bronze Globe Valves: Bronze body with bronze disc.

D. Type 2, Class 150, Bronze Globe Valves: Bronze body with nonmetallic PTFE or TFE disc.

2.15 CAST-IRON GLOBE VALVES

A. Manufacturers:

1. Type I, Cast-Iron Globe Valves with Metal Seats:
a. Crane Co.
b. Grinnell Corporation.
c. Hammond Valve.
d. Kitz Corporation of America.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corp.

B. Cast-Iron Globe Valves, General: MSS SP-85.

C. Type I, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

2.16 CHAINWHEEL ACTUATORS

A. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating on exterior applications.
2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

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

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, gate, or plug valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Chilled-Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
5. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Single-flange, 150-psig (1035-kPa) CWP rating, ferrous alloy, with Buta-N liner.
6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: 300-psig (2070-kPa) CWP rating.
7. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
8. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
9. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.

10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) CWP rating.
11. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Dual-plate, wafer, Class 125 or 150 ferrous alloy.
12. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 150.
13. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.
14. Gate Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
15. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
16. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
17. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

D. Condenser Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-psig CWP rating, ferrous alloy, with Buta-N liner.
4. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 300-psig CWP rating.
5. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
6. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
8. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
9. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer, Class 125 or 150, ferrous alloy.
10. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
11. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
12. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
13. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
14. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
15. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.

E. Heating Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
5. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-psig CWP rating, ferrous alloy, with EPDM liner.
6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 300-psig CWP rating.
7. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal vertical, bronze.
8. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
9. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
11. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer, Class 125 or 150, ferrous alloy.
12. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.

13. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
14. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
15. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
16. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
17. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.

F. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water.
2. For Copper Tubing, NPS 2-1/2 (DN65) and larger: Flanged ends.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 (DN65) and larger: Flanged ends.
5. For Grooved-End, Copper Tubing and Steel Piping: Valve ends may be grooved. Do not use for steam or steam condensate piping.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

SECTION 23 05 29
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
3. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
4. Division 23 Section(s) "Metal Ducts” for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code—Steel"

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers: Similar to MSS Type 1, steel pipe hanger except hanger is made of fiberglass and continuous-thread rod and nuts are made of polyurethane or stainless steel.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Champion Fiberglass, Inc.
c. Cope, T. J., Inc.; Tyco International, Ltd.
d. Seasafe, Inc.
e. Unistrut Corp.; Tyco International, Ltd.
f. Wesanco, Inc.

B. Strap-Type, Fiberglass Pipe Hangers: Made of fiberglass loop with stainless-steel continuous-thread rod, nuts, and support hook.

1. Available Manufacturers:

a. Plasti-Fab, Inc.

2.5 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 FIBERGLASS STRUT SYSTEMS

A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Champion Fiberglass, Inc.
3. Cope, T. J., Inc.; Tyco International Ltd.
4. Seasafe, Inc.

2.7 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.8 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.9 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Available Manufacturers:

a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Portable Pipe Hangers.

2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Available Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.10 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.11 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include

auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 7 Section "Roof Accessories" for curbs.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2 (DN 65)**] and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Elastomeric isolation pads and mounts.
2. Freestanding spring isolators.
3. Elastomeric hangers.
4. Spring hangers.
5. Pipe riser resilient supports.
6. Resilient pipe guides.
7. Inertia, vibration isolation equipment bases.

1.3 SUBMITTALS

A. Product Data: Include load deflection curves for each vibration isolation device.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

C. Welding certificates.

1.4 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

A. Available Manufacturers:

B. Manufacturers:

1. Ace Mounting Co., Inc.
2. Amber/Booth Company, Inc.
3. B-Line Systems, Inc.
4. California Dynamics Corp.
5. Isolation Technology, Inc.
6. Kinetics Noise Control, Inc.
7. Mason Industries, Inc.
8. Vibration Eliminator Co., Inc.
9. Vibration Isolation Co., Inc.
10. Vibration Mountings & Controls/Korfund.

C. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene.
2. Durometer Rating: As required to load in upper halff of stress range.
3. Number of Layers: As recommended by manufacturer.

D. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Durometer Rating: As recommended by manufacturer.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig (690 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

H. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

I. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Available Manufacturers:

B. Manufacturers:
1. Isolation Technology, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. Vibration Eliminator Co., Inc.
5. Vibration Isolation Co., Inc.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 INSTALLATION

A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."

B. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

C. Install resilient bolt isolation washers on equipment anchor bolts.

3.3 EQUIPMENT BASES

A. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.

1. Cast-in-place concrete materials and placement requirements are specified in Division 3.

B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Cast-in-place concrete materials and placement requirements are specified in Division 3.

3.4 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust active height of spring isolators.

C. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.5 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

3.6 VIBRATION ISOLATOR SCHEDULE

A. Supported or Suspended Equipment: AHU.

1. Equipment Location: Floor.
2. Isolator Type: Elastomeric Isolation.

B. Supported or Suspended Equipment: AHU/In-line fans

1. Equipment Location: Suspended.
2. Isolator Type: Spring Hangers.

C. Supported or Suspended Equipment: Pumps

1. Equipment Location: Floor.

2. Isolator Type: Inertia Base.

D. Supported or Suspended Equipment: Chillers

1. Equipment Location: Floor.
2. Isolator Type: Elastomeric Isolation Pads.

E. Supported or Suspended Equipment: Terminal Units

1. Equipment Location: Suspended.
2. Isolator Type: Elastomeric Isolation Hangers.

F. Piping at Pumps

1. Equipment Location: Suspended within 50 pipe diameters.
2. Isolator Type: Spring Hangers.

G. Piping at Pumps

1. Equipment Location: Floor-supported within 50 pipe diameters.
2. Isolator Type: Elastomeric Isolation Mounts.

END OF SECTION 230548

SECTION 23 05 53
MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Stencils.
5. Valve tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

END OF SECTION 230553

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:

   a. Constant-volume air systems.
   b. Variable-air-volume systems.

2. Hydronic Piping Systems:
   a. Primary-secondary systems.
3. Kitchen hood airflow balancing.
4. Indoor-air quality measuring.
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

L. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

M. TAB: Testing, adjusting, and balancing.

N. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

O. Test: A procedure to determine quantitative performance of systems or equipment.

P. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 90 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service

representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

   a. Submittal distribution requirements.
   b. The Contract Documents examination report.
   c. TAB plan.
   d. Work schedule and Project-site access requirements.
   e. Coordination and cooperation of trades and subcontractors.
   f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from TAB firm's forms approved by Engineer.

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents or provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.

S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

A. Balance the primary system crossover flow first, then balance the secondary system.

3.11 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Check the setting and operation of safety and relief valves. Record settings.

3.12 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.

3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.13 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
3. Power factor if factory-installed instrumentation is furnished for measuring kilowatt.
4. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
5. Capacity: Calculate in tons of cooling.
6. If air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.14 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

3.15 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.16 PROCEDURES FOR COMMERCIAL KITCHEN HOODS

A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.

1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.
2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 inches (300 mm) between points and between any point and the perimeter. Calculate the average of the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.
3. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results.

C. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.

1. Check duct slopes as required.
2. Verify that duct access is installed as required.
3. Verify that point of termination is as required.
4. Verify that duct air velocity is within the range required.
5. Verify that duct is within a fire-rated enclosure.

D. Report deficiencies.

3.17 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.18 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.19 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.20 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. Settings for supply-air, static-pressure controller.
    f. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.

7. Position of balancing devices.

F. Vibration Measurement Reports:

1. Date and time of test.
2. Vibration meter manufacturer, model number, and serial number.
3. Equipment designation, location, equipment, speed, motor speed, and motor horsepower.
4. Diagram of equipment showing the vibration measurement locations.
5. Measurement readings for each measurement location.
6. Calculate isolator efficiency using measurements taken.
7. Description of predominant vibration source.

G. Sound Measurement Reports: Record sound measurements on octave band and dBA test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms:

1. Date and time of test. Record each tested location on its own NC curve.
2. Sound meter manufacturer, model number, and serial number.
3. Space location within the building including floor level and room number.
4. Diagram or color photograph of the space showing the measurement location.
5. Time weighting of measurements, either fast or slow.
6. Description of the measured sound: steady, transient, or tonal.
7. Description of predominant sound source.

H. Indoor-Air Quality Measurement Reports for Each HVAC System:

1. HVAC system designation.
2. Date and time of test.
3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
4. Room number or similar description for each location.
5. Measurements at each location.
6. Observed deficiencies.

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.21 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.

2. Randomly check the following for each system:

   a. Measure airflow of at least 10 percent of air outlets.
   b. Measure water flow of at least 5 percent of terminals.
   c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
   d. Measure sound levels at two locations.
   e. Measure space pressure of at least 10 percent of locations.
   f. Verify that balancing devices are marked with final balance position.
   g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in 4-hours.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.22 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

3.27 DUCT LEAKAGE TESTING

A. Contractor shall prepare ductwork for leakage testing by test and balance firm. Refer to requirements of Section 233113 for those duct sections being tested. Contractor shall remake any joints and/or duct runs which do not comply with maximum allowable leakage rates for retest and balance firm. Mechanical Contractor shall be responsible for any compensation due to the test and balance firm for additional testing required as a result of initial system failure.

B. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
   1. Test ductwork assemblies in excess of 1-1/2 inch static pressure class installed by Mechanical Contractor.
   2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
   3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa).

END OF SECTION 230593

SECTION 23 07 13
HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:

1. Insulation Materials:

   a. Phenolic Foam.
   b. Cellular glass.
   c. Flexible elastomeric.
   d. Mineral fiber.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied fabric-reinforcing mesh.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.
14. Corner angles.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. FSP: Foil, scrim, polyethylene.

D. PVDC: Polyvinylidene chloride.

E. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Application at linkages of control devices.
7. Field application for each equipment type.

C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control inspection reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

a. ACS.
b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
3. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Available Products:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Owens Corning; All-Service Duct Wrap.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

a. CertainTeed Corp.; Commercial Board.
b. Johns Manville; 800 Series Spin-Glas.
c. Knauf Insulation; Insulation Board.
d. Owens Corning; Fiberglas 700 Series.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Available Products:
a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000(Pipe Insulation.

c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 1 or 2-hour fire rating, as required.

1. Products:

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Thermal Ceramics; FireMaster Duct Wrap.
d. 3M; Fire Barrier Wrap Products.

2.4 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.5 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:

2.6 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

2.7 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
2. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
3. Color: White.

2.8 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Products:

a. Childers Products, Division of ITW; CP-76.
b. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.9 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.10 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

2.12 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness 20 mil; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Thickness: 0.020” Smooth.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.13 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.14 SECUREMENTS

A. Bands:
1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

2.15 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

3.5 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

3.6 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around

outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.7 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets,

valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.8 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.9 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

    1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
    2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
    3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.12 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.13 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections. Paint only those items in exposed, public areas.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent inspecting agency to perform field inspections and prepare inspection reports.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.

C. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

3.15 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed oven and warewash exhaust.
6. Indoor, exposed oven and warewash exhaust.
7. Indoor, concealed exhaust air.
8. Indoor, exposed exhaust air.
9. Outdoor, concealed supply and return.
10. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.16 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

E. Concealed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

F. Concealed, rectangular, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

G. Concealed, rectangular, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

H. Concealed, rectangular, exhaust-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

I. Concealed, return-air plenum insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
   2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

J. Exposed, round and flat-oval, supply-air duct insulation shall be the following:

   1. Double wall insulated duct (in finished spaces)

   2. Single wall insulated duct: 2-inches thick (in mechanical rooms and mezzanine)

K. Exposed, round and flat-oval, return-air duct insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick
   2. Insulation not required in conditioned spaces.

L. Exposed, round and flat-oval, outdoor-air duct insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick

M. Exposed, round and flat-oval, exhaust-air duct insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick.
   2. Insulation not required in conditioned spaces.

N. Exposed, rectangular, supply-air duct insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick. (include in mechanical rooms and mezzanine spaces).

O. Exposed, rectangular, return-air duct insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick (include in mechanical rooms and mezzanine spaces).
   2. Insulation not required in conditioned spaces.

P. Exposed, rectangular, outdoor-air duct insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick (include in mechanical rooms and mezzanine spaces).

Q. Exposed, rectangular, exhaust-air duct insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick (include in mechanical rooms and mezzanine spaces).
   2. Insulation not required in conditioned spaces.

R. Exposed, return-air plenum insulation shall be the following:
   1. Single wall insulated duct: 2-inches thick (include in mechanical rooms and mezzanine spaces).

3.17 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Round, flat-oval, and rectangular supply-air duct insulation shall be the following:
   1. Flexible Elastomeric: 3 layers, each 1” thick.

C. Round,flat-oval, and rectangular return-air duct insulation shall be the following:
   1. Flexible Elastomeric: 3 layers, each 1” thick.

3.18 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Chillers: Insulate cold surfaces on chillers, including, but not limited to, evaporator bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles with the following:
   1. Flexible Elastomeric: 1 inch thick.

D. Heat-exchanger (water-to-water for cooling service) insulation shall be the following:
   1. Flexible Elastomeric: 1 inch thick.

E. Chilled-water pump insulation shall be the following:

   1. Cellular Glass: 3 inches thick.

   2. Phenolic Foam: 2 inches thick.

F. Condenser-water pump insulation shall be the following:
   1. Not applicable.

G. Domestic water pump insulation shall be the following:
   1. Not applicable.

H. Heating-hot-water pump insulation shall be the following:
   1. Cellular Glass: 3 inches thick.

I. Chilled-water expansion/compression tank insulation shall be the following:
   1. Flexible Elastomeric: 1 inch thick.

J. Chilled-water air-separator insulation shall be the following:
   1. Flexible Elastomeric: 1 inch thick.

K. Domestic hot-water storage tank insulation shall be the following:

   1. Mineral-Fiber Board: 4 inches thick and 2-lb/cu. ft. nominal density.

L. Thermal storage tank (brine, water, ice) insulation shall be the following:

1. Cellular Glass: 4 inches thick.

3.19 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Fire-suppression piping.
2. Drainage piping located in crawl spaces.
3. Below-grade piping.
4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.20 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 3/4 inch thick.

B. Chilled Water and Brine, above 40 Deg F:

1. NPS 4 DN 100 and Smaller: Insulation shall be the following:

   a. Cellular Glass: 1-1/2 inches thick.

   b. Phenolic Foam: 1 inch thick.

2. NPS 6 (DN 150) to NPS 12 (DN300: Insulation shall be the following:

   a. Cellular Glass: 2 inches thick.

   b. Phenolic Foam: 1 ½ inches thick.

3. NPS 14 (DN350) and Larger: Insulation shall be the following:

   a. Cellular Glass: 2 - ½ inches thick.

   b. Phenolic Foam: 2 inches thick.

C. Condenser-Water Supply and Return:

1. No insulation.

D. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

E. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 3/4 inch thick.

3.21 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine:

1. All Pipe Sizes: Insulation shall be the following:

   a. Cellular Glass: Refer to interior schedule for thickness.

   b. Phenolic Foam: Refer to interior schedule for thickness.

B. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation not required.

C. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 ½ inches thick.

D. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

3.22 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.

B. Chilled Water, All Sizes: Use pre-insulated pipe system.

C. Condenser-Water Supply and Return, All Sizes: Insulation not required. Provide anti corrosion coating as specified in Hydronic Piping Specification.

D. Heating-Hot-Water Supply and Return, All Sizes, 200 Deg F and below: Use pre-insulated pipe system.

3.23 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed:

1. None.

E. Equipment, Concealed:

1. None.

F. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. None.

G. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. None.

H. Piping, Concealed:
1. ASJ – factory.

I. Piping, Exposed:
1. PVC: 20 mils thick.

3.24 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
1. Painted Aluminum, Smooth: 0.020 inch thick.

D. Ducts and Plenums, Exposed:
1. Painted Aluminum, Smooth: 0.020 inch thick.

E. Equipment, Concealed:
1. PVC: 20 mils thick.

F. Equipment, Exposed:

1. Aluminum, Smooth: 0.020 inch thick.

G. Piping, Concealed:
1. PVC: 20 mils thick.

H. Piping, Exposed:
1. Aluminum, Smooth: 0.020 inch thick.

3.25 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 23 09 00 BAS Instrumentation and Control

PART 1 - GENERAL

1.1 Related Sections

1. SECTION 23 09 93, BAS Sequences of Operations

1.2 References

1. American National Standards Institute (ANSI)

    1. ANSI/ISA 5.5-1985 Graphic Symbols for Process Displays.

    2. ANSI/IEEE 260.1 2004, Standard Letter Symbols for SI and Certain Other Units of Measurements (SI Units, Customary Inch Pound Units and Certain Other Units).

    3. ANSI/ASHRAE 135-2016, BACnet® - A Data Communication Protocol for Building Automation and Control Networks.

1.3 Acronyms, Abbreviations and Definitions

1. Acronyms used in BAS.

    1. BAS – Building Automation System

    2. EMCS – Energy Management and Control System

    3. GUI – Graphical User Interface

    4. HVAC - Heating, Ventilation, Air Conditioning

    5. I/O - Input/output

    6. ISA - Industry Standard Architecture

    7. O&M - Operation and Maintenance

    8. Niagara4 – Software framework for building device-to-enterprise applications and Internet-enabled products.

1.4 Standards Compliance

1. All equipment and material to be from manufacturer's regular production, UL and/or ULC or CSA certified, manufactured to standard quoted plus additional specified requirements.

2. Where UL and/or ULC or CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

3. Additional applicable codes and standards:

    1. National Electrical Code -- NFPA 70.

2. Local Electrical Codes

3. Federal Communications Commission -- Part J.

1.5 Work Included

1. Provide a new building system to control and monitor the building's mechanical and electrical systems.

2. Provide control valves, control damper actuators / end switches (gravity, fire and smoke control dampers by others), flow switches, thermal wells for temperature control, air flow stations, and other control devices as necessary.

3. Provide submittal data sheets, control drawings schematics (in Visio or AutoCAD), data entry, electrical installation, programming, start up, test and validation acceptance documentation, as-built documentation, maintenance manuals and system warranties.

4. All labor, material, equipment and services not specifically referred to in this specification or on associated drawings that are required to fulfill the functional intent of this specification shall be provided at no additional cost to the Owner.

5. The work covered by this specification and related sections consists of providing submittals, labor, materials, engineering, technical supervision, and transportation as required to furnish and install a fully operational BAS to monitor and control the facilities listed herein, and as required to provide the operation specified in strict accordance with these documents, and subject to the terms and conditions of the contract. The work in general consists of but is not limited to, the following:

   1. Furnish and install all to achieve system operation, any control devices, conduit and wiring, in the facility as required to provide the operation specified.

   2. Furnish complete operating and maintenance manuals and field training of operators, programmers, and maintenance personnel.

   3. Perform acceptance tests and commissioning as indicated.

1.6 Work By Others

1. Setting in place of valves and dampers, access doors, flow meters, water pressure and differential taps, flow switches, thermal wells, air flow stations, and current transformers shall be by others.

2. Duct smoke detectors, smoke dampers, fire/smoke dampers, and associated actuators / end switches shall be provided under another Division of this specification. The Division 26 electrical contractor shall interlock these devices to the BAS for shutdown/monitoring unless otherwise outlined in the Sequences of Operations for this project. The BAS contractor shall coordinate where to land wires and programming as needed.

3. Switches, and power wiring to motors, starters, thermal overload switches, and contactors, is specified under another Division of this specification.

PART 2 - PRODUCTS

2.1 Acceptable System Manufacturers and Contractors

1. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

2. BACnet/IP communication protocol must be used for all BAS manufacturer provided controllers (including terminal devices such as VAVs, FCUs, etc.)

3. Any approved manufacturer that can supply both equipment and controls must provide controls pricing separately from equipment pricing.

4. Acceptable Manufacturers

    1. Distech Controls (Basis of Design)

        1. Installed by Perry Mechanical Systems

2.2 Quality Assurance

1. All new building automation system products on this project shall be provided by a firm that is a registered ISO 9001:201508 manufacturer, for a minimum duration of 5 years, at time of bid.

2.3 Computer Hardware

1. Provide the following computer hardware for this project:

    1. Workstation Computer

    2. Uniterruptable Power Supplies

2. Workstation Hardware Requirements

    1. The Workstation shall adhere to the following minimum requirements: the latest generation Intel Core i5 processor, 8 GB RAM, and a 500GB solid state hard drive. It shall include the latest Windows 64-bit operating system (Windows 10 pro or newer), Microsoft Office programs, VM support, an ethernet adapter (10/100MB with RJ45 connector), 32X CD-ROM drive, and 2-USB ports.

    2. A minimum 21”, HDMI, DVI-D video interfaces, minimum 1024 x 768 resolution, 4x3 Widescreen, LED color monitor with a minimum 60 Hz refresh rate shall also be included.

    3. A mouse and keyboard shall be provided.

    4. Connection to the BAS LAN network shall be via an Ethernet network interface card, 100 Mbps.

    5. Workstation(s) should be loaded with Programming Tools

    6. Acceptable Manufacturers are:

        1. Dell

        2. Lenovo

3. HP (Hewlett Packard)

3. Uninterruptable Power Supplies

1. Provide the OWS, Server, and each network/building controller with individual UPS to provide clean, reliable, noise-filtered power at all times and to protect and maintain systems operation throughout short term power interruptions of up to 15 minutes duration.

2. Acceptable Manufacturer is APC.

2.4 Remote Access and Cyber Security Best Practices

1. Remote Access

1. The BAS contractor shall comply with owner IT infrastructure security policies for remote access. The owner IT team shall provide VPN, firewalls, etc. as needed for secure remote access.

2. A VPN and firewall must be used for secure remote access.

2. Cyber Security Best Practices

1. Unless predetermined by the owner IT team the BAS network shall be separate from the owners IT infrastructure besides a single point connection for remote access (owner provided internet access). All ethernet switches and communication backbone required for a fully operational BAS shall be provided by the BAS contractor.

2. Refer to “Communication Backbone” section of this specification for further details on segmenting the network (VLANs, subnets) and when managed switches (with port security, network user interface, etc.) are required based on building size / type.

3. Do not use factory provided usernames and passwords. Update passwords and usernames regularly for strong system security.

4. Update software and firmware regularly.

5. Adhere to controls manufacturer hardening guidelines where applicable.

2.5 Operator Software

1. Real-Time Displays

1. Provide a visual graphical representation of buildings, floor layouts, each piece of mechanical equipment and/or mechanical system that duplicates the represented system, presented as a web page via any industry standard web browser, where applicable.

2. Graphics shall include at a minimum the value of each input, each output, each setpoint, alarms and graphical representation of trend logs.

2. On-Line Help

1. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system.

3. Security

1. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data.

2. System security shall be selectable for each operator.

3. The system administrator shall have the ability to set passwords and security levels for all other operators.

4. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object.

5. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected.

6. This auto log-off time shall be set per operator password.

7. All system security data shall be stored in an encrypted format.

4. System Diagnostics.

1. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers.

2. The failure of any device shall be annunciate to the operator.

5. Third-Party Windows-Based Programs

1. The system shall be capable of utilizing third-party Windows-based programs for such things as spreadsheet analysis, graphing, charting, custom report generation, and graphics design packages.

2. Graphics generation shall be done using standard Windows packages.

3. No proprietary graphics generation software shall be needed.

6. Overrides

1. It shall be possible for the operator to override automatic analog and digital output commands.

2. Where the BAS software normally originates these outputs, the provision shall exist for the operator to terminate automatic BAS control of any particular output and to originate a manual analog or digital output command.

3. The provision shall exist for the operator to return analog or digital output command functions to automatic BAS software control.

7. Password Protection

1. Provide security system that prevents unauthorized use unless operator is logged on.

8. Trend Data

1. System shall periodically gather historically recorded selected samples of object data stored in the field equipment (global controllers, field controllers) and archive the information on the operator's workstation (server) hard disk.

1. Archived files shall be appended with new sample data, allowing samples to be accumulated over 3 years.

2. Systems that write over archived data shall not be allowed, unless limited file size is specified.

3. Samples may be viewed at the operator's terminal in a trend log.

4. Logged data shall be stored in spreadsheet format.

5. Operator shall be able to scroll through all trend log data.

2. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to six object types at the same time in different colours and these Graphs shall show object type value relative to time.

3. Operator shall be able to change trend log setup information such as time intervals and objects logged

9. Graphics

1. The operator's workstation shall display all data associated with the project.

1. Operator's workstation shall display all data using 3-D graphic representations of all mechanical equipment.

2. System shall be capable of displaying graphic file, text, and dynamic object data together on each display.

1. Information shall be labelled with descriptors and shall be shown with the appropriate engineering units.

2. All information on any display shall be dynamically updated without any action by the user.

3. Terminal shall allow user to change all field-resident BAS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display.

3. Animated graphic objects shall be displayed as a sequence of multiple bitmaps to simulate motion.

4. Analog objects may also be assigned to an area of a system graphic, where the colour of the defined area would change based on the analog objects value.

1. For example, an area of a floor-plan graphic served by a single control zone would change colour with respect to the temperature of the zone or its deviation from setpoint.

5. Separate Displays shall be supplied, specific to the project, to form the following overall presentation style.

6. All Displays will be linked in a logical fashion using hyperlink style (single left mouse click on text/display object/dynamic to load linked display if programmed)

7. Entire system shall operate without dependency on the operator's terminal. Provide graphic generation software at each workstation.

10. Alarms

1. Operator’s terminal shall provide audible, visual, electronic and printed means of alarm indication.

2. Any alarm may be handled based on its individual or assigned class actions.

1. Displayed on the Alarm console.

1. The system shall be provided with a dedicated alarm window or console.

2. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm.

2. Alarm reports shall be viewable via the BAS system and available for delivery by electronic mail (e-mail) or printing.

3. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator’s terminal.

1. Each entry shall include a description of the event-initiating object generating the alarm, time and date of alarm occurrence, time and date of object state return to normal, and time and date of alarm acknowledgement.

11. Scheduling

1. Operator’s terminal display of weekly schedules shall show all information in easy-to-read 7-day (weekly) format for each schedule.

2. Exception schedules (non-normal schedules, such as holidays or special events) shall display all dates that are an exception to the weekly schedules.

3. At the operator’s terminal, the system user shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.

12. Archiving

1. Store back-up copies of all controller databases in at least one OWS and the server.

2. Provide continuous supervision of integrity of all controller databases.

3. Data base back up and downloading to occur over LAN without operator intervention.

4. Operator to be able to manually download entire controller database or parts thereof.

13. Reports

1. Provide a report facility to generate and format for display, printing, or permanent storage, as selected by the operator, the reports as specified in this section.

2. Provide the software to automatically generate any report specified; the user will be able to specify the type of report, start time and date, interval between reports (hourly, daily, weekly, monthly) and output device.

3. As a minimum, the following reports shall be configured on the system:

1. Dynamic Reports: To allow operator to request a display of the dynamic value for the user specified points which shall indicate the status at the time the request was entered and updated at an operator modifiable scan frequency.

2. Summary Report: To permit the display or printing of the dynamic values for the user specified points.

3. Trend Reports: To permit the trending of points selected by the operator, including as a minimum digital input and output, analog input and output, set points, and calculated values.

4. Historical Data Collection: Provision shall be made to ensure historical data is not lost.

5. Alarm Summary: Provide a summary of all points in alarm and include as a minimum; point acronym, point description, current value, alarm type, limit exceeded, and time and date of occurrence.

6. Disable Point Summary: Provide a summary of all points in the disabled state and include as a minimum point acronym and point description.

7. Run Time Summary: Provide a summary of the accumulated running time of selected pieces of equipment with point acronym and description, run time to date, alarm limit setting. The run time shall continue to accumulate until reset individually by means of suitable operator selection.

8. Schedule Summary: Provide a summary of all schedules and indicate as a minimum, which days are holidays and, for each section, the day of the week, the schedule times and associated values; for digital schedules value will be on or off; for analog schedules value will be an analog value.

9. User Record Summary: Provide a summary of all user records to include as a minimum; user name, password, initials, command access level and point groups assigned.

2.6 BAS Controllers

1. All controllers on the job shall have the following minimum requirements:

    1. IP Communication (BACnet/IP)

        1. BACnet/IP communication protocol shall be used for all BAS manufacturer provided controllers (including terminal devices such as VAVs, FCUs, etc.)

        2. Support for IPv4 addressing

        3. DHCP support and Auto DNS

        4. Baud rate of not less than 100 Mbps

        5. 2 - RJ45 ports each capable of supporting 10/100 Base-T.

            1. Supporting controller daisy chaining on the Ethernet network via integral switch functionality.

            2. Integrated fail-safe should allow for communication when the controller is powered down.

        6. All controllers shall be able to communicate peer-to-peer without the need for a Network Control Unit (such as JACE, NAE, etc.) and shall be capable of assuming all responsibilities typically assumed by a Network Control Unit.

            1. Any controller on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.

            2. The resulting network will be a ‘Flat’ topology with all devices (controllers, workstations, …) connecting at the same physical network level

    2. Memory and Processing

        1. 512KB of RAM and 4GB of non-volatile flash memory.

        2. 32-bit microprocessor operating at a minimum of 600 MHz

    3. Each individual controller shall have an embedded web-based HTML5 visual interface with the following functionality without reliance on any other controller for access:

        1. Typical and custom control processes

        2. Scheduling

3. Energy management applications
4. Alarm management applications
5. Historical/trend data for points specified
6. Maintenance support applications
7. Graphical interface

4. Shall be capable of monitoring/controlling the following types of inputs/outputs:
    1. Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
    2. Analog inputs of 4-20 mA, 0-10 Vdc, thermistor and RTD in the range 0 to 350,000 ohm.
    3. Digital outputs including Form C relay outputs and Triac outputs
    4. Analog outputs of 4-20 mA and 0-10 Vdc.
    5. A minimum of 10% spare capacity for each point type for future point connection.
5. Any software required for programming shall be unlicensed and openly available
6. Auto commissioning features shall be available for VAVs and FCUs to schedule automatic testing and record values (air flows, pressures, temperatures, etc.) for different operating modes. The auto commissioning feature shall be able to email reports and run commissioning on a specified schedule.
7. Power and Environmental Requirements:
    1. 24 VAC with local transformer power
    2. The controllers shall also function normally under ambient conditions of -40 ˚F [-40 ˚C] to 158 ˚F [-70 ˚C] and 0% to 90% RH (non-condensing).
    3. Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.
8. Code Compliance:
    1. “FIPS 140-2 Level 1 Compliant” cryptographic module
    2. BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
    3. UL916 Energy management equipment
    4. FCC rules part 15, subpart B, class B
    5. UL94-V0 flammability rating

2.7 Control Panels

1. Indoor control cabinets located in offices or dry/dust free environments shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.

2. All outdoor control cabinets and control cabinets located in mechanical/electrical rooms shall be NEMA 4.

3. Control panels containing more than 4 controllers shall be provided with a terminal strip for field wiring. All control wiring inside the panel shall be between a terminal strip and controller inputs/outputs. All field control wiring shall be terminated at the terminal strip. Field control wiring inputs/outputs shall never be run directly to inputs/outputs of controller.

2.8 Automatic Control Dampers

1. Provision of dampers shall be provided by another section of this specification (the BAS contractor shall only be responsible for providing actuators/end switches for control dampers).

2.9 Variable Frequency Drives (VFDs)

1. Provision of variable frequency drives shall be provided by another section of this specification (the BAS contractor shall only be responsible for providing associated low voltage wiring and controls programming for the VFDs).

2.10 Auxiliary Control Devices, Sensors, and Transmitters

1. Control Valves

1. Hydronic System Two and Three-way Control Valves :

1. Ball Valve (only acceptable for valves 2” [50 mm] and smaller): Nickel-plated forged brass body rated at no less than 400 psi [2760 kPa], stainless steel ball and blowout proof stem, NPT female end fittings, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon seats, and a Tefzel flow characterizing disc.

2. Globe Valve (valves 2” [50 mm] and smaller): ANSI Class 250 bronze body, stainless steel stem, brass plug, bronze seat, and a TFE packing.

3. Globe Valve (valves 2.5” [62.5 mm] to 5” [125 mm]): ANSI Class 125 cast iron body, stainless steel stem, bronze plug, bronze seat, and a TFE V-ring packing. End connections shall be flanged.

4. Sizing

1. Two-Position: Line size or size using a pressure differential of 1 psi.

2. 2-way Modulating: 5 psig [35 kPa]or twice the load pressure drop, whichever is greater.

3. 3-way Modulating: Twice the load pressure drop, but not more than 5 psig [35 kPa].

5. Flow Characteristics: 2-way valves shall have equal percentage characteristics; 3-way valves shall have linear characteristics.

6. Close-off Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of total system head pressure for 2-way valves and 150% of the design pressure differential across the 3-way valves.

7. Power Requirements: 24 VAC, 24 VDC, or 120VAC as required by manufacturer

2. Butterfly Control Valves:

1. Butterfly Valve (valves 6” [150 mm] to 12” [300 mm]): Valve body shall be full lugged cast iron 200 psig [1380 kPa] body with a 304 stainless steel disc, EPDM seat, extended neck and shall meet ANSI Class 125/150 flange standards. Disc-to-stem connection shall utilize an internal spline. External mechanical methods to achieve this mechanical connection, such as pins or screws, are not acceptable. The shaft shall be supported at four locations by RPTFE bushings. Close-off pressure rating of 200 psi [1380 kPa] bubble tigher shut-off.

2. Butterfly Valve (valves 14” [350 mm] and larger): Valve body shall be full lugged cast iron 150 psig [1035 kPa] body with a 304 stainless steel disc, EPDM seat, extended neck and shall meet ANSI Class 125/150 flange standards. Disc-to-stem connection shall utilize a dual-pin method to prevent the disc from settling onto the liner. The shaft shall be supported at four locations by RPTFE bushings. Close-off pressure rating of 150 psi [1035 kPa] bubble tigher shut-off.

3. Sizing:

1. Two-Position: Line size or size using a pressure differential of 1 psi.

2. Modulating: [5 psig [35 kPa]] or twice the load pressure drop, whichever is greater. Size for the design flow with the disc in a 60° open-position with the design velocity less than 12 feet [3.7 m] per second.

4. Power Requirements: 24 VAC, 24 VDC, or 120VAC as required by manufacturer

3. Zone Control Valves (On/Off, Two-Position Applications):

1. Zone Valve (valves 1” [25 mm] and smaller): Forged brass body, rated at no less than 300 psi,[2070 kPa] female NPT union or sweat with a stainless steel stem and EPDM seals.

2. Sizing:

1. Two-Position: Line size or size using a pressure differential of 1 psi.[7 kPa]

3. Close-off Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of total system head pressure for 2-way valves and 125% of the design pressure differential across the 3-way valves.

4. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory.

5. Power Requirements: 24 VAC or 24VDC

4. Acceptable Manufacturers:

1. Belimo

2. Distech Controls

3. Bray

2. Damper Actuators

1. Features:

1. Electronic Damper Actuators: Actuators shall be sized for torque required for sealing the damper at load conditions, shall utilize v-bolt dual nut clamp with v-shaped tooth cradle coupling, and shall be capable of bing mechanically or electrically paralleled to increase torque if required. Electronic overload protection or digital rotation-sensing circuitry shall be used to prevent any damage to the actuator during a stall condition (and shall not require the use of end switches for protection). Fail-safe operation shall be provided as mechanical spring return (or electrical if spring return is not available for actuator size).

2. Terminal Unit Actuators: Actuators shall be sized for torque required for sealing the damper at load conditions and shall utilize V-bolt dual nut clamp with a V-shaped toothed cradle or an ISO-style direct-coupled mounting pad coupling. Close of differential pressure rating of 200psi.

2. Operating Temperature: -22° F to 122° F (-30° C to 50° C)

3. Protection / Rating: Minimum requirement NEMA type 2 / IP54 mounted in any orientation, NEMA 4X for outdoor applications, and UL94-5V(B) flammability for terminal unit actuators

4. Input/Output:

1. Two Position: Digital output including Form C relay output

2. Modulating: 4-20 mA and 0-10 Vdc.

3. End Switches / Auxiliary Switches (if applicable): SPDT, digital inputs from dry contact closure

5. Power:

1. Electronic Damper Actuators: Two position spring return shall be 24 or 120VAC as required by manufacturer and proportional actuators shall be 10VA at 24VAC or 8W at 24VDC

2. Terminal Unit Actuators: maximum of 1 VA at 24VAC or 1 W at 24VDC

6. Agency Approvals:

1. Electronic Damper Actuators: ISO 9001, UL, UL(C) and CSA C22.2 No. 24-93.

2. Terminal Unit Actuators: CE, UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC.

7. Approved Manufacturers / Models:

1. Distech Controls

2. Belimo

3. Water Pressure Sensor

1. Features: Provide water pressure sensors as indicated within the sequences of operations and/or controls diagrams with operating range suitable for application. Select range such that it covers from zero pressure to twice the amount of pressure desired for control purposes or that could be encountered. Sensor shall include over pressure input protection of a minimum two times rated input, burst pressure of a minimum five times rated input, and 17-4PH stainless steel wetted parts

2. Operating Temperature: -40° F to 185° F (-40° C to 85° C)

3. Protection / Rating: 17-4 PH Stainless Steel or NEMA 4X if enclosure provided

4. Input/Output: 4-20 mA output proportional to water pressure

5. Power: 3-wire circuit for power and output (COM, OUT, EXC) with EXC being 15-30 VDC (18-30 VAC)

6. Accuracy: ± 1% of full scale

7. Range: selectable pressure range 1 – 10,000 psi

8. Agency Approvals: CE & RoHS Compliant

9. Approved Manufacturer / Model:

1. Setra (Model 2091)

2. Distech Controls (PS-2LSP Series)

4. Water Differential Pressure Sensor

1. Features: Provide water differential or gage pressure sensors as indicated within the sequences of operations and/or controls diagrams suitable for application. Select range such that it covers from zero differential pressure up to a differential static pressure of 20% to 50% in excess of the maximum static pressure that could be encountered. Remember that if the sensor is used for the control of a chilled water bypass and is located across, for example, a chilled water AHU coil, the pressure drop of both the coil and the associated valve at full design flow have to be taken into account. Sensor shall include over pressure input protection of a minimum two times rated input, burst pressure of a minimum five times rated input, and 17-4PH stainless steel wetted parts.

2. Operating Temperature: -4° F to 185° F (-20° C to 85° C)

3. Protection / Rating: NEMA 4 or NEMA4X if enclosure provided

4. Input/Output: 4-20 mA output proportional to pressure sensed

5. Power: 3-wire circuit for power and output (COM, OUT, EXC) with EXC being 15-30 VDC (18-30 VAC)

6. Accuracy: ± 1% of full scale

7. Range: selectable pressure range 1 – 500 psi

8. Agency Approvals: CE & RoHS Compliant

9. Approved Manufacturer / Model:

    1. Setra (Model 231)

    2. Distech Controls (PS-2LDP Series)

5. Air Pressure Sensor – Duct / Space / Air Differential (Filter/Coil Monitoring)

    1. Features: Provide air pressure sensors as indicated within the sequences of operations and/or controls diagrams suitable for application. Select range as detailed below based on application type. Sensor shall include over pressure input protection of a minimum two times rated input or 20 psi (whichever is greater).

        1. Duct Mounted Static Pressure Sensor: Select range such that it covers from zero duct static pressure relative to the exterior of the duct up to a static pressure of between 20% and 50% in excess of the maximum static pressure that could be encountered in the duct relative to the duct exterior. Typically, for low pressure commercial duct consider using a range of 0 to 2” wc. (0 to 500Pa), for medium pressure duct use a range of 0 to 6” wc. (0 to 1500Pa) and for high-pressure duct use a range of 0 to 10” wc (0 to 2500 Pa).

        2. Space Static Pressure Sensor: Input range of -0.2” to + 0.2” wc (–50 to +50 Pa).

        3. Air Differential Pressure Sensor: Select range as required, taking into consideration pressure drop across filter or coil. Typically 0-2” wc (0 to 500 Pa) range for low-pressure commercial duct.

2. Operating Temperature: 32° F to 140° F (0° C to 60° C)

3. Protection / Rating: Polycarbonate (UL 94 V-0 Approved)

4. Input/Output: 4-20 mA, 0-5V, or 0-10V output proportional to pressure sensed

5. Power: 24VAC or 24VDC

6. Accuracy: ± 1% of full scale

7. Range: selectable pressure range 0- 20” w.c.

8. Agency Approvals: UL listed

9. Approved Manufacturer / Model:

    1. Setra

    2. Distech Controls

6. Air Pressure Switch

    1. Features: Provide air pressure switches as indicated within the sequences of operations and/or controls diagrams suitable for application. Select range as required, taking into consideration pressure drop across filter or coil. Typically 0.2-2” wc (0 to 500pa) range for low-pressure commercial duct. Sensor shall include over pressure input protection of a minimum two times rated input or 20 psi (whichever is greater).

    2. Operating Temperature: -4° F to 140° F (-20° C to 60° C)

    3. Protection / Rating: IP54 (NEMA 13) polycarbonate

    4. Input/Output: SPDT switch digital input from dry contact closure

    5. Power: N/A

    6. Accuracy: ± 1% of full scale

    7. Range: selectable pressure range 0- 12” w.c.

    8. Agency Approvals: N/A

    9. Approved Manufacturer / Model:

        1. Setra

        2. Distech Controls

7. Carbon Dioxide (CO2) Sensor

1. Features: Provide a space or duct carbon dioxide gas detection sensor as indicated within the sequences of operations and/or control diagrams. Optional features include BACnet communication, LCD display, setpoint adjustment, or integral temperature/humidity sensors (optional features shall be provided if necessary based on project scope).

2. Operating Temperature: 32° F to 122° F (0° C to 50° C)

3. Input/Output: 4-20 mA, 0-10 or 0-5 Vdc output compatible with BMS proportional to carbon dioxide concentration

4. Power: 24VAC or 24VDC

5. Accuracy: ± 3% of full scale

6. Range: 0 to 2000 ppm

8. Duct / Immersion / Outdoor Temperature Sensors

1. Features: Provide Thermistor or RTD temperature sensors as indicated within the sequences of operations and/or control diagrams. Install sensor as detailed below.

1. Outside Air Temperature Sensor: Provide outside air temperature sensors with Aluminum LB with PVC sun and windscreen weatherproof enclosure with conduit entrance. Install in an area where exhaust or roof heat will not affect readings.

2. Duct Mounted Temperature Sensor (ducts less than 10ft² [1m²] in cross-sectional area): Provide duct mounted, single point probe temperature sensor with 0.25” [6.35 mm] stainless steel probe of length between one-third and two-thirds of the duct width.

3. Duct Mounted Averaging Temperature Sensor (ducts greater than 10ft² [1m²] in cross-sectional area): Provide duct mounted, averaging, temperature sensor with probe length of 12 feet [3.66m] minimum or 1ft per ft² (3.25m per m²) of duct cross-sectional area, whichever is greater. Copper sheathed or plenum rated flexible construction.

4. Liquid Temperature Sensor: Provide immersion thermowell mounted temperature sensors for liquid temperature sensing. Rigid 0.25” [6.35mm] stainless steel probe of length, which is, at minimum, 20% of the pipe width. Provide Brass or Stainless steel thermowell (316 or 304) with thermal grease to aid temperature sensing.

5. Strap-on Temperature Sensor: Provide strap-on mounted temperature sensors where thermo well mounted sensors cannot be mounted.

2. Operating Temperature: -58° F to 212° F (-50° C to 100° C) dependent upon application

3. Input/Output: thermistor or RTD compatible with BAS

4. Power: dependent upon sensor type – provide as per manufacturers recommendations

5. Accuracy: ± 1.0°F (0.5 °C)

6. Range: -58° F to 212° F (-50° C to 100° C) dependent upon application

9. Duct / Outdoor Humidity Sensors

1. Features: Provide duct / outdoor humidity sensors as indicated within the sequences of operations and/or control diagrams. Outside air humidity sensors shall have ABS hinged weatherproof housing with conduit entrance and shall be installed in an area where exhaust or roof heat will not affect readings. Duct humidty sensors shall have ABS housing with conduit entrance. In addition all humidity sensors shall have 9” probe length, 60 micron HDPE filter, reverse voltage protection, and be output limited.

2. Operating Temperature: 32° F to 122° F (0° C to 50° C)

3. Input/Output: 4-20 mA two wires, 0-10 Vdc and/or 0-5 Vdc output proportional to relative humidity range of 0% to 100%

4. Power: 24VAC or 24VDC

5. Accuracy: ± 3% of full scale

6. Range: 5-95%RH

10. Space Temperature Sensors

1. Features: Provide space temperature sensors as indicated within the sequences of operations and/or control diagrams. Shall consist of an element within a ventilated cover. Space sensors located in mechanical rooms and large public spaces shall contain a network jack, but shall have no ability to adjust temperature setpoint (Set Point Adjustment). Space sensors located in other spaces shall include options (setpoint adjustment, network jack, fan speed selection, override switch, and/or digital display) in accordance with the drawings and sequences of operations.

2. Operating Temperature: 32° F to 122° F (0° C to 50° C)

3. Input/Output: dependent upon sensor type – provide as per manufacturers recommendations

4. Power: dependent upon sensor type – provide as per manufacturers recommendations

5. Accuracy: ± 1.0°F (0.5 °C)

6. Range: 32° F to 122° F (0° C to 50° C)

11. Space Humidity Sensors

1. Features: Provide space humidity sensors as indicated within the sequences of operations and/or control diagrams. Sensor shall have reverse voltage protection and be output limited.

2. Operating Temperature: 32° F to 122° F (0° C to 50° C)

3. Input/Output: dependent upon sensor type – provide as per manufacturers recommendations

4. Power: dependent upon sensor type – provide as per manufacturers recommendations

5. Accuracy: ± 3% of full scale

6. Range: 5-95%RH

12. Combination Relative Humidity And Temperature Sensors

1. Where there is a requirement for the monitoring of both relative humidity and temperature at the same location, the BMS Contractor shall provide a combination relative humidity sensor and temperature sensor. The individual sensors must each meet the specifications details above.

13. Low Limit Thermostats

1. Features: Provide low limit thermostats as indicated within the sequences of operations and/or control diagrams. Safety low limit thermostats shall be vapor pressure type with an element 20 ft [6.1 m] minimum length. Element shall respond to the lowest temperature sensed by any one foot section. Low limit shall be manual reset only.

2. Operating Temperature: -60° F to 160° F (-51° C to 71° C)

3. Input/Output: 2 SPDT switches, digital inputs from dry contact closure

4. Power: N/A

5. Accuracy: ± 1.0°F (0.5 °C)

6. Range: adjustable range 34° F to 70° F (1° C to 21° C)

14. Current Relay/Switch

1. Features: Provide current sensing relays as indicated within the sequences of operations and/or control diagrams. The current sensing relay shall be rated for the applicable load, shall have input and output isolation via current transformer, and the output relay shall have an accessible trip adjustment over its complete operating range. Whenever the status of a single speed motor is monitored it shall be done via a current sensing relay. The BAS contractor shall provide current sensing relays at the MCC starters (or at the local starter for motors without a MCC starter).

2. Operating Temperature: 5° F to 140° F (-15° C to 60° C)

3. Input/Output:digital input from dry contact closure

4. Power: Current relay shall be self-powered with no insertion loss

5. Accuracy: ± 2% of full scale

15. Current Sensor

1. Features: Provide current sensors as indicated within the sequences of operations and/or control diagrams. The current sensors shall be rated for the applicable load and shall be reverse polarity protected and output limited.

2. Operating Temperature: -20° F to 120° F (-29° C to 49° C)

3. Input/Output:4-20 mA, 0-10 or 0-5 Vdc output proportional to current draw

4. Power: Current sensor shall be self-powered with no insertion loss

5. Accuracy: ± 1% of full scale

16. Leak Detection Monitoring – Water

1. Features: Provide leak detectors as indicated within the sequences of operations and/or control diagrams. The appropriate leak detector type should be provided based on application (i.e spot leak detector for drain pans and rope leak detector for floors). Leak detectos shall be corrosion and abrasion resistant.

2. Operating Temperature: 50° F to 104° F (10° C to 40° C)

3. Input/Output: (2) Form C relays, digital input from dry contact closure

4. Power: 24 VAC

17. Damper End Switch

1. Features: Provide damper end switches as indicated within the sequences of operations and/or control diagrams. End switches shall prove a damper has reached the position specified. End switches shall be integral to damper actuator unless otherwise specified.

2. Input/Output: SPDT switch, digital input from dry contact closure

PART 3 - EXECUTION

3.1 Communication Backbone

1. To allow for future expandability, cyber security measures, optimal bandwidth, and enhanced data trending this project shall adhere to the below communication backbone requirements.

2. IP (CAT 5 / RJ45) Network

1. BACnet/IP communication protocol shall be used for all BAS manufacturer provided controllers (including terminal devices such as VAVs, FCUs, etc.)

2. For all buildings NOT exceeding 5 levels (including rooftops/cellars), 100m between ethernet connections, 250 controllers, or more than 1 type of operational technology residing on the same network (CCTV, lighting, access, etc.):

1. Ethernet Switches shall be provided as needed to support a fully functional BAS – fiber network shall not be required.

2. BACnet/IP communication for all BAS manufacturer provided controllers

3. Modbus TCP shall only be used for third party systems / equipment that do not support BACnet/IP

4. Modbus RTU and BACnet MS/TP only to be used for third party systems / equipment that do not support BACnet/IP provisions (VFDs, boilers, etc.)

3. Modbus RTU and BACnet MS/TP (RS-485) Network

1. Only to be used for systems / equipment that do not have IP provisions (VFDs, boilers, etc.)

3.2 Installation of Sensors

1. Install sensors according to manufacturer's recommendations.

2. Mount sensors rigidly and adequately for operating environment.

3. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 1 ft.[9 m] of sensing element for each 1 ft^2 [1 m^2] of coil area.

4. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

5. Install outdoor air temperature sensors on north wall at designated location with sun shield.

6. Install building pressure pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.

7. High and low limit thermostats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.3 Co-ordination

1. All work shall be performed at times acceptable to the Engineer/Construction Manager. Provide work schedule at the start of the job for the approval of the Engineer / Construction Manager. Schedule shall show when all staff and sub-contractors shall be on-site.

3.4 Electrical Work, Wiring and Safety

1. Electrical work shall be in accordance ANSI/NFPA 70 and the local Electrical Code.

2. Based on project location, Regional Regulation Compliance Certifications (CSA C22.1) will be required.

3. Electrical wiring, terminal blocks and other high voltage contacts shall be fully enclosed or properly guarded and marked to prevent accidental injury to personnel.

4. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26 00 00, and manufacturer's recommendations. Where the requirements of this Section differ from other Divisions, this Section shall take precedence.

    1. Power wiring to mechanical equipment, variable air volume boxes, and motor controllers shall be provided by the Electrical contractor (Division 26).

    2. EMT conduit shall be used in mechanical/electrical rooms and exposed spaces.

    3. Rigid Galvanized Steel conduit shall be used outdoors.

    4. Plenum rated cable shall be used in concealed spaces/hung ceilings.

5. All wiring associated with and required by the BAS shall be the responsibility of this contractor.

    1. The term "wiring" shall be construed to include furnishing of wire, conduit, and miscellaneous material and labor as required to install a total working system.

    2. If departures from the contract documents are deemed necessary by the contractor, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the drawings to the Engineer for approval.

6. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

7. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

8. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

9. Each run of communication wiring shall be a continuous length without splices when that length is commercially available.

10. Label communication wiring to indicate origination and destination.

11. Fiber optic cable shall comply with the following requirements:

    1. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 µm.

    2. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

3.5 Submittals

1. Schematic diagram of each controlled system. Label control points with point names.

2. Bill of Material for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.

3. Specification sheets for each item including manufacturers descriptive literature, drawings, diagrams, performance and characteristic curves, manufacturer and model number, size, layout, dimensions, capacity, etc.

4. Control schematics with narrative description and control descriptive logic fully showing and describing operation and/or manual procedures available to operating personnel to achieve proper operation of the building, including under complete failure of the BAS.

5. Shop drawings for each input/output point showing all information associated with each particular point including sensing element type and location; details of associated field wiring schematics and schedules; point address; software and programming details associated with each point; and manufacturer's recommended installation instructions and procedures for each type of sensor and/or transmitter.

6. Riser diagrams showing control network layout, communication protocol, and wire types.

7. Network diagram of control, communication, and power wiring for BAS Server and OWS installation.

3.6 As-built Documentation

1. As-built documentation shall consist of 4 hard copies and one soft copy for all information described below

2. The final documentation package shall include:

    1. As-built Submittals: Final as built control submittals and technical data sheets.

    2. Programming, Sequences, and Graphics: All programming, sequences, and graphics saved to an external hard drive.

    3. Operation and Maintenance Manuals: Factory operating and maintenance manuals with any customization required.

    4. Test Procedures and Reports: The test implementation shall be recorded with a description of the test exercise script of events and documented as test procedures.

3.7 Warranty

1. The BAS system labor and materials shall be warranted free from defects for a period of 1 year(s) after final commissioning and owner acceptance.

3.8 Training

1. BAS Contractor shall provide a minimum of 16 hours of training with course outline and materials for personnel designated by the owner.

2. If desired manufacturer provided training on the use and operation of all products provided within these specifications shall be available for purchase and attendance by the Owner or his designated agent. A list of training courses with detailed course outline and duration with the associated cost shall be provided as part of the BAS submittals.

3.9 Balancing and Commissioning

1. BAS Contractor shall provide a minimum of 16 hours of commissioning assistance with a commissioning agent and 16 hours of balancing assistance with a balancing agent. Balancing and commissioning agents shall NOT be provided by BAS contractor – BAS contractor is responsible for assistance only.

2. For projects without balancing and commissioning agents the BAS contractor shall self commission the system utilizing the allotted hours stated above.

3. For projects including gas detection / air quality sensors involved in life safety operations a minimum of 8 hours shall be provided within BAS scope of work for the gas sensor manufacturer to provide checkout, calibration, and owner training.

4. Provide commissioning data sheets prior to acceptance testing.

End of Section

SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal Ductwork.
2. Nonmetal ductwork.
3. Casing and plenums.
4. Kitchen hood ductwork.
5. Dishwasher exhaust ductwork.
6. Hangers and supports.

B. References:

1. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 1997a.
2. ASTM A 366/A 366M - Standard Specification for Commercial Steel (CS) Sheet, Carbon, (0.15 Maximum Percent) Cold Rolled; 1997.
3. ASTM A 569/A 569M - Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial; 1998.
4. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 1998.
5. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 1996.
6. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 1996.
7. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 1994.
8. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; latest Edition.
9. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; 1996.

1.3 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", latest edition and NFPA 90A.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Duct Construction Standards (DCS) for each pressure class required for this project. DCS shall include transverse and longitudinal joint type, any internal or external reinforcement and sheetmetal thickness and size for each pressure class.
4. Flexible duct manufacturer, type and product details.
5. Flexible connection materials and connection types.
6. Fitting fabrication details.
7. Damper details.
8. Description of hanger types and sizes for duct sizes used in this project. Hangers must comply with the latest edition of SMACNA's "HVAC Duct Construction Standards - Metal and Flexible". Hanger submittal should include hanger spacing to be used.

B. Coordination Drawings: Provide drawings indicating fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work. Minimum scale of ¼” = 1’0”. Coordinate duct location with other trades.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

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.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Construct with a radius of not less than 1-1/2 times width of duct on centerline. Where not possible, provide a centerline radius of 1.0 times the width of duct. Where space constraints will not allow a centerline radius of 1.0 times the width of duct, provide rectangular elbows with double wall (airfoil) factory fabricated turning vanes installed on vane runner rails. Turning vanes shall not be used in bends other than 90 degrees.

1. Branch connections shall be 45 degree entry fittings.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. McGill AirFlow LLC.
2. SPOT
3. SEMCO

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated. If duct is exposed to the weather, provide a continuous sheetmetal hat channel over all transverse joints and position openings in longitudinal seams facing in the direction of possible water flow. Provide a flexible, adhesive aluminum jacket designed for this application over entire duct surface per manufacturer’s recommendations.

D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.
5. Insulation thickness to be 2 inches.

E. Inner Duct: Minimum 0.028-inch (0.7-mm) solid sheet steel.

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. SPOT

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 36 Inches (1524 mm) in Diameter: Flanged.

D. Longitudinal Seams: Round and flat oval duct must be spiral seam ductwork. Longitudinal seam snap-lock duct will not be allowed.

E. Tees, Laterals and Bends: Fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Elbows and bends: Construct with a radius of not less than 1-1/2 times width of duct on centerline. Where not possible, provide a centerline radius of 1.0 times the width of duct. Elbows shall be of gored, pleated or stamped construction. 90 degree bends shall be a minimum of 5-gore. 45 degree bends shall be a minimum of 3 gore. Adjustable elbows will not be allowed.

2. Branch connections shall be conical, 45 deg. entry or lateral fittings.

2.4 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. SPOT

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Transverse Joints in Ducts Larger Than 36 Inches (1524 mm) in Diameter: Flanged.

2. Longitudinal Seams: Round and flat oval duct must be spiral seam ductwork. Longitudinal seam snap-lock duct will not be allowed.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Elbows and bends: Construct with a radius of not less than 1-1/2 times width of duct on centerline. Where not possible, provide a centerline radius of 1.0 times the width of duct. Elbows shall be of gored, pleated or stamped construction. 90 degree bends shall be a minimum of 5-gore. 45 degree bends shall be a minimum of 3 gore. Adjustable elbows will not be allowed.
b. Branch connections shall be conical, 45 deg. entry or lateral fittings.

D. Inner Duct: Minimum 0.028-inch (0.7-mm) solid sheet steel.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: [0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K)] at 75 deg F (24 deg C) mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.5 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Tie Rods: Galvanized steel, 3/8-inch (10-mm) minimum diameter.

2.6 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.

2. Maximum Thermal Conductivity:

   a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
   b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

   a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet (6 m) in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches (38 mm) from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal all duct according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. All duct: Seal Class A.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

   a. Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections, selected by Engineer from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel**.**

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

   a. Pressure Class: Positive [1-inch wg (250 Pa)]
   b. SMACNA Leakage Class for Rectangular: 12
   c. SMACNA Leakage Class for Round and Flat Oval: 12

2. Ducts Connected to Constant-Volume Air-Handling Units:

   a. Pressure Class: Positive 1-inch wg (500 Pa), or round up the ESP listed in the equipment schedules and provide, whichever is greater.
   b. SMACNA Leakage Class for Rectangular: 12
   c. SMACNA Leakage Class for Round and Flat Oval: 12

3. Ducts Connected to Variable-Air-Volume Air-Handling Units prior to terminal units:

   a. Pressure Class: Positive 3-inch wg (750 Pa)
   b. SMACNA Leakage Class for Rectangular: 12
   c. SMACNA Leakage Class for Round and Flat Oval: 12

C. Return, toilet exhaust and outside air ducts:

1. Pressure Class: Positive or negative 1-inch wg (250 Pa).
2. SMACNA Leakage Class for Rectangular: 12
3. SMACNA Leakage Class for Round and Flat Oval: 12

D. Special Exhaust Ducts:

1. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

   a. Exposed to View: Type 304, stainless-steel sheet.
   b. Concealed: Type 304, stainless-steel sheet.
   c. Welded seams and joints.
   d. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   f. SMACNA Leakage Class: 3.
   g. Minimum 18 gauge or thickness required per local code, whichever is greater

2. Ducts Connected to Dishwasher Hoods:

   a. Type 304, stainless-steel sheet.
   b. Welded seams and flanged joints with watertight EPDM gaskets.
   c. Pressure Class: Positive or negative 2-inch wg (500 Pa).
   d. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   e. SMACNA Leakage Class: 3.
   f. Minimum 18 gauge or thickness required per local code, whichever is greater

E. Duct Exposed to View

1. Supply Air Ducts: shall be double wall spiral round construction with 1” thick insulation in conditioned spaces and 2” insulation in unconditioned spaces.
2. Return and Exhaust Air Ducts: shall be un-insulated single wall spiral round construction in conditioned spaces and double wall round construction with 1” insulation in unconditioned spaces.

END OF SECTION

SECTION 23 33 00
DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.
12. Louvers.

B. Related Sections include the following:

1. Section "Fire Alarm" for duct-mounting fire and smoke detectors.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.

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. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT DAMPERS

A. Manufacturers:
1. CESCO Products.
2. Greenheck.
3. Ruskin Company.

B. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 6-inch (150-mm) width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 20 gauge, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Vinyl.

F. Blade Axles: Stainless Steel.

G. Tie Bars and Brackets: Galvanized steel.

H. Basis of Design: Ruskin S3G.

2.4 VOLUME DAMPERS

A. Manufacturers:
1. Flexmaster U.S.A., Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 2-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 22 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Single Skin Steel Blades: 22 gauge, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Molded synthetic.
5. Tie Bars and Brackets: Aluminum.
6. Tie Bars and Brackets: Galvanized steel.
7. Basis of Design: Ruskin MD 15 (rectangular) and MDRS25 (round).

D. Jackshaft: 1-inch- (25-mm-) diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 MOTORIZED CONTROL DAMPERS

A. Manufacturers:
1. CESCO Products.
2. Greenheck.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Ruskin Company.

B. General Description: AMCA-rated, parallel (return air applications) or opposed (outside air applications) blade design; minimum of 16 gauge thick, galvanized-steel frames with holes for duct mounting; minimum of 16 gauge thick, galvanized-steel damper blades with maximum blade width of 8 inches (203 mm).

1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
3. Provide closed-cell neoprene edging rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 1-inch wg; when tested according to AMCA 500D.

C. Basis of Design: Ruskin CD35.

2.6 FIRE DAMPERS

A. Manufacturers:
1. CESCO Products.
2. Greenheck.
3. METALAIRE, Inc.

4. Nailor Industries Inc.
5. Ruskin Company.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1-1/2 hours (3 hours as noed).

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 20 gauge galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 20 gauge frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: 24 gauge, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F rated.

J. Basis of Design: 1-1/2 hour – Ruskin 1BD2-B (rectangular) and FDR25 (round), 3 hour – Ruskin 1BD2-B3 (rectangular)

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. CESCO Products.
2. Greenheck.
3. Nailor Industries Inc.
4. Ruskin Company.

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Fusible Links: Replaceable, 165 deg F rated.

D. Frame and Blades16 gauge, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Modulating and two-position action.

1. Comply with requirements in Division 23 Section "Motors."
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).

4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
6. Electrical Connection: 115 V, single phase, 60 Hz.

G. Basis of Design: Ruskin FSD376.

2.8 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

1. Manufacturers:
   a. CESCO Products.
   b. Flexmaster U.S.A., Inc.
   c. Greenheck.
   d. Nailor Industries Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

   a. Less Than 12 Inches (300 mm) Square: Secure with two sash locks.
   b. Up to 18 Inches (450 mm) Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches.
   d. Sizes 24 by 48 Inches (600 by 1200 mm) and Larger: One additional hinge.

C. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

D. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

2.11 INSULATED ACOUSTICAL MEDIUM PRESSURE FLEXIBLE DUCT

A. Where flexible duct is shown on drawings, provide Flexmaster Type 8M UL 181 Class I Air Duct or equal.

B. The duct shall be constructed of a CPE fabric supported by helical wound galvanized steel. The fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.

C. The internal working pressure rating shall be at least 6” w.g. positive and 4” w.g. negative with a bursting pressure of at least 2 ½ time the working pressure

D. The duct shall be rated for a velocity of at lease 4000 feet per minute.

E. The duct must be suitable for continuous operation at a temperature range of -20° F to +250° F.

F. Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council’s Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties, shall be as follows:

1. The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7

Hz.	125	250	500	1000	2000	4000
6" diameter	7	31	40	38	40	27
8" diameter	13	29	36	35	38	22
12" diameter	21	28	29	33	26	12

2. The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	5	8	7	8	11	15
8" diameter	10	7	7	8	10	13
12" diameter	9	6	6	5	9	13

3. The self generated sound power levels (LW) dB re 10^{-12} Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	42	31	23	18	17	21
8" diameter	41	34	27	19	18	21
12" diameter	54	45	38	31	27	23

G. Factory insulate the flexible duct with fiberglass insulation. Provide insulation as required by ASHRAE 90.1.

H. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM #96, Procedure A.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.13 LOUVERS

A. Manufacturers:
   1. Ruskin
   2. Greenheck

B. Description: Stationary-type louver with blades designed to prevent the penetration of wind driven rain.
   1. Extended sill to drain water to building exterior.
   2. Extruded aluminum alloy as follows:
      a. 5” deep frame with 0.081” wall thickness.
      b. Blades shall be double drainable and sight proof.
      c. Provide with aluminum screen.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

E. Provide test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

G. Install duct silencers independent of ducts with flexible duct connectors, lagged with loaded vinyl sheet on inlets and outlets where indicated.

H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
5. On sides of ducts where adequate clearance is available.

I. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body Plus Ladder Access: 25 by 17 inches (635 by 430 mm).

J. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches (200 mm) in diameter.
2. Two-Hand Access: 10 inches (250 mm) in diameter.
3. Head and Hand Access: 12 inches (300 mm) in diameter.
4. Head and Shoulders Access: 18 inches (460 mm) in diameter.
5. Body Access: 24 inches (600 mm) in diameter.

K. Label access doors according to Division 23 Section "Mechanical Identification."

L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

M. For fans developing static pressures of 5-inch wg (1250 Pa) and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

O. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with draw bands.

Q. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 233300

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Shutoff single-duct air terminal units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
   2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale (1/4”=1’0”), on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:

   1. Instructions for resetting minimum and maximum air volumes.
   2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship.
   1. Provide 3 year parts and labor warranty on the entire assembly.

1.6 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers:
   1. Environmental Technologies, Inc.; Enviro-Air Div.
   2. Nailor Industries of Texas Inc.
   3. Price Industries.
   4. Titus.

B. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

C. Casing: 22 gauge steel.

   1. Casing Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
   2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
   3. Air Outlet: S-slip and drive connections.
   4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 1-1/2 percent of nominal airflow at 6-inch wg inlet static pressure.
2. Damper Position: Normally open.

E. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:

1. Primary and secondary overtemperature protection.
2. Airflow switch.
3. Noninterlocking disconnect switch.
4. Magnetic contactor for each step of control (for three-phase coils).

F. Volume Damper: Construct of 18 ga. galvanized steel riveted or bolted through a solid core damper shaft with peripheral gasket and self-lubricating bearings. Gaskets shall be mechanically fastened to blade.

~~1.~~ Maximum Damper Leakage: 1.5 percent (2% fan-powered) of airflow at 6-inch wg inlet static pressure per ARI 880 test procedures.

~~G.~~ Controller shall be capable of maintaining design flow plus 5% regardless of inlet static pressure from minimum specified to 6” wg. Utilizing a multi-port sensing device (4 minimum radially distributed points) connected to center averaging chamber.

2.3 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air terminal units to allow service and maintenance.

C. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

D. Ground units with electric heating coils according to Division 23 Section "Grounding and Bonding."

E. Connect wiring according to Division 26 Section "Conductors and Cables."

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and do the following:

a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
b. Verify that controls and control enclosure are accessible.
c. Verify that control connections are complete.
d. Verify that nameplate and identification tag are visible.
e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 233600

SECTION 23 37 13
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Ceiling and wall mounted diffusers, registers, and grilles.

B. Related Sections:

   1. Division 8 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
   2. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 Manufacturers:

A.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. METALAIRE, Inc.
   b. Price Industries.
   c. Titus.

2. Refer to drawings for air device accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

PACKAGED ROOF TOP AIR CONDITIONING UNITS
SECTION 23 74 16A

GENERAL

1.01 Section Includes:

A. Packaged rooftop air conditioners

1.02 REFERENCES

A. AFBMA 9—Load Ratings and Fatigue Life for Ball Bearings.
B. AMCA 99—Standards Handbook
C. AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes
D. AMCA 500—Test Methods for Louver, Dampers, and Shutters.
E. ARI 340/360 - Unitary Large Equipment
F. IBC 2000 – International Building Code
G. NEMA MG1—Motors and Generators
H. National Electrical Code.
I. NFPA 70—National Fire Protection Agency.
J. UL 900—Test Performance of Air Filter Units.

1.03 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.
B. Product Data:
1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
2. Provide computer generated fan curves with specified operating point clearly plotted.
3. Manufacturer's Installation Instructions.

1.04 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Provide instructions for installation, maintenance and service

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.
B. Startup must be done by trained personnel experienced with rooftop equipment.
C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.
B. Accept products on site and inspect for damage.
C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Daikin Applied

2.02 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Maverick II Packaged Heating and Cooling Unit(s) model MPS. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings:

1. Return plenum / economizer section
2. Filter section
3. Cooling coil section
4. Supply fan section
5. Condensing unit section

C. The complete unit shall be ETL/CETL listed

D. The unit shall be ASHRAE 90.1-2016 compliant and labeled.

E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with Refrigerant 410A and oil.

F. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final balancing of the supply fan assemblies, a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Performance: All scheduled capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

I. Warranty: The manufacturer shall provide 24-month entire unit parts only warranty and 60 month compressor parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.03 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all doors, side panels and ceiling panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick and shall be neoprene coated glass fiber. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

B. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

C. Service doors shall be provided on both sides of the mixing box, filter and DX coil sections.. An access door shall also be provided to the fan section, heat section and control box in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.04 SUPPLY FAN

A. Supply fan shall be a non-overloading, single width, single inlet (SWSI) airfoil centrifugal fan. The fan blade design shall be a double blade with the airfoil geometry, a backward inclined blade fan wheel design will not be acceptable. The fan wheel shall be Class II construction with fan blades welded to the back plate and end rim. The supply fan shall be mounted using solid-steel shafts and wheel hubs with mating keyways

B. The fan assembly shall have fixed pitched drives. The drives shall be selected with a minimum diameter of 4 inches and a 1.2 service factor. The belts shall be of the grip-notch design.

C. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. All fan assemblies shall employ solid steel fan shafts. Heavy-duty pillow block type, self-aligning, grease lubricated ball bearings shall be used. Bearings shall be sized to provide a L-50 life at 250,000 hours. The entire fan assembly shall be isolated from the fan bulkhead with a flexible collar and mounted on 1” spring isolators.

D. Fan motors shall be heavy-duty 1800 rpm open drip-proof (ODP) type with grease lubricated ball bearings. Motors shall be premium efficiency. Motors shall be mounted on an adjustable base that provides for proper alignment and belt tension adjustment. Motors shall be suitable for use with a variable frequency drive.

E. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.05 VARIABLE AIR VOLUME CONTROL

A. An electronic variable frequency drive shall be provided for the supply air fan. Each drive shall be factory installed out of the air stream in a conditioned cabinet. Drives shall meet UL Standard 95-5V. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.

B. The unit manufacturer shall install all power and control wiring.

C. The supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

2.06 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit

transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance. A GFI receptacle shall be unit mounted. The receptacle shall require a field power connection independent from the unit's main power block and / or disconnect..

B. The unit's short circuit resistance rating [SCCR] shall be 10,000 amps.

2.07 HEATING AND COOLING SECTIONS

A. The direct expansion (DX) coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped stainless steel drain pan with a minimum depth of 2.3" on the connection side.

B. Direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows and a maximum of 12 fins per inch. All units shall have two independent refrigerant circuits and shall use an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. A positively sloped drain pan shall be provided with the cooling coil. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan construction shall be a stainless steel design. The drain pan shall be connected to a threaded drain connection extending through the unit base. Drain pan shall be removable from the side of the unit without the removal of the cooling coil.

D. Provide stainless steel coil casing for evaporator coil.

2.08 HOT GAS REHEAT

A. Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser. Provide dual point temperature control.

B. Hot gas coil shall be an all aluminum design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. Each condenser coil shall be factory leak tested with high-pressure air under water.

C. Hot gas coil shall be sized to allow for full condensing across the operation range of the unit. High temperature liquid shall be piped downstream of the unit's condenser coils into the liquid line.

D. The reheat coil volume shall be small enough to not require receivers or any device that reduces sub-cooling. Controls and control valves will automatically cycle operation between normal cooling, dehumidification or reheat modes in response to the field wired, space humidity or dew point sensor without refrigeration safety trips.

E. The hot gas reheat option shall have a fully modulated control to allow for unit leaving air temperature control to +/- 2°.

F. The modulating hot gas reheat systems shall allow for independent control of the DX cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling and reheat leaving air temperature setpoints shall be adjustable through the unit MT III controller.

2.09 FILTERS

A. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” MERV 8 construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.

2.010 OUTDOOR / RETURN AIR SECTION

A. Damper blades shall be gasketed with side seals to provide an air leakage rate of no more than 1.5 cfm / square foot of damper area at 1” differential pressure. Leakage rate to be tested in accordance with AMCA Standard 500. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers.

B. Unit shall be provided with an outdoor air economizer section. The 0 to 100% outside air economizer section shall include outdoor, return, and exhaust air dampers. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be opposed blade design. All damper blades shall be low leak, gasketed and also have side and blade seals to provide an air leakage reate of 1.5 cfm/square foot of damper area at 1” differential pressure. Leakage rate to be tested in accordance with AMCA Standard 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. An adjustable dry bulb control shall be provided to sense the dry-bulb temperature of the outdoor air stream to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for “free” cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system.

2.011 CONDENSING SECTION

A. Condenser coils shall be an all aluminum design, and mounted on polymer brackets, to minimize di-electric corrosion. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. Each condenser coil shall be factory leak tested with high-pressure air under water. Condenser coils shall be protected from incidental contact to coil fins by a coil guard. Coil guard shall be constructed of cross wire welded steel with PVC coating

B. Condenser fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Condenser fan rpm shall be 1140 rpm maximum. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, inherently protected, three-phase, non-reversing type with permanently lubricated ball bearing and integral rain shield.

C. Each circuit shall have fan cycling of at least one condenser fan to maintain positive head pressure. An ambient thermostat shall prevent the refrigeration system from operating below 0º F.

D. Condenser coils shall be recessed and protected from hail damage as an integral part of the unit design. Hail guards shall be provided on all units with vertical mounted condenser coils.

E. Each unit shall have multiple, heavy-duty scroll compressors. Each compressor shall be complete with gauge ports, crankcase heater, sight-glass, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission

F. Each unit shall have two independent refrigeration circuits for redundancy. Each circuit shall be complete with a low pressure control, filter-drier, liquid moisture indicator/sight-glass, thermal expansion valve, and a manual reset high pressure safety switch. The thermal expansion valve shall be capable of modulation from 100% to 25% of its rated capacity. Sight-glasses shall be accessible for viewing without disrupting unit operation. Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.

G. Option for sizes 20-50 - Each unit shall have at least 4 compressor stages of cooling capacity control for better part load control as required by ASHRAE 90.1-2013.

H. Provide factory applied electrofin coating on condenser coil with minimum 10,000 hr ASTM B117 salt spray rating.

2.012 ROOF CURB

A. A prefabricated galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 18" high. Gasket shall be provided for field mounting between the unit base and roof curb. Curb shall be wind rated with calculations provided by a professional engineer. Curb manufacturer to include instructions for mounting the curb to the building structure and the unit to the curb.

2.013 CONTROLS

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

B. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

D. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

E. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

F. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English

language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

1. Return air temperature
2. Discharge air temperature
3. Outdoor air temperature
4. Space air temp
5. Dirty filter indication
6. Airflow verification
7. Cooling status
8. Control temperature (Changeover)
9. VAV box output status
10. Cooling status/capacity
11. Unit status
12. All time schedules
13. Active alarms w/time and date
14. Previous alarms with time and date
15. Optimal start
16. System operating hours
    a. a. Fan
    b. b. Exhaust fan
    c. c. Cooling
    d. d. Individual compressor
    e. e. Heating
    f. f. Economizer
    g. g. Tenant override

G. The user interaction with the keypad shall provide the following setpoints as a minimum:

1. Controls mode
    a. a. Off manual
    b. b. Auto
    c. c. Heat/cool
    d. d. Cool only
    e. e. Heat only
    f. f. Fan only
2. Occupancy mode
    a. a. Auto
    b. b. Occupied
    c. c. Unoccupied
    d. d. Tenant override
3. Unit operation changeover control
    a. a. Return air temperature
    b. b. Space temperature
    c. c. Network signal
4. Cooling and heating change-over temperature with deadband
5. Cooling discharge air temperature (DAT)
6. Supply reset options

a. a. Return air temperature
b. b. Outdoor air temperature
c. c. Space temperature
d. d. Airflow (VAV)
e. e. Network signal
f. f. External (0-10 vdc)
g. g. External (0-20mA)

7. Temperature alarm limits
   a. a. High supply air temperature
   b. b. Low supply air temperature
   c. c. High return air temperature
8. Lockout control for compressors
9. Compressor interstage timers
10. Night setback and setup space temperature
11. Building static pressure
12. Economizer changeover
    a. a. Enthalpy
    b. b. Drybulb temperature
13. Current time and date
14. Tenant override time
15. Occupied/unoccupied time schedule
16. One event schedule
17. Holiday dates and duration
18. Service mode
    a. a. Timers normal (all time delays normal)
    b. b. Timers fast (all time delays 20 sec)

H. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:

1. Zone sensor with tenant override switch
2. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

I. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:

1. Airflow
2. Outside air temperature
3. Space Temperature
4. Return air temperature
5. External signal of 1-5 VDC
6. External signal of 0-20 mA
7. Network signal

INSTALLATION:

Install units level and plumb, maintaining manufacturer's recommended clearances.

A. Curb Support: Install roof curb on roof structure, level and secure, according to ARI Guideline B. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

1.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 15 Section "Duct Accessories."
4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
5. Install normal-weight, 3000 psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified in Division 3.

C. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

1.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

1.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Clean outside coil and inspect for construction debris.
9. Adjust vibration isolators.
10. Lubricate bearings on fan.
11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
12. Adjust fan belts to proper alignment and tension.
13. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system in summer only.
    b. Complete startup sheets and attach copy with Contractor's startup report.

14. Inspect and record performance of interlocks and protective devices; verify sequences.
15. Operate unit for an initial period as recommended or required by manufacturer.

16. Calibrate thermostats.
17. Adjust and inspect high-temperature limits.
18. Inspect outside-air dampers.
19. Start refrigeration system and measure and record the following:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outside-air, dry-bulb temperature.
    d. Outside-air-coil, discharge-air, dry-bulb temperature.

20. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
21. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outside-air intake volume.

22. Simulate maximum cooling demand and inspect the following:
    a. Short circuiting of air through outside coil or from outside coil to outside-air intake.

23. After startup and performance testing, change filters, vacuum cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

1.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

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 two visits to site outside normal occupancy hours for this purpose, without additional cost.

1.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 23 74 16A

237416B – Packaged Rooftop Air Conditioning Units

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Packaged Rooftop air conditioners

1.02 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
B. AMCA 99—Standards Handbook
C. AMCA 500—Test Methods for Louver, Dampers, and Shutters.
D. AHRI 340/360 - Unitary Large Equipment
E. NEMA MG1—Motors and Generators
F. National Electrical Code.
G. NFPA 70—National Fire Protection Agency.
H. SMACNA—HVAC Duct Construction Standards—Metal and Flexible.
I. UL 900—Test Performance of Air Filter Units.

1.03 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.
B. Product Data:
1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
2. Provide computer generated fan curves with specified operating point clearly plotted.
3. Manufacturer's Installation Instructions.

1.04 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Provide instructions for installation, maintenance and service

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.
B. Startup must be done by trained personnel experienced with rooftop equipment.
C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.
B. Accept products on site and inspect for damage.
C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Daikin Applied
B. Trane
C. York; JCI
D. Carrier
E. AAON

2.02 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Rebel Single zone Heating and Cooling Unit(s) model DPS. Unit performance and electrical characteristics shall be per the job schedule.
B. Configuration: Fabricate as detailed on prints and drawings:
1. Return plenum / economizer section
2. Filter section
3. Cooling coil section
4. Supply fan section
5. Condensing unit section
C. The complete unit shall be cETLus listed.
D. The unit shall be ASHRAE 90.1-2016 compliant and labeled.
E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.
F. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
H. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.
I. Warranty: The manufacturer shall provide 5 -year compressor warranty and 1-year parts and labor warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup.

2.03 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 2" thick with an R-value of 13.0, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.
B. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure

to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.04 OUTDOOR/RETURN AIR SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1” differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for “free” cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system.

B. Economizer assembly Fault Detection and Diagnostics (FDD) shall be 90.1, IECC, and California Title 24 compliant. MicroTech III controls shall display a warning, and write a warning to the BAS, if the economizer malfunctions in accordance with 90.1, IECC, and Title 24 specifications.

2.05 FILTERS

A. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” MERV 8 construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.

2.06 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil

circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

2.07 HOT GAS REHEAT

A. Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser

B. Hot gas reheat coil shall be a Micro Channel design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.

C. The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.

D. Each coil shall be factory leak tested with high-pressure air under water.

2.08 SUPPLY FAN

A. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additonal maintenance.

B. All fan assemblies shall employ solid steel fan shafts. Heavy-duty pillow block type, self-aligning, grease lubricated ball bearings shall be used. Bearings shall be sized to provide a L-50 life at 250,000 hours. The entire fan assembly shall be isolated from the fan bulkhead with a flexible collar and mounted on 1” spring isolators.

C. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

D. Supply fan and motor assembly combinations larger than 8 hp or 22” diameter shall be internally isolated on 1” deflection, spring isolators and include removable shipping tie downs.

E. The motor shall be T Frame and open drip proof. Ovrload protection and speed control is provided by the factory installed VFD and rooftop unit controller. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

F. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.09 VARIABLE AIR VOLUME CONTROL

A. An electronic variable frequency drive shall be provided for the supply air fan. Each drive shall be factory installed out of the air stream in a conditioned cabinet. Drives shall meet UL Standard 95-5V.

The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.

B. The unit manufacturer shall install all power and control wiring.

C. The supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

2.010 CONDENSING SECTION

A. Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

B. Outdoor air coils shall be protected from incidental contact to coil fins by a coil guard. Coil guard shall be constructed of cross wire welded steel with PVC coating.

C. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0~120°F. Mechanical cooling shall be provided to 0º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

D. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite materia

E. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and low oil safety protection.

F. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

G. Each circuit shall be dehydrated and factory charged with R-410A Refrigerant and oil.

2.011 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B. A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle.

2.012 CONTROLS

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

B. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

D. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

E. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

F. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

1. Return air temperature.
2. Discharge air temperature.
3. Outdoor air temperature.
4. Space air temperature.
5. Outdoor enthalpy, high/low.
6. Compressor suction temperature and pressure
7. Compressor head pressure and temperature
8. Expansion valve position
9. Condenser fan speed
10. Inverter compressor speed
11. Dirty filter indication.
12. Airflow verification.
13. Cooling status.
14. Control temperature (Changeover).

15. VAV box output status.
16. Cooling status/capacity.
17. Unit status.
18. All time schedules.
19. Active alarms with time and date.
20. Previous alarms with time and date.
21. Optimal start
22. Supply fan and exhaust fan speed.
23. System operating hours.
    a. Fan
    b. Exhaust fan
    c. Cooling
    d. Inndividual compressor
    e. Heating
    f. Economizer
    g. Tenant override

G. The user interaction with the keypad shall provide the following:
1. Controls mode
    a. Off manual
    b. Auto
    c. Heat/Cool
    d. Cool only
    e. Heat only
    f. Fan only
2. Occupancy mode
    a. Auto
    b. Occupied
    c. Unoccupied
    d. Tenant override
3. Unit operation changeover control
    a. Return air temperature
    b. Space temperature
    c. Network signal
4. Cooling and heating change-over temperature with deadband
5. Cooling discharge air temperature (DAT)
6. Supply reset options
    a. Return air temperature
    b. Outdoor air temperature
    c. Space temperature
    d. Airflow (VAV)
    e. Network signal
    f. External (0-10 vdc)
    g. External (0-20 mA)
7. Temperature alarm limits
    a. High supply air temperature

b. Low supply air temperature
c. High return air temperature
8. Lockout control for compressors.
9. Compressor interstage timers
10. Night setback and setup space temperature.
11. Building static pressure.
12. Economizer changeover
a. Enthalpy
b. Drybulb temperature
13. Currently time and date
14. Tenant override time
15. Occupied/unoccupied time schedule
16. One event schedule
17. Holiday dates and duration
18. Adjustable set points
19. Service mode
a. Timers normal (all time delays normal)
b. Timers fast (all time delays 20 sec)

H. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
1. Zone sensor with tenant override switch
2. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

I. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:
1. Airflow
2. Outside air temperature
3. Space temperature
4. Return air temperature
5. External signal of 1-5 vdc
6. External signal of 0-20 mA
7. Network signal

2.013 ROOF CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

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 installation instructions and manufacturer’s SPEC-DATA® sheets.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

3.3 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances.

B. Curb Support: Install roof curb on roof structure, level and secure, according to ARI Guideline B. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

1.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 15 Section "Duct Accessories."
4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
5. Install normal-weight, 3000 psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified in Division 3.

C. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

1.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

1.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Clean outside coil and inspect for construction debris.
9. Adjust vibration isolators.
10. Lubricate bearings on fan.
11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
12. Adjust fan belts to proper alignment and tension.
13. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system in summer only.
    b. Complete startup sheets and attach copy with Contractor's startup report.

14. Inspect and record performance of interlocks and protective devices; verify sequences.
15. Operate unit for an initial period as recommended or required by manufacturer.

16. Calibrate thermostats.
17. Adjust and inspect high-temperature limits.
18. Inspect outside-air dampers.
19. Start refrigeration system and measure and record the following:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.

c. Outside-air, dry-bulb temperature.
d. Outside-air-coil, discharge-air, dry-bulb temperature.

20. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
21. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outside-air intake volume.

22. Simulate maximum cooling demand and inspect the following:
    a. Short circuiting of air through outside coil or from outside coil to outside-air intake.

23. After startup and performance testing, change filters, vacuum cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

1.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

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 two visits to site outside normal occupancy hours for this purpose, without additional cost.

1.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 23 74 16B

END OF SECTION

PACKAGED ROOF TOP AIR CONDITIONING UNITS
SECTION 23 74 16C

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged rooftop units, heat pumps and commercial packaged, gas/electric and electric/electric

1.2 RELATED SECTIONS

1.3 REFERENCES

A. Agency Listings:
   1. Intertek ETL
   2. Canadian Standards Association (CSA).
B. Safety Standards:
   1. Underwriters Laboratories (UL).
   2. Underwriters Laboratories of Canada (ULC).
   3. National Electric Code (NEC).
   4. Canadian Electric Code (CEC).
C. Air-Conditioning, Heating and Refrigeration Institute (AHRI):
   1. AHRI 340/360 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
   2. AHRI 370 Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.
   3. AHRI 210/240 Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment.
D. All models are ASHRAE 90. 1-2010 compliant
E. ISO 9001, Manufacturing Quality Systems
F. MSAV models meet California Code of Regulations, Title 24 rand ASHRAE 90.1-2010 section 6.4.3.10 requirements for staged airflow

1.4 PERFORMANCE REQUIREMENTS

A. Electrical Characteristics
   1. 60 Hz
   2. 208 v – 3 Phase

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures
B. Product Data: Submit product data for specified products
C. Shop Drawings:
   1. Submit shop drawings
   2. Indicate:
      a. Equipment, piping and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware and recommended ancillaries which are mounted, wired and piped ready for final connection to

building system, its size and recommended bypass connections
b. Piping, valves and fittings shipped loose showing final location in assembly
c. Control equipment shipped loose, showing final location in assembly
d. Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads
e. Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers
f. Details of vibration isolation
g. Estimate of sound levels to be expected across individual octave bands in db
h. Type of refrigerant used
i. Plan view, front view end view, back view and curb detail with dimensions

D. Quality Assurance:
1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements
3. Manufacturer's Instructions: Manufacturer's installation instructions

E. Manufacturer's Field Reports: Manufacturer's field reports specified herein
F. Closeout Submittals: Submit the following:
1. Warranty: Warranty documents specified herein
2. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance. Include names and addresses of spare part suppliers
3. Provide brief description of unit, with details of function, operation, control and component service
4. Provide equipment inspection report and equipment operation test report
5. Commissioning Report: Submit commissioning reports, report forms and schematics

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project
2. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings).

1.7 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements
B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays
C. Packing, Shipping, Handling and Delivery:
1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact
2. Ship, handle and unload units according to manufacturer's instructions
D. Storage and Protection:
1. Store materials protected from exposure to harmful weather conditions
2. Factory shipping covers to remain in place until installation

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions
B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

C. Warranty Bond: Commencing on Date of Installation

1. Limited 5 years on compressors

2. Limited 1 year parts and labor on all other covered components

PART 2 - PRODUCTS

2.1 LENNOX LANDMARK® PACKAGED ROOFTOP UNITS

A. Manufacturer: Lennox Industries
   1. Contact: 2140 Lake Park Blvd., Richardson, TX 75080; Telephone: (800) 453-6669; Website: www.lennoxcommercial.com

B. General:
   1. Capacity
      a. **7.5-12.5** tonnages

C. Proprietary Products/Systems:
   1. Cabinet:
      a. Heavy gauge steel panels
      b. Pre-painted steel panels
      c. Full perimeter heavy gauge galvanized steel base rail
      d. Rigging holes on all four corners
      e. Forklift slots (on three sides, not directly below condenser coil) on base rail
      f. Raised or flanged edges around duct and power entry openings
      g. Airflow Choice:
         1. 2 to 12.5 ton units are shipped in downflow. Configuration can be field converted to horizontal air flow with optional Horizontal Discharge Kit
      h. Electrical lines can be brought through the base of the unit or through horizontal knockouts
      i. Insulation:
         1. All panels adjacent to conditioned air are fully insulated with non-hygroscopic fiberglass insulation
         2. Unit base is fully insulated
         3. Unit base insulation also serves as air seal to the roof curb
      j. Access Panels are provided for compressor/controls/heating areas, blower access and air filter/economizer access;
      k. Exterior panels constructed of heavy-gauge galvanized steel with two layer enamel paint finish
      l. Corrosion Protection – Factory or field applied condenser coil coating
   2. Cooling System:
      a. Refrigerant type: R-410A
      b. Capable of operating from 30 to 125ºF (-1 to 52ºC) without installation of additional controls
      c. Compressors:
         1. Scroll Type
         2. Resiliently mounted on rubber grommets for quiet operation
         3. Overload Protected
         4. Internal excessive current and temperature protection
         5. Isolated from condenser and evaporator fan air streams
         6. Refrigerant cooled

d. Thermal Expansion Valve
e. High capacity filter/driers
f. High pressure switches
g. Freezestats

3. Coil Construction:
    1. Rippled-edge aluminum fins
    2. Flared shoulder tubing connections
    3. Silver soldered construction for improved heat transfer
    4. Factory leak tested at manufacturing facility

b. Evaporator Coils:
    1. With balanced , freeze protection on each compressor circuit, pressure and leak tested to 500 psi
    2. Each compressor circuit on coil divided across face of coil and active through full depth of coil

c. Condensate Drain Pan:
    1. Plastic pan, sloped to meet drainage requirements of ASHRAE
    2. Side or bottom drain connections
    3. Reversible to allow connection at back of unit

d. Outdoor coil fan motors:
    1. Thermal overload protected
    2. Shaft up, wire basket mount
    3. Permanently lubricated Ball bearings

e. Outdoor coil fans: PVC coated fan guard furnished

4. Electric Heating System:
    a. Electrical resistance heater
    d. Reset thermal limit protection.
    e. Single point power supply
    f. Heater Element:
        1. Nickel chromium wire
        2. Individually fused.
    g. Electric heater slides out of unit for service

5. Heat Pump System:
    a. Dual fuel models, 2-10 tons high efficiency heat pumps

6. Supply Air Fan (Blower)
    a. Motor
        1. Overload protected
        2. Equipped with ball bearings (belt drive)
    b. Supply Air Blower
        1. Forward curved blades
        2. Wheel is statically and dynamically balanced
        3. Equipped with ball bearings and/or adjustable pulley for speed change

4. Blower assembly slides out of unit for servicing

Specifier Note: Following blower options are available on Landmark 7.5 to 25-ton models only.

c. Blower Option

1. MSAV® (Multi-Stage Air Volume)

7. Supply Air Filters:

a. Disposable 2 inch furnished as standard

8. Controls Options:

1. Thermostat

a. Wiring:

1. Keyed and labeled field connections, color coded and continuously marked wire to identify point-to-point component connections
2. Not in contact with hot-gas refrigerant lines or sharp metal edges

b. Electrical Plugs

c. Access Panels

d. Blower Access

e. Technical Expansion Valve Access

f. Coil Cleaning

g. Standard Components

h. Compressor Compartment

2.2 PRODUCT SUBSTITUTIONS

A. Carrier, Trane, York.

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 installation instructions and manufacturer's SPEC-DATA® sheets.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances.

B. Curb Support: Install roof curb on roof structure, level and secure, according to ARI Guideline B. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

1.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 15 Section "Duct Accessories."
4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
5. Install normal-weight, 3000 psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified in Division 3.

C. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

1.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

1.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Clean outside coil and inspect for construction debris.
9. Adjust vibration isolators.
10. Lubricate bearings on fan.
11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
12. Adjust fan belts to proper alignment and tension.
13. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system in summer only.
    b. Complete startup sheets and attach copy with Contractor's startup report.

14. Inspect and record performance of interlocks and protective devices; verify sequences.
15. Operate unit for an initial period as recommended or required by manufacturer.

16. Calibrate thermostats.
17. Adjust and inspect high-temperature limits.
18. Inspect outside-air dampers.
19. Start refrigeration system and measure and record the following:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outside-air, dry-bulb temperature.
    d. Outside-air-coil, discharge-air, dry-bulb temperature.

20. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
21. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outside-air intake volume.

22. Simulate maximum cooling demand and inspect the following:
    a. Short circuiting of air through outside coil or from outside coil to outside-air intake.

23. After startup and performance testing, change filters, vacuum cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

1.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

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 two visits to site outside normal occupancy hours for this purpose, without additional cost.

1.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 23 74 16C

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

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. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

C. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in

annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.3 SUBMITTALS

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

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Ground rods.
   2. Ground rings.
   3. Grounding arrangements and connections for separately derived systems.
   4. Grounding for sensitive electronic equipment.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1.4 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

G. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.

2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.5 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal , and at individual ground rods. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
1. For handholes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

C. Rigid Steel Conduit: ANSI C80.1.

D. Aluminum Rigid Conduit: ANSI C80.5.

E. IMC: ANSI C80.6.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: ANSI C80.3.

H. FMC: Zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket.

J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel, set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

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. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

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. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

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. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

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. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Butler Manufacturing Company; Walker Division.
b. Enduro Systems, Inc.; Composite Products Division.
c. Hubbell Incorporated; Wiring Device-Kellems Division.
d. Lamson & Sessions; Carlon Electrical Products.
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The).
g. Wiremold Company (The); Electrical Sales Division.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

G. Hinged-Cover Enclosures: 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. Nonmetallic Enclosures: Plastic.

H. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. CDR Systems Corporation.
   d. NewBasis.

2.8 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.9 SLEEVE SEALS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

C. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit .
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 1-Inch (25-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
   d. Attics: 135 deg F (75 deg C) temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install

in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 26 05 44
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage[**and system or service type**].

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

C. Tag: [**Type I**] <**Insert drawing designation**>:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils (0.1 mm).
3. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.10 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.11 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than [**30**] <**Insert number**> A, and [**120**] <**Insert number**> V to ground: Identify with [**self-adhesive vinyl label**] [**self-adhesive vinyl tape applied in bands**]. Install labels at [**10-foot (3-m)**] [**30-foot (10-m)**] maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

   a. Power transfer switches.
   b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches (100 mm) high.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION 260553

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single space wireless lighting control systems and associated components:
   1. Wireless occupancy/vacancy sensors.
   2. Wireless daylight sensors.
   3. Wired load control modules with wireless communication inputs.
      a. Includes fixture control modules with wired occupancy/vacancy/daylight sensors.
   4. Wired receptacles with wireless communication inputs.
   5. Wireless fixture control components factory-installed in luminaires not specified in this section.
   6. Wired wall dimmers and switches with wireless communication inputs.
   7. Wired wallbox occupancy sensors with wireless communication inputs.
   8. Wireless control stations.
   9. LED Drivers.
   10. Power interfaces.
   11. Digital dimming ballast modules.

B. Wireless hub(s) for centralized control, monitoring, and system integration.

C. Software data and analytics dashboard, including server requirements.

1.02 REFERENCE STANDARDS

A. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test**; *2008***.

B. ISO 9001 - Quality Management Systems-Requirements**; *2008***.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction**; *2015***.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association**; *2010***.

E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association**; *2015***.

F. NFPA 70 - National Electrical Code; National Fire Protection Association**; *Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements***.

G. UL 20 - General-Use Snap Switches**; *Current Edition, Including All Revisions***.

H. UL 508 - Industrial Control Equipment; Underwriters Laboratories Inc.**; *Current Edition, Including All Revisions***.

I. UL 924 - Emergency Lighting and Power Equipment**; *Current Edition, Including All Revisions***.

J. UL 935 - Fluorescent-Lamp Ballasts**; *Current Edition, Including All Revisions***.

K. UL 1310 – Class 2 Power Units**; *Current Edition, Including All Revisions***.

L. UL 1472 - Solid-State Dimming Controls**; *Current Edition, Including All Revisions***.

M. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits**; *Current Edition, Including All Revisions***.

N. 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***.

O. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products**; *Current Edition, Including All Revisions***.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall controls with actual installed door swings.

3. Coordinate the placement of daylight sensors 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.
4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install sensors and wall controls until final surface finishes**<< and painting>>** are complete.

1.04 SUBMITTALS

A. See Section **01 3000 - *Administrative Requirements*** for submittal procedures.
B. Design Documents: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS", Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.
C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
2. Wall Dimmers: Include derating information for ganged multiple devices.

D. Samples:
1. Wall Controls:
a. Show available color and finish selections.

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. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under “WARRANTY”. Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications:
1. Company with not less than ten years of experience manufacturing lighting control products using wireless communication between devices.
2. Registered to ISO 9001, including in-house engineering for product design activities.
3. Provides factory direct technical support hotline available 24 hours per day, 7 days per week.
4. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.
1. Basis of Design System Requirements ***- Lutron***, Unless Otherwise Indicated:
a. Ambient Temperature:
1) Lighting Control System Components, Except Fluorescent Electronic Dimming Ballasts: Between 32 and 104 degrees F (0 and 40 degrees C).

2) Fluorescent Electronic Dimming Ballasts: Between 50 and 140 degrees F (10 and 60 degrees C).
b. Relative Humidity: Less than 90 percent, non-condensing.
c. Protect lighting controls from dust.

1.08 WARRANTY

A. See ***Section 01 7800 - Closeout Submittals***, for additional warranty requirements.
B. Manufacturer's Standard Warranty, With Manufacturer Full-Scope Start-Up***; Lutron Standard 2-Year Warranty; Lutron LSC-B2***:
1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:
a. First Two Years:
1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
2) First-available on-site or remote response time.
3) Remote diagnostics for applicable systems.
b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
2. Lighting Management System Computer: One year 100 percent parts coverage, one year 100 percent manufacturer labor coverage.
3. Ballasts/Drivers and Ballast Modules:
a. With Remote Full-Scope Start-Up: Three years 100 percent parts coverage, no manufacturer labor coverage.
b. With On-Site Full-Scope Start-Up: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: ***Lutron Electronics Company, Inc; Vive; www.lutron.com***.
B. Other Acceptable Manufacturers:
1. Products by listed manufacturers are subject to compliance with specified requirements **and prior approval of Architect and Engineer.**
2. Substitutions: See Section 01 6000 - Product Requirements**;** All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect a minimum of **10;** working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
3. Any proposed substitutions to be reviewed by Architect at Contractor's expense**<< at a rate of $200 per hour** By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.
C. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 LIGHTING CONTROLS - GENERAL REQUIREMENTS

A. .
B. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.
C. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
D. Power Failure Recovery: When power is interrupted for periods up to **<<10 years;** and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
E. Wireless Devices:

1. Wireless device family includes area or fixture level sensors, area or fixture level load controls for dimming or switching, and load controls that can be mounted in a wallbox, on a junction box, or at the fixture.
2. Wireless devices including sensors, load controls, and wireless remotes or wall stations, can be set up using simple button press programming without needing any other equipment (e.g. central hub, processor, computer, or other smart device).
3. Wireless hub adds the ability to set up the system using any smart device with a web browser (e.g. smartphone, tablet, PC, or laptop).
4. System does not require a factory technician to set up or program the system.
5. Capable of diagnosing system communications.
6. Capable of having addresses automatically assigned to them.
7. Receives signals from other wireless devices and provides feedback to user.
8. Capable of determining which devices have been addressed.
9. RF Range: 60 feet (18 m) line-of-sight or 30 feet (9 m) through typical construction materials between RF transmitting devices and compatible RF receiving devices.
10. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 15, for Class B application.

F. Wireless Network:
1. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
   a. Wireless sensors, wireless wall stations and wireless load control devices do not operate in the noisy 2.4 GHz frequency band where high potential for RF interference exists.
   b. Wireless devices operate in an uncongested frequency band providing reliable operation.
   c. Fixed network architecture ensures all associated lights and load controls respond in a simultaneous and coordinated fashion from a button press, sensor signal, or command from the wireless hub (i.e. no popcorning).
2. Distributed Architecture: Local room devices communicate directly with each other. If the wireless hub is removed or damaged, local control, sensing, and operation continues to function without interruption.
3. Local room devices communicate directly with each other (and not through a central hub or processor) to ensure:
   a. Reliability of system performance.
   b. Fast response time to events in the space (e.g. button presses or sensor signals).
   c. Independent operation in the event of the wireless hub being removed or damaged.

G. Device Finishes:
1. Wall Controls: Match finishes for Wiring Devices in Section **26 2726**, unless otherwise indicated.
2. Wall Controls: **White;** Standard Colors: Comply with NEMA WD1 where applicable.
3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

H. Interface with building automation system ***Lutron System and Network Integration Consultation; LSC-INT-VISIT.***

2.03 WIRELESS SENSORS

A. General Requirements:
1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.

4. Capable of being placed in test mode to verify correct operation from the face of the unit.

B. Wireless Occupancy/Vacancy Sensors:
1. General Requirements:
   a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
   b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
   c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions***; Lutron XCT Technology***. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
   d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
   e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
   f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
   g. Color: White.
   h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
   i. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
   j. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.
   k. Ceiling-Mounted Sensors:
      1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
      2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.
   l. Wall-Mounted Sensors: Provide wall or corner mounting brackets compatible with drywall and plaster walls.
2. Wireless Combination Occupancy/Vacancy Sensors:
   a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).
   b. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).
   c. Product(s):
      1) Ceiling-Mounted Occupancy/Vacancy Sensor***;*** **Lutron Radio Powr Savr Series, Model LFR2-OCR2B-P-WH; or** Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
      2) Corner-Mounted Occupancy/Vacancy Sensor***;*** **Lutron Radio Powr Savr Series, Model LFR2-OKLB-P-WH; s**quare feet (113.8 sq m) and major

motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 90 degree field of view.

3) Hallway Occupancy/Vacancy Sensor***;*** **Lutron Radio Powr Savr Series, Model LFR2-OHLB-P-WH**Major motion coverage of up to 150 feet (45.7 m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); narrow field of view.

3. Wireless Vacancy-Only Sensors:
   1) Ceiling-Mounted Vacancy-Only Sensor***;*** **Lutron Radio Powr Savr Series, Model LFR2-VCR2B-P-WH**Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
   2) Wall-Mounted Vacancy-Only Sensor***;*** **Lutron Radio Powr Savr Series, Model LFR2-VWLB-P-WH**Minor motion coverage of 1500 square feet (139.4 sq m) and major motion coverage of 3000 square feet (278.7 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 180 degree field of view.
   3) Corner-Mounted Vacancy-Only Sensor***;*** **Lutron Radio Powr Savr Series, Model LFR2-VKLB-P-WH;** Minor motion coverage of 1225 square feet (113.8 sq m) and major motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 90 degree field of view.
   4) Hallway Vacancy-Only Sensor***;*** **Lutron Radio Powr Savr Series, Model LFR2-VHLB-P-WH; or Lutron Radio Powr Savr Series** Major motion coverage of up to 150 feet (45.7 m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); narrow field of view.

C. Wireless Daylight Sensors:
   1. Product: ***Lutron Radio Powr Savr Series, Model LFR2-DCRB-WH***.
   2. Open-loop basis for daylight sensor control scheme.
   3. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
   4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
   5. Provide linear response from 2 to 150 footcandles.
   6. Color: White.
   7. Mounting:
      a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
      b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
      c. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
   8. Meets CAL TITLE 24 P6 requirements.

2.04 LOAD CONTROL MODULES

A. Provide wireless load control modules as indicated or as required to control the loads as indicated.

B. Junction Box-Mounted Modules:
   1. Plenum rated.
   2. 0-10 V Dimming Modules:
      a. Product(s):
         1) 8 A dimming module with 0-10V control, without emergency lighting mode***;*** **Lutron PowPak Dimming Module Model RMJS-8T-DV-B**8 A dimming module with 0-10V control, with emergency lighting mode***;*** **Lutron PowPak Dimming Module Model RMJS-8T-DV-B-EM**.

b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
c. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.
d. Selectable minimum light level.
e. Configurable high- and low-end trim.
f. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.
g. Dimming Modules with Emergency Lighting Mode:
1) Operation With ***Lutron Vive*** Wireless Hub: Upon loss of power, dimming module enters and remains in emergency lighting mode as long as wireless hub is de-energized; upon restoration of power to wireless hub, dimming module returns to normal mode and lights automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
2) Operation Without ***Lutron Vive*** Wireless Hub: Upon loss of power, dimming module enters and remains in emergency lighting mode for 90 minutes, during which time local unit buttons and wireless controls are disabled.
3) UL 924 listed.

3. Relay Modules:
a. Product(s):
1) 16 A relay module, without emergency lighting mode, without contact closure output***;*** **Lutron PowPak Relay Module Model RMJS-16R-DV-B; or Lutron PowPak Relay Module Model URMJS-16R-DV-B (BAA-Buy American Act Compliant)>>**.
2) 16 A relay module, with emergency lighting mode, without contact closure output***;*** **Lutron PowPak Relay Module Model RMJS-16R-DV-B-EM**.
3) 16 A relay module, without emergency lighting mode, with contact closure output***;*** **Lutron PowPak Relay Module Model RMJS-16RCCO1-DV-B; or Lutron PowPak Relay Module Model URMJS-16RCCO1-DV-B (BAA-Buy American Act Compliant)>>**.
4) 5 A relay module, without emergency lighting mode, without contact closure output***; Lutron PowPak Relay Module Model RMJS-5R-DV-B***.
5) 5 A relay module, without emergency lighting mode, with contact closure output***; Lutron PowPak Relay Module Model RMJS-5RCCO1-DV-B***.
b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
c. Relay:
1) Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
2) Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
3) Fully rated output continuous duty for inductive, capacitive, and resistive loads.
d. Contact Closure Output:
1) Single contact closure output with normally open and normally closed dry maintained contacts suitable for connection to third party equipment (e.g. building management system, HVAC system, etc.).
2) Contact Ratings: Resistive load; 1 A at 0-24 VDC, 0.5 A at 0-24 VAC.

3) Controlled by associated occupancy/vacancy sensors and wall controls.
e. Relay Modules With Emergency Lighting Mode:
1) Operation With ***Lutron Vive*** Wireless Hub: Upon loss of power, relay module enters and remains in emergency lighting mode as long as wireless hub is de-energized; upon restoration of power to wireless hub, relay module returns to normal mode and lights automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
2) Operation Without ***Lutron Vive*** Wireless Hub: Upon loss of power, relay module enters and remains in emergency lighting mode for 90 minutes, during which time local unit buttons and wireless controls are disabled.
3) UL 924 listed.
4. Selectable minimum light level.
5. Supports configurable high- and low-end trim.
6. Plenum rated in accordance with UL 2043.
7. Mounts to fixture through hole.
8. Wireless Fixture Control Dongle with Integral Sensing Capabilities:
a. Occupancy/Vacancy Sensing:
1) Passive infrared coupled with technology for sensing fine motions**;** ***Lutron XCT Technology***. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
2) Coverage: 300 square feet (28 sq m) with mounting height of 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
3) Sensor Timeout: 15 minutes.
(a) Sensor timeout adjustable via ***Lutron Vive*** wireless hub.
b. Daylight Sensing:
1) Automatic calibration.
2) Provide linear response to changes in perceived light level.
(a) Response adjustable via ***Lutron Vive*** wireless hub.
3) Closed loop proportional control scheme.
4) Sensor Range: 0 to 150 footcandles (0 to 1600 lux).
c. Coordination between Integral and Wireless Sensors:
1) Occupancy/Vacancy Sensing: Integral and wireless sensors work in conjunction (occupancy detected by either sensor turns lights on and vacancy detected by both sensors turns lights off).
2) Daylight Sensing: Wireless sensor takes precedence over integral sensor.

C. Digital Bus Interface:
1. Product: ***Lutron OEM Digital Bus Interface; Model DFC-OEM-DBI***.
2. Provides power for wireless fixture control dongle and up to four LED drivers (60mA at 17-19 VDC).

2.05 WIRED WALL DIMMERS AND SWITCHES WITH WIRELESS COMMUNICATION INPUTS

A. General Requirements:
1. Provide air gap service switch to disconnect power to load for safe lamp replacement, accessible without removing faceplate.
2. Operates at the rated capacity across the full ambient temperature range including modified capacities for ganged configurations which require removal of fins.
3. Provide radio frequency interference suppression.
4. Surge Tolerance: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
5. Dimmers: Provide full range, continuously variable control of light intensity.
6. Dimmers for Electronic Low Voltage (ELV) Transformers:

a. Provide circuitry designed to control the input of electronic (solid-state) low voltage (ELV) transformers. Do not use dimmers that utilize standard phase control.
b. Provide resettable overload protection that provides automatic shut-off when dimmer capacity is exceeded. Do not use protection methods that are non-resettable or require device to be removed from outlet box.
c. Designed to withstand a short, per UL 1472, between load hot and either neutral or ground without damage to dimmer.

7. Dimmers for Magnetic Low Voltage (MLV) Transformers:
   a. Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
   b. Magnetic low voltage transformers to operate below rated current or temperature.
8. Electronic Switches:
   a. Listed as complying with UL 20, UL 508, and UL 1472.

B. Preset Smart Wall Dimmers and Switches with Wireless Communication Inputs***; Lutron Maestro Wireless Series:***
1. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
2. Dimmer Control: Multi-function tap switch with small, raised rocker for dimmer adjustment.
   a. Rocker raises/lowers light level, with new level becoming the current preset level.
   b. Switch single tap raises lights to preset level or fades lights to off.
   c. Switch double tap raises light to full on level.
   d. Switch tap and hold slowly fades lights to off over period of 10 seconds.
   e. LEDs adjacent to tap switch indicate light level when dimmer is on, and function as locator light when dimmer is off.
3. Switch Control: Switch single tap turns lights on/off.
4. Dimmer High End Trim:
   a. Incandescent Dimmers: Minimum of 92 percent of line voltage.
   b. Dimmers for Electronic Low Voltage (ELV) Transformers: Minimum of 95 percent of line voltage.
   c. Dimmers for Magnetic Low Voltage Transformers: Minimum of 92 percent of line voltage.
5. Product(s) - Preset Smart Dimmers with Wireless Communication Inputs:
   a. Preset Smart Dimmer***; Lutron Maestro Wireless Series***: Incandescent/halogen (600 W, 120 V), magnetic low voltage (600 VA/450 W, 120 V), dimmable CFL/LED (150 W, 120 V); multi-location capability using companion dimmers (up to nine companion dimmers may be connected); minimum load requirement.
      1) ***Lutron Model MRF2S-6CL;*** single pole/multi-location; 120 V.

2.06 Preset Smart Dimmer***; Lutron Maestro Wireless Series***: Electronic low voltage (600 W, 120 V); neutral required; multi-location capability **WIRED WALLBOX OCCUPANCY SENSORS WITH WIRELESS COMMUNICATION INPUTS**

A. 0-10 V Wall Dimmer/Switch Combination Occupancy/Vacancy Sensors with Wireless Communication Inputs***; Lutron Maestro Wireless 0-10 Dimmer Sensor/Maestro Wireless Sensor Switch Series***:
1. Communicates via radio frequency with up to ten compatible wireless occupancy/vacancy sensors, ten wireless control stations, and one wireless daylight sensor.
2. Compatible with sourcing electronic 0-10 V ballasts/drivers, as per IEC 60929 Annex E.2 0-10 V protocol.

3. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be selectable as either adaptive utilizing occupant feedback **(Lutron Smart Ambient Light Detection)** or as fixed (high, medium, low, and minimum presets).
4. Occupancy/Vacancy Sensors:
   a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
   b. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions***; Lutron XCT Technology***. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
   c. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
   d. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area; adjustable timeout settings (1, 5, 15, or 30 minutes).
   e. Adjustable sensitivity (high, medium, low, and minimum presets).
   f. Selectable option to inhibit automatic turn-on of lights after manual-off operation while room is occupied for applications such as presentation viewing in conference rooms and classrooms; when room is vacated, returns to normal automatic-on operation after time delay period.
   g. Selectable walk-through mode to override selected timeout and automatically turn off lights if no motion is detected within 3 minutes after initial occupancy for applications where space may be briefly occupied.
5. Vacancy-Only Sensors:
   a. Operates only as a vacancy sensor (manual-on and automatic-off)**<< *in accordance with California Title 24 requirements*>>**.
   b. Adjustable sensitivity (high, medium, low, and minimum presets).
6. Dimmer Features:
   a. Adjustable high/low end trims.
   b. Selectable dimming curve (linear or switched).
   c. Selectable fade on/fade off times (15, 5, 2.5, or 0.75 sec).
   d. Adjustable auto-on light level (fully adjustable from one to 100 percent).
7. Dimmer Control: Multi-function tap switch with small, raised rocker for dimmer adjustment.
   a. Rocker raises/lowers light level, with new level becoming the current preset level.
   b. Switch single tap raises lights to preset level or fades lights to off.
   c. Switch double tap raises light to full on level.
8. Switch Control: Switch single tap turns lights on/off.

2.07 LESS CONTROL STATIONS

A. Product(s):
1. 2-Button Control; **<<Lutron Pico Wireless Control Model PJ2-2B;**
   a. Button Marking: **<<Light (icons); As indicated on drawings**
2. Button Control with Night Light***; Lutron Pico Wireless Control Model PJN-2B***.
3. 2-Button with Raise/Lower Control; **<<Lutron Pico Wireless Control Model PJ2-2BRL**
   a. Button Marking: **<<Light (icons**
4. 3-Button Control; **<<Lutron Pico Wireless Control Model PJ2-3B;**
5. Button Marking: **Light (icons);** 3-Button with Raise/Lower Cl; **Lutron Pico Wireless Control Model PJ2-3BRL**
   a. Button Marking: **Light (icons);**

b. ; **Lutron Pico Wireless Control Model PJ2-4B;** Button Marking: **Zone controls (light); Scene keypads (light); 2-group controllers (lights); 4-group toggle; As indicated on drawings.**

6. Wallbox Adapter***; Lutron Model PICO-WBX-ADAPT***.

B. Quantity: As indicated on the drawings**;** Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.

C. Does not require external power packs, power or communication wiring.

D. Allows for easy reprogramming without replacing unit.

E. Button Programming:
1. Single action.
2. Toggle action.

F. Includes LED to indicate button press or programming mode status.

G. Mounting:
1. Capable of being mounted with a table stand or directly to a wall under a faceplate.
2. Faceplates: Provide concealed mounting hardware.

H. Power: Battery-operated with minimum ten-year battery life (3-year battery life for night light models).

I. Finish: **As specified for wall controls in "Device Finishes" under LIGHTING CONTROLS - GENERAL REQUIREMENTS article above; White;** .

1) Support for troffers, linear pendants, and linear recessed fixtures from 150 mA to 1.05 A to ensure a compatible driver exists.
(a) Support LED arrays up to 20 W.
(b) Constant Current Reduction (CCR) dimming method.
(c) UL listed Class P.
(d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
(e) Luminaires Version 2.0.
(f) UL listed.
(g) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.

b. Constant Voltage Drivers:

1) Support for downlights and pendant fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
(a) Support LED arrays up to 40 W.
(b) Pulse Width Modulation (PWM) dimming method.
(c) UL listed Class P.
(d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.

2) Support for troffers, linear pendants, and linear recessed fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
(a) Support LED arrays up to 40 W.
(b) Pulse Width Modulation (PWM) dimming method.
(c) UL listed Class P.
(d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.

3) Support for cove and under-cabinet fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
(a) Support LED arrays up to 40 W.
(b) Pulse Width Modulation (PWM) dimming method.
(c) UL listed.

(d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
(e) UL listed.

c. Constant Voltage Drivers:
1) Support for downlights and pendant fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
(a) Support LED arrays up to 40 W.
(b) Pulse Width Modulation (PWM) dimming method.
2) Support for troffers, linear pendants, and linear recessed fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
(a) Support LED arrays up to 40 W.
(b) Pulse Width Modulation (PWM) dimming method.

2.08 WIRELESS HUBS

1. Wireless hub with BACnet***; Lutron Vive Premium Hub***.
a. Flush-mount wireless hub***; Model HJS-2-FM***; supports up to 700 total paired devices.
b. Surface-mount wireless hub***; Model HJS-2-SM***; supports up to 700 total paired devices.

B. Integrated multicolor LED provides feedback on what mode the hub is in for simple identification and diagnosis.

C. Integrated processor and web server allows hub to set up and operate the system without any external connections to outside processors, servers, or the internet.

D. Utilizes Ethernet connection for:
1. Networking up to 64 hubs together to create a larger system.
2. Integration with Building Management System (BMS) via native BACnet; does not require interface (***Lutron Vive Premium*** wireless hub with BACnet only).
3. Remote connectivity capabilities, including maintaining system date/time and receiving periodic firmware updates (requires internet connection).

E. A single hub or network of hubs can operate on either a dedicated lighting control only network or can be integrated with an existing building network as a VLAN.

F. Communicates directly to compatible ***Lutron Vive*** RF devices through use ***Lutron Clear Connect*** radio frequency communications link; does not require communication wiring; RF range of 71 feet (23 m) through walls to cover an area of 15836 square feet (1471 sq m) (device and hub must be on the same floor).

G. Communicates directly to mobile device (smartphone or tablet) or computer using built-in Wi-Fi, 2.4 GHz 802.11b/g; wireless range of 71 feet (23 m) through walls (device and hub must be on the same floor).
1. Does not require external Wi-Fi router for connecting to the hub.

H. Allows for system setup, control, and monitoring from mobile device or computer using ***Vive*** web-based software:
1. Supports paired devices up to maximum number indicated including compatible wireless sensors, wireless control stations, and wireless load devices.
2. Allows for timeclock scheduling of events, both time of day and astronomic (sunrise and sunset).
a. Timeclock is integrated into the unit and does not require a constant internet connection.
b. Retains time and programming information after a power loss.
c. 365-day schedulable timeclock allows for:
1) Scheduling of events years in advance.
2) Setting of recurring events with exceptions on holidays.
d. Time clock events can be scheduled to:

1) Send lights to a desired level and select the fade rate desired to reach that level.
2) Adjust level lights go to when occupied.
3) Adjust level lights go to when unoccupied.
4) Enable/disable occupancy.
5) Control individual devices, areas, or groups of areas. When connected to ***Vive Vue*** server, only areas or groups of areas can be controlled with timeclock events.

3. Daylighting:
   a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
   b. Daylight set point can be adjusted with the software to increase or decrease the electric light level in the room based on the same amount of natural light.
4. Allows for control, monitoring, and adjustment from anywhere in the world (***Lutron Vive*** wireless hub internet connection required).
5. Uses RF signal strength detection to find nearby devices for quick association and programming without having to climb ladders.
   a. Association and setup does not require a factory technician to perform.
6. System using ***Lutron Vive*** wireless hub(s) can operate with or without connection to the internet.
7. Supports energy reporting.
   a. Reports measured energy data for ***PowPak*** fixture control modules at accuracy of plus/minus 2 percent or 0.5 W (whichever is higher).
   b. Reports calculated energy data for ***PowPak*** junction box mounted modules at accuracy of 10 percent.
   c. .
8. Supports automatic demand response for load shedding via:
   a. Local contact closure without need for separate interface.
   b. OpenADR® 2.0b compliant utility command.
   c. BACnet (***Lutron Vive Premium*** wireless hub with BACnet only).
9. Wireless hub can be firmware upgraded to provide new software features and system updates.
   a. Firmware update can be done either locally using a wired Ethernet connection or Wi-Fi connection, or remotely if the wireless hub is connected to the internet.

I. ***Lutron Vive*** Web-Based Application:
   1. Accessibility and Platform Support:
      a. Web-based; runs on most HTML5 compatible browsers (including Safari and Chrome).
      b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone.
      c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
      d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
      e. Multi-level Password Protected Access: Individual password protection on both the integrated Wi-Fi network and web-based software.
      f. WPA2 security for Wi-Fi communication with wireless hub.
   2. System Navigation and Status Reporting:
      a. Area Tree View: Easy navigation by area name to view status and make programing adjustments through the software.
      b. Area and device names can be changed in real time.
   3. Setup app available for iOS and Android that allows for:
      a. Job registration to extend product warranty.
      b. Management of setup for multiple projects in different locations.

c. Creation of handoff documents that are sent directly to a facility manager via email once setup is complete.
d. Backup of ***Vive*** wireless hub database to ***Lutron*** cloud for hub replacement.
e. Access to native help and instructions to assist user with ***Vive*** system setup.

J. BACnet Integration (***Lutron Vive Premium*** wireless hub with BACnet only):
1. Provide ability to communicate by means of native BACnet IP communication (does not require interface) to lighting control system from a user-supplied 10BASE-T or 100BASE-T Ethernet network.
2. Requires only one network connection per hub.
3. BACnet Integrator Capabilities:
a. The BACnet integrator can command:
1) Area light output.
2) Area load shed level.
3) Area load shed enable/disable.
4) Enable/Disable:
(a) Area occupancy sensors.
(b) Area daylighting.
5) Daylighting level.
6) Area occupied and unoccupied level
7) Occupancy sensor timeouts (for fixture sensors).
b. The BACnet integrator can monitor:
1) Area on/off status.
2) Area occupancy status.
3) Area load shed status.
4) Area instantaneous energy usage and maximum potential power usage.
5) Enable/Disable:
(a) Area occupancy sensors.
(b) Daylighting.
(c) Timeclocks.
6) Daylighting level.
7) Light levels from photo sensors.
8) Area occupied and unoccupied level.
9) Occupancy sensor timeouts.

K. Contact Closure Interface: Provide two contact closure inputs; accepts both momentary and maintained contact closures that can be used for automatic demand response.
L. Rated for use in air-handling spaces as defined in UL 2043.
M. Meets CAL TITLE 24 P6 requirements.
N. Provide Ethernet switch(es) as required for inter-hub network wiring per manufacturer's instructions; do not exceed manufacturer's required maximum wiring segment lengths.
1. Product(s):
a. ***Lutron Model ETH-SWITCH-16***; 16 port.
b. ***Lutron Model ETH-SWITCH-24***; 24 port.
c. ***Lutron Model ETH-SWITCH-24-1M***; 24 port, 1 multi-mode fiber.
d. ***Lutron Model ETH-SWITCH-24-2M***; 24 port, 2 multi-mode fiber.
e. ***Lutron Model ETH-SWITCH-24-1S***; 24 port, 1 single-mode fiber.
f. ***Lutron Model ETH-SWITCH-24-2S***; 24 port, 2 single-mode fiber.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.
B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive system components.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. System and Network Integration Consultation***; Lutron LSC-INT-VISIT***: Include as part of the base bid; as an alternate to the base bid.
B. Manufacturer to conduct meeting with facility representative and other related equipment manufacturers to discuss equipment and integration procedures.
   1. Coordinate scheduling of visit with Lighting Control Manufacturer. Manufacturer recommends that this visit be scheduled early in construction phase, after system purchase but prior to system installation.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130Install products in accordance with manufacturer's instructions.
B. Sensor Locations:
   1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.
   2. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.
C. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.
D. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
E. Lamp Lead Lengths: Do not exceed 3 feet (0.9 m) for T4 4-pin compact and T5 BIAX lamps and 7 feet (2.1 m) for T5, T5-HO, T8 U-bend, and T8 linear fluorescent lamps.
F. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).
G. Identify system components in accordance with Section **26 0553**.

3.04 FIELD QUALITY CONTROL

A. See Section **01 4000 - *Quality Requirements***, for additional requirements.
B. Manufacturer's Full-Scope Start-Up Service **<<is not** Use the following paragraph only if Lutron Full-Scope Start-Up Service is specified in the paragraph above. Edit the choice to indicate if On-Site Start-Up Service is required or if Remote Start-Up is preferred where possible (Lutron will quote On-Site Start-Up Service if required due to system size and other system characteristics). Either Full-Scope On-Site Start-Up or a Warranty Audit Visit is required if Lutron Silver, Gold, or Platinum Enhanced Warranties are specified in Part 1 under "WARRANTY".

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 COMMISSIONING

A. See Section ***01 9113*** for commissioning requirements.
B. Training:
   1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site system start-up services.
   2. Customer-Site Solution Training Visit***; Lutron LSC-TRAINING-SP***: Include **as part of the base bid** additional costs for Lighting Control Manufacturer to provide **<<one>>** day(s) of additional on-site system training.

3.07 MAINTENANCE

A. See Section **01 7000 – *Execution and Closeout Requirements***, for additional requirements relating to maintenance service.

3.08 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Electronic-grade panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards and components 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. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
b. Altitude: Not exceeding 6600 feet (2000 m).

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.

4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

E. Mains: Circuit breaker or Lugs only.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker or lugs only.

E. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
i. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
j. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
k. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
l. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

8. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Wall-box motion sensors.
4. Isolated-ground receptacles.
5. Snap switches and wall-box dimmers.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
5.

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CR 5253IG.
b. Leviton; 5362-IG.
c. Pass & Seymour; IG6300.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; IG2310.
b. Leviton; 2310-IG.

2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
      c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
      d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Key-Operated Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 2221L.
      b. Hubbell; HBL1221L.
      c. Leviton; 1221-2L.
      d. Pass & Seymour; PS20AC1-L.

   2. Description: Single pole, with factory-supplied key in lieu of switch handle.

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 1995.
      b. Hubbell; HBL1557.
      c. Leviton; 1257.
      d. Pass & Seymour; 1251.

E. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 1995L.
      b. Hubbell; HBL1557L.
      c. Leviton; 1257L.
      d. Pass & Seymour; 1251L.

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AT120 for 120 V, AT277 for 277 V.
b. Leviton; ODS 15-ID.

3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP1600WRP.
b. Leviton; ODWWV-IRW.
c. Pass & Seymour; WA1001.
d. Watt Stopper (The); CX-100.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATD1600WRP.
b. Leviton; ODW12-MRW.
c. Watt Stopper (The); DT-200.

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP120HBRP.

b. Leviton; ODWHB-IRW.
c. Pass & Seymour; HS1001.
d. Watt Stopper (The); CX-100-3.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

F. Exterior Occupancy Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; PS200-10.
b. Watt Stopper (The); EW-100-120.
c.

2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.8 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.9 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers 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. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
3. Lugs: Compression type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Lugs: Compression type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION 262816

SECTION 26 43 13
SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

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 field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Sections:

1. Division 26 Section "Switchboards" for factory-installed SPD.
2. Division 26 Section "Panelboards" for factory-installed SPD.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. VPR: Voltage Protection Rating.

C. SPD: Surge Protective Device(s).

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

B. Submittals shall include UL 1449 Listing documentation verifying:

1. Short Circuit Current Rating (SCCR)
2. Voltage Protection Ratings (VPRs) for all modes
3. Maximum Continuous Operating Voltage rating (MCOV)
4. I-nominal rating (I-n)
5. Type 1 Device Listing

(NOTE: VPR, MCOV, I-n, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCRs are posted in manufacturer's UL docs.)

UL data and visual inspection takes precedence over manufacturer's published documentation.

C. Product Certificates: For SPDs, from manufacturer.

D. Field quality-control reports.

E. Operation and Maintenance Data: For SPDs to include in emergency, operation, and maintenance manuals.

F. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: UL or an NRTL.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by UL, and marked for intended location and application.

C. Comply with ANSI/IEEE C62.41.1-2002 & ANSI/IEEE C62.41.2-2002 and test devices according to ANSI/IEEE C62.45-2002.

D. Shall be UL 1449 3rd Edition Listed and UL1283 complimentary listed.

E. Comply with NFPA 70.

F. Comply with NEC Article 285 – Correct Installation of Surge Protective Devices.

1.6 PROJECT CONDITIONS

A. Service Conditions: Rate SPDs 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 for 480Y/277 V and not less than 125 percent of nominal system voltage for 208Y/120 V.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.7 COORDINATION

A. Coordinate location of field-mounted SPDs to allow adequate clearances for maintenance.

B. Coordinate SPD with Division 26 Section "Electrical Power Monitoring and Control."

1.8 WARRANTY

A. Special Warranty: After SPD is installed per manufacturer's instructions, the manufacturer shall replace components of modular surge protection devices and replace complete non-modular suppressors that fail in materials or workmanship, or any other end-of life electrical event, including lightning within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

B. Special Warranty for Cord-Connected, Plug-in Surge Protective Devices: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge protective devices.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology Inc.
2. Thor Systems
3. Liebert
4. Advanced Protection Technologies (APT)

B. Surge Protection Devices:

1. Shall be UL 1449 3rd Edition Listed and UL1283 complimentary listed.
2. Modular design (with field-replaceable modules).
3. The SPD shall be UL labeled with a Short Circuit Current Rating (SCCR) of 200 kA. Fuse ratings shall not be considered in lieu of demonstrated withstand testing of the SPD, per NEC 285.6.
4. Fabrication using bolted compression lugs for internal wiring.
5. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. SPD shall include visual LED diagnostics including a minimum of one green LED indicator light per phase for protection status and one red service light.
8. SPD shall include a diagnostic test switch and an audible alarm, with an on/off silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of 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.
10. Six-digit transient-event counter with reset with EPROM memory, which retains the data while power is off to the SPD.
11. SPD shall be UL labeled as a Type 1 (verifiable at UL.com) intended for use without need for external or supplemental overcurrent control. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent to this specification.
12. SPD shall be UL labeled with 20 kA I nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
13. Suppression components shall be heavy duty, large block MOVs, each exceeding 30 mm in diameter.
14. SPD shall provide surge current paths for all modes of protection: L-N, L-G and N-G for wye systems; L-L and L-G in Delta and impedance grounded wye systems.
15. Integral disconnect switch if there is no breaker position is available.

C. Peak Single Impulse Surge Current Rating: 150 kA per mode/300 kA per phase.

D. Protection modes and UL 1449 Third Edition 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. Neutral to Ground: 1200 V for 480Y/277 V

2.2 PANELBOARD SURGE PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Current Technology Inc.
   2. Thor Systems
   3. Liebert
   4. Advanced Protection Technologies (APT)

B. Surge Protection Devices:

   1. Shall be UL 1449 3rd Edition Listed and UL1283 complimentary listed.
   2. Non-Modular design.
   3. The SPD shall be UL 1449 3rd Edition Listed and labeled with a Short Circuit Current Rating (SCCR) of 200 kA. Fuse ratings shall not be used in lieu of demonstrated withstand testing of the SPD per the NEC Article 285.6. The SPD shall match or exceed the panelboard short-circuit rating.
   4. The SPD shall have redundant suppression circuits; with thermally protected individually fused metal-oxide varistors.
   5. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
   6. LED indicator lights for power and protection status.
   7. Audible alarm, with silencing switch, to indicate when protection has failed.
   8. 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.
   9. Six-digit transient-event counter with reset.
   10. SPD shall be UL labeled as a Type 1 (verifiable at UL.com) intended for use without need for external or supplemental overcurrent control. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent to this specification.
   11. SPD shall be UL labeled with 20 kA I nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
   12. Suppression components shall be heavy duty, large block MOVs, each exceeding 30 mm in diameter.
   13. Integral disconnect switch if there is no breaker position is available.

C. Peak Single-Impulse Surge Current Rating: 100 kA per mode/ 200 kA per phase.

D. Protection modes and UL 1449 Third Edition VPR for grounded wye circuit with 208Y/120 V, 3-phase, 4-wire circuits shall not exceed the following:
   1. Line to Neutral: 700 V for 208Y/120 V

2. Line to Ground: 700 V for 208Y/120 V
3. Neutral to Ground: 700 V for 208Y/120 V

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1.

B. Outdoor Enclosures: NEMA 250 Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Per NEC2011 Article 285.23, install UL 1449 3rd Edition Listed and Labeled, Type 1 SPDs at the service entrance on the load side, with ground lead bonded to the service entrance ground.

B. Install SPD for panelboards and auxiliary panels with conductors or buses between the SPD and point of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Gently twist conductors together. Do not bond neutral and ground.
   1. Provide a 3-pole circuit breaker as a dedicated disconnecting means for SPD per SPD manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform inspections.

B. Manufacturer's Field Service: Verify that electrical wiring installation complies with manufacturer's written installation requirements.

C. Inspections:
   1. After installing SPDs but before electrical circuitry has been energized, test for compliance with requirements.
   2. Complete startup checks according to manufacturer's written instructions.

D. SPD will be considered defective if it does not pass inspections. Prepare test and inspection reports.

E. Prepare inspection reports.

F. Submit to engineer a schedule of installed SPDs listing the panel name, voltage configuration, and SPD part number and serial number. Also provide a digital image each SPD with panel cover removed to show SPD conductors and connections.

G. Do not energize the SPDs until the installer has verified service and separately derived system's neutral to ground bonding jumpers are installed and connected correctly per NEC.

END OF SECTION 264313

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."
6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."
7. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
8. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Installation instructions.

D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

7. Perimeter moldings.

E. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

F. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

G. Field quality-control reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

I. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace

components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Fluorescent-fixture-mounted, emergency battery pack: One for every 20 emergency lighting unit.
4. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: One for every 20 Insert quantity of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings. Contractors wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

G. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

I. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.

11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

F. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

I. Ballasts for Tri-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 and 50 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate one fluorescent lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.

2.7 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.8 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.9 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

C. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

D. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

E. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.10 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.

1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, [**12 gage (2.68 mm)**] <**Insert size**>.

D. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, [**12 gage (2.68 mm)**] <**Insert size**>.

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 275123
INTERCOM, PAGING, AND EMERGENCY MESSAGING SYSTEM

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. The system specified is based on the Telecor eSeries Supervised Network based Communications System providing at least the features and functions outlined below. The System shall be installed and programmed by a local authorized and certified Telecor dealer.

B. Supply and install a complete supervised network-based intercom system. Field wiring shall be CAT 5E or CAT 6 cable, control wiring for power distributions and very long runs, and utilize an optional fiber backbone (when distances exceed normal Ethernet limitations). All station equipment shall utilize standard RJ-45 modular connections. All remote devices utilizing standard structured cabling shall be capable of PoE (Power over Ethernet) or power supplied within the CAT 5E or CAT 6 cable jacket. Wiring shall be capable of either being installed in conduit or cable trays, where shown on the plans.

C. The system shall be capable of interconnecting with the building LAN (Local Area Network). This connection shall be minimal and utilize only one Ethernet 100 Mbps (or optionally 1 Gb) connection per station to accomplish all intercom operations. Ethernet ports and associated network switches that are required to connect any intercom devices will be provided by the OWNER.

D. Provide a separate circuit for each room and administrative office so each room, speaker, amplifier, and emergency messaging display/clock can be individually addressed.

E. Overall intercom communications network shall utilize Ethernet or VoIP communications between all major components: administrative consoles, intercom stations, amplifiers and individual paging speakers, and network switches. Systems not utilizing Ethernet or VoIP communications protocol to each end-point device will not be acceptable. Systems not capable of supervising all networked devices including network amplifiers, network speakers, notification switches, and emergency messaging display/clocks will not be acceptable.

F. The network shall support a VLAN configuration to separate activity in the intercom system from other in building LAN traffic. In locations where the supervised network communications system will be considered as part of the facilities life safety systems, a dedicated and isolated network shall be required.

G. The system shall interface to the facility's IP-PBX via SIP trunk connectivity.

H. The Communications System shall include master clock support and synchronization of digital secondary clocks, event scheduling, and messaging software allowing the facility to configure multiple schedules per school, multi zone time tone signaling for class changes, and message notification.

1.3 DEFINITION OF TERMS

A. Installer(s): Shall refer to the person, persons, or company who or which contracts to perform the work specified herein.

1.4 SUBMITTALS

A. Submit the shop drawings, product data, and quality control submittals specified below at the same time as a package.

B. Shop Drawings: Composite wiring and/or schematic diagrams of the complete system as proposed to be installed. Drawing shall include relative position of all major components, typical connections, field components, accessories, and cable types.

C. Product Data: Include catalogue data sheets, manufacturer's default specifications, user operation guides, and bill of materials.

D. Quality control shall include the following:

1. Name, address, and telephone number of the nearest fully equipped service organization.
2. Submit a certificate of completion of installation and service training from the system manufacturer.
3. Submit a list of comparable completed projects. Furnish the name, address, telephone number, and contact name of end user.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.

F. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.

a. Record of Owners equipment-programming option decisions.
b. All instructions necessary for proper operation and manufacturer's instructions.
c. "Proof of Performance" information.
d. Manufacturer's maintenance information.
e. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.

G. Record Drawings: Prior to final

H. acceptance, provide three (3) complete sets of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".

I. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.

a. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
b. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
c. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.

d. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

J. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required **five-year** warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

1.5 QUALITY ASSURANCE

A. Manufactures: Firms regularly engaged in manufacture of integrated communication systems, time keeping systems, and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for no less than five years.

B. Installer's Qualifications: Firms with at least five years of successful installation experience with projects utilizing integrated communications systems and equipment similar to that required for this project.

C. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

D. The Contractor shall be an established communications and electronics Contractor that has had and currently maintains a locally run and operated business for at least five years. The Contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.

E. The Contractor shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system. The Contractor shall maintain at their facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

F. Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and experience in the industry. The Contractor shall have attended the manufacturer's installation and service school and upon request must show proof of attending such a school.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

H. Comply with NFPA 70.

I. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.

1.6 IN-SERVICE TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. 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 the staff and faculty members who attended, received, and completed the training program.

1.7 WARRANTY

A. Provide a **manufacturer's five-year extended limited warranty** of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover clocks, speakers, and call-in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one-year warranty shall be provided for labor.

B. The Contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

C. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

1.8 MANUFACTURERS

A. Manufacturers: Full Network Based solution Subject to compliance with requirements, provide a system by one of the following manufacturers which are currently in use by the owner:

1. Telecor

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The system shall utilize a decentralized network structure not requiring any head-end equipment, central server, or any other control hardware to maintain system operation. Systems utilizing centralized electronics and subject to a single-point-of-failure (power supply, CPU, server, power, etc.) shall not be accepted unless the system has 100% duplication of all centralized operating equipment running concurrently and can automatically take over, including up to the minute programming configuration in the event of a failure of the main system head-end electronics or any required, centralized electronics required to make the system fully operational. Systems that are not based on decentralized structure or systems that do not provide 100% duplication of head-end or systems that operate in a "down-graded" operational mode as the result of a centralized failure are not acceptable.

B. All station devices shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power-over-Ethernet network switch, all networked devices shall be immediately operational and as applicable shall place or receive calls and pages from stations as well as page all devices in the network. Consoles, intercom stations, clocks, emergency displays, or

speakers connected to the network shall not require any network configuration or administration to function.

C. Each Intercom Station, Loudspeaker, clock/message display, shall be assignable to all or any combination of Unlimited Paging, Program Distribution or Time Zones in the system.

D. Each Classroom shall be provided with two Call Stations located in separate locations in order to comply with NEMA Standard SB40 for Emergency Communications in K-12 Schools. One Call switch shall provide the ability to generate normal calls to a designated location while the other shall generate Emergency level calls.

E. Speech shall be transmitted in the frequency range from 50 Hz to 7 kHz and shall use a maximum of 128 kbps of bandwidth during a call. In order to assure maximum intelligibility, all system audio shall be HD Audio as defined in Intel™ High Definition Audio Specifications, June 17, 2010.

F. Intercom communications between consoles and system devices shall be non-blocking with no channel restrictions or limitations (other than network capacity) to the number of simultaneous conversations at any time between pairs of intercom stations, intercom station to console, console to console, console to speaker or zone of speakers, program source to a speaker or zone of speakers, or bell tones to a speaker or zone of speakers regardless of number of stations or consoles.

G. Any and all devices shall have the ability to have their programming downloaded, individually or simultaneously via the network. Programming shall be downloadable in a series of human readable, industry standard comma-separated values (CSV) files that can be saved and edited using common spreadsheet applications. Consoles, intercom stations, clocks, displays, and speakers residing on a network shall have the ability to update their programming, simultaneously from a CSV file. Furthermore, all devices shall also have the capability to be configured directly, such that device numbers, names, zones, and call-in destinations can be altered in real time without the uploading or downloading of their programming. System shall be capable of uploading firmware updates to all device classes simultaneously, via the network, without the requirement of tools, by authorized technician or qualified facility technician or representatives.

H. Audio communications between all devices shall be accomplished with latency values of a maximum of 0.1 seconds and connection times of 0.01s for 1 to 500 speakers.

I. The system shall support a minimum of 50 channels of simultaneous duplex communication paths on the intercom system LAN, plus a minimum of 10 simultaneous duplex channels for PBX integration.

J. The system shall be capable of routing calls from the Public Switched Telephone Network (PSTN) into any classroom, zone or the entire school via the District's SIP enabled Telephone System. This shall allow for remote monitoring and two-way voice communications from outside the facility to classrooms as well as paging into areas of the school. Additional features shall include:

1. The ability to place call-ins from classroom call stations to SIP Telephones.
2. The ability to initiate calls from SIP Telephones to eSeries Classroom Speakers.
3. The ability to initiate zone and all call paging announcements from SIP Telephones to eSeries Speakers throughout the facility.
4. The ability to make outside calls from Administrative Consoles to the PSTN via the Districts Phone System.
5. The ability to receive Live District Wide Paging Announcements from the District Office

K. The System shall allow users to configure multiple schedules per school, with an unlimited number of programmable events in each schedule. Each Event shall sound a user selectable tone, play a user

provided audio file or an external audio source. In addition, a textual message shall be programmed to display on associated message displays throughout the school. All scheduling assignments shall be performed via a simple to use, Graphical User Interface (GUI) from a non-dedicated PC, residing in the School. Programming shall also be accomplished from a non-dedicated PC at the District Office. The following features and functions shall be provided. Systems that cannot provide these, shall not be acceptable.

1. The system schedules shall facilitate the requirements of combined facilities (e.g. elementary and middle schools in a common building) where multiple schedules running concurrently would be required.
2. Each event shall play any of the available tones, audio files or audio sources provided. Events shall be directed to any one or more Time Zones in the systems.
3. Events shall include textual messages to clock/message displays. These shall be formatted as fixed, flashing or scrolling displays that can include up to 200 characters in length.
4. Time Tones may be manually activated from Administrative Consoles or selected SIP phones residing on the schools IP PBX.
5. An integral Master Clock shall provide time synchronization to all secondary, digital clock/Message Displays throughout the school. The communications shall be capable of obtaining it's time synch signal from any NTP timeserver.

L. The System shall be capable of automatically distribute SMS and email notifications to relevant staff members when an emergency event is occurring the facility. Notifications shall be distributed to user alert devices such as mobile phones and smart devices. Mobile phones shall receive the notifications as SMS messages while smart devices shall receive email messages. Emergency events include:

1. The activation of emergency-themed element icons on a PC GUI (e.g., Lockdown, Evacuate, etc.)
2. Emergency Calls placed from Call Stations located room locations.

M. The system shall automatically distribute SMS and email notifications to appropriate technical support staff in the event that the system is experiencing a fault.

2.2 EQUIPMENT AND MATERIAL

A. Supervised Interactive Graphical User Interface

1. The system shall include an Interactive Graphical User Interface (subsequently referred to as IGUI). The software shall reside on Telecor provided PC and should have ability to interface to District Wide Emergency Communication system located in the district office.
2. The IGUI shall be supervised and shall utilize an easy-to-use graphical user interface for quick and easy graphically aided navigation to access functionality for all intercom stations, paging zones, and program distribution sources. Emergency operations shall be simplified through the IGUI allowing stored audio files and alphanumeric messages for message displays to be activated from the IGUI. The IGUI shall allow common operations such as daily announcements to become simplified into single touch activated icons; removing multi-step console set ups and dial strings.
3. The voice device used to originate voice communication for the IGUI to selected locations shall be a system console, telephone handset, or microphone independent from the computer hosting the IGUI. The voice device shall remain functional and accessible regardless of the operational state of a computer supporting the IGUI.
4. The IGUI shall allow the creation of a custom operating screen(s) based on the floor plans of the facilities. Icons representing intercom stations, zones used for paging, tone distribution, textual Message distribution, and audio program distribution shall be incorporated onto the floor plans. The IGUI software shall provide:

a. Simple routine call processing, including: hold, transfer, and forward
b. Activation of remote station auxiliary relays for applications such as door lock or release

c. Emergency functions
d. Paging
e. Audio program distribution
f. Customizable page elements
g. Customizable operating screen
h. Element library for emergency event icons
i. Initiation of emergency and non-emergency messaging, textual and audible
j. Remote station volume adjustment
k. Remote activation of do not disturb status and/or message waiting status
l. Remote station trouble indication
m. Remote station background music channel selection
n. Dynamic zone management for interactive on-the-fly console specific zones
o. Single touch emergency response (supporting both actual emergencies and drills) including but not limited to all or any combination of the following:
1) Live voice notification
2) Pre-recorded audio message
3) Digital plain text messaging with simultaneous numerically coded message capability
4) Remote system activation, i.e., access control systems, CCTV systems, door release systems, etc.

5. The IGUI must provide an efficient and reliable method of notifying the occupants within the facility of critical situations. A variety of emergency tone signals that reside within the intercom/paging system shall be activated by clicking on pre-programmed buttons on the IGUI screen, initiating the transmission of tone signals to speakers, and alphanumeric messages to message displays/digital clocks. A “lockdown” icon shall be designed as per Owner direction, with Owner selecting the appropriate tone. Whole building macros for emergency or off-normal response shall be built into the internal communication system as directed by the Owner. Each macro shall be capable of being activated by the console, the IGUI as indicated on plans or as directed by the Owner or AHJ. It shall be possible to activate a WAV file message or Owner selected tone coinciding with multi-language textual messages for distributions to zones as directed by the Owner, all from a single activation icon located on the IGUI. Other single action macros shall be activated in similar fashion via the IGUI and a custom-labeled icon. Plain language labeling of all icons on the IGUI shall be user changeable.

B. Emergency Notification

1. The system shall be capable of providing emergency notifications by email and SMS to mobile devices and designated PCs. during an emergency utilizing a district wide communication system. This feature will notify all relevant staff members so that they are made aware of the emergency event and can respond appropriately. Up to 100 users can be supported directly. When integrated with the facility’s email server, it can effectively distribute notifications to an unlimited number of alert devices.
2. Alert devices may be mobile phones and smart devices. Mobile phones shall receive the notifications as SMS messages while smart devices shall receive email messages.
3. When deployed, the emergency notification feature shall support the fault monitoring capabilities of the Master Clock/Message Host. Trouble/fault notifications from eSeries devices shall be annunciated on the IGUI with a flashing Icon. Activation of this icon shall distribute notifications of a fault to appropriate technical support staff.

C. Emergency Alert

1. The Emergency Alert platform shall consist of displays, adapters, and integrators as located on the drawings and specifications.
2. The platform shall allow visual displays to be integrated into Telecor’s eSeries System. These displays shall show the time, weather, information, alarms, messages, and emergency alarms. Multiple visual layouts and color schemes shall be available for use. The time shall be displayed as either an analog or digital clock. Messages and emergency alarms shall include plain text and audio. Messages shall have

the ability to be scheduled to appear at certain times and days of the week. Live local weather at the facility shall also be shown on each screen.

3. Messages shall be configurable to appear on specific displays and zones (which shall group together multiple displays).
4. Severe weather notifications issued by the National Oceanic and Atmospheric Administration (NOAA) shall activate weather alerts automatically.
5. Emergency alarm screens shall be activated from the IGUI. This shall allow complete integration with an operational control from the facility's Telecor communications system. Emergency Alert alarms shall activate in conjunction with the delivery of SMS text messages and email notifications.
6. The Emergency Alert platform shall support an unlimited number of displays. All displays shall have adjustable brightness levels. A scheduled sleep mode feature shall be available for further energy conservation. Should a display lose power, it shall automatically resume regular operation upon power and network restoration.
7. Displays shall connect via wired Ethernet or wireless Wi-Fi to the facility LAN which shall have access to the Emergency Alert cloud-based web portal. This portal shall be used to manage and configure the Emergency Alert platform and its features. The cloud-based nature of the Emergency Alert platform shall provide the ability to manage different sites, each with their own sets of displays, through the web portal.
8. The Emergency Alert display shall consist of a 22" HD screen. The display shall be equipped with both wired and wireless network adapters for connection to the facility LAN.
9. The display shall be wall mounted with a surface mount bracket in either a landscape or portrait orientation.
10. The adapter shall allow any third-party display capable of receiving HDMI input to serve as an Emergency Alert display. This shall include large-format HD resolution displays. The adapter shall include wired and wireless network adapters to allow the display to connect to the facility LAN.
11. The integrator provide integration between Telecor's eSeries System and the Emergency Alert platform.
12. Emergency Alert platform messages and emergency alarms shall have the ability to be configured so that they can be activated from the IGUI.

D. Supervised SIP Trunk IP/PBX Interface

1. The system Session Internet Protocol (SIP) Interface shall be a VoIP PBX phone interface of the same manufacturer as the supervised network intercom and paging system. Third party gateway devices shall not be accepted.
2. The SIP Interface shall be supervised and shall connected directly to the facilities network and the PBX's network and shall provide the following:

a. Establish a barrier gateway between the intercom and paging network and the PBX and/or common computer network.
b. Transparent audio operation between VoIP PBX phones and any device on the supervised network intercom and paging system. Paging access from any telephone on the facility system VoIP PBX to any intercom speaker, speaker zone, intercom station, console, all speakers, or paging horns and zones throughout the facility.
c. Any call-in from the supervised network intercom and paging system shall be capable of being routed directly to a VoIP PBX phone. Call-in stations can be configured and programmed to automatically dial any number on the publicly switched telephone network, landline, or cellular number through the SIP interface and via the PBX.
d. Ability to escalate a call-in to be redirected to a VoIP PBX connected phone via the SIP Interface. Escalation can also include the ability to dial any number on the publicly switched telephone network, landline, or cellular number through the SIP interface via the PBX.
e. Ability to initiate alarm and crisis response protocols from any VoIP PBX connected phone.
f. Ability to require security access code to utilize the intercom or paging system emergency communication features.
g. Minimum of 10 simultaneous telephone channels of access to/from VoIP PBX phone system. Full caller ID support from any supervised network intercom call-in device to a VoIP PBX connected phone identifying the calling station ID/Location.

h. Emergency level call-in to be uniquely identified as emergency on the VoIP PBX phones.
i. Activation of all supervised networked intercom and paging system emergency tones and pre-recorded announcements from any phone connected to the building VoIP PBX phone system.
j. The SIP Interface shall additionally allow for calls to be placed from a console to any phone number on the publicly switched telephone network (landline or cellular). Additionally, intercom calls at a console may be transferred to any number on the publicly switched telephone network to any landline or cellular number through the SIP interface via the PBX.

3. Systems that connect to a building or district phone system and are limited to a SLT or CO connection will not be accepted as a substitute for a fully operational SIP Interface.

E. Control Interface

1. The Control Interface shall provide a Desktop Application for PC interaction with the Intercom and Paging system, a Command Interface Protocol for external system interaction with third party systems, Group Zone functionality, and a Scripting Engine supporting multiple sequential operations.
2. The system shall incorporate a Windows based Desktop application that makes use of a Command Protocol Interface, allowing external systems to interact with the Network Intercom and Paging System. Combined with the Scripting and Group Zones features, the Desktop application shall generate a preprogrammed series of operations from a single action. These features shall be used in conjunction with a graphical user interface and the Microsoft Windows desktop.
3. Default Scripts shall be used to generate customized shortcuts according to the needs of a facility. These shortcuts shall then be placed directly on the Windows desktop and shall activate virtually any Intercom and Paging function by clicking on the shortcut icon. These shall include activating:

a. Alerts, audio distributions, coded and plain text messages, intercom operations.
b. Pre-Recorded Evacuate, Lockdown, and All Clear audio files.
c. Companion text messages for audio alerts.
d. Coded messages on all secondary digital clocks and displays.

4. The Desktop Application shall also activate SMS text messages, computer pop-up notifications, and email distributions in conjunction with any script. Desktop icons such as a Panic Button shall send SMS notifications to a crisis team, advance warning to building occupants through pop-ups to heighten the level of awareness.
5. Any Desktop location running the Application shall have the ability to create and send an instant message using the Desktop's keyboard and display. The textual message can be sent independently or as a companion message to an audible alert.
6. The Desktop Application shall be capable of utilizing Soft Call and Panic buttons. Soft Call buttons shall be created to operate as a call button on the desktop with a normal or emergency call priority. They shall also be combined with other preset or on-the-fly custom text messages. Panic buttons shall allow a user to unobtrusively activate an audio path from the panic button location to another eSeries device at a security location. This shall allow security personnel to listen to an occurring situation and provide the appropriate response.
7. The System shall be capable of streaming multiple audio programs over 10 available channels, simultaneously, to speaker locations in the facility. The ability to turn the broadcast on or off to a specific location shall be controlled from the Desktop Application.
8. A user from the Desktop Application shall enable or disable Do Not Disturb (DND) mode for a group of devices such as speakers or intercom stations.
9. Volume Adjustments to individual devices, devices in a zone, or all devices in the intercom and Paging System shall be made from the Desktop Application.
10. The Desktop Application shall be used to create a call directory to provide the user with the ability to quickly and easily place calls to a large number of prospective recipients and locations. The shortcuts shall be customized with the name of the call recipient or location. The call directory shall also contain shortcuts that activate message-waiting indications in addition to the option of placing calls.

11. The system shall interface with other external systems using a Command Interface Protocol. External systems include integrated security management or building management systems via devices such as computers, programmable logic controllers, or software-based annunciator panels.
12. The Command Interface Protocol shall be used to send real time commands and receive real time status messages between the third party system and eSeries devices. The Command Interface Protocol shall be an ASCII protocol that includes both outbound messaging, and support for inbound command via a virtual COM port and a physical USB connection.
13. Scripting shall allow operations to be carried out in sequence. Scripts shall be activated in various ways including: automatically based on the day of week and time of day, using a Console or a phone, by using the Desktop Application, or from other scripts.
14. When scripts from a Console or PBX phone (via a SIP interface), the name of the script shall be displayed on the Console or phone. Then the user shall be presented with options to enable or disable the script (depending on the current state of the script). Consoles and PBX phones that dial the script number shall hear voice prompts for enabling or disabling the script.
15. Scripts shall be used for scheduling time tone programs that include tones, pre-recorded messages, and textual messages displayed on Message Display/Calendar Clocks reoccurring at specific times and days.
16. Scripts shall perform cascading evacuation operations where evacuation audio messages are automatically first distributed to zones closest to the location of an emergency before spreading outwards to other zones according to a time schedule, thus reducing evacuation route congestion throughout the facility.
17. Group Zones shall allow groups of page zones or devices to be defined as a group zone with a dial number. Group Zones shall be accessed from the Desktop Application, Consoles or PBX phones.
18. Group zones shall be the destination for various functions including textual messages, or audio operations, such as pages or audio program distributions). Group zones shall be assigned customized names, which will appear on Console or phone displays when they are dialed.
19. Group Zones shall make it possible for a dial number to be forwarded to different destinations based on time and day. For example, common audio operations directed to a Group Zone dial number shall be configured to go to the usual destination during regular hours but to a different destination outside of regular hours.
20. Group Zone shall support designated priorities, such as emergency. Operations that are to a zone with a priority are automatically elevated to override any normal or lower priority operations the devices in that group zone are receiving.

F. Master Clock/Message Host

1. The Master Clock/Message Host shall be a time master device for the eSeries network which enables configuration and activation of eSeries operations from a web-based graphical user interface (GUI). An unlimited number of operations shall be managed for activation by schedules or users. The application shall be web-based and secured via HTTPS certification. It shall be preconfigured with a variety of default operations, schedules, audio, and icons for quick customization. Users shall log into the application from any desktop computer or mobile smart device using a supported web-browser. Supported web browsers shall include Microsoft Edge, Mozilla Firefox, Google Chrome, and Apple Safari.
2. Master Clock/Message Host functionality shall include central time keeping and synchronization of all other eSeries devices throughout the eSeries network.
3. The Master Clock/Message Host shall manage an unlimited number of calendar-based schedules, which are collections of operations intended to be performed frequently, periodically, or on specific dates and times. For example, a schedule may be a series of bell tones that consistently indicate class changes. Users shall set schedules so that the operations they contain will activate accordingly.
4. Schedules shall be viewed, enabled or disabled in a calendar. The calendar shall display schedules on a daily, weekly, monthly or yearly basis. The Master Clock shall support scheduling operations up to 10 years into the future.
5. An unlimited number of holidays shall be specified and marked on the calendar. This shall indicate days where disabling all schedules may be appropriate.

6. The Master Clock/Message Host shall obtain time from and synchronizes with Network Time Protocol (NTP) servers directly or via an NTP-enabled SIP interface present on the eSeries network.
7. Operations shall include several components, including: pre-announce tones, pre-recorded audio, scrolling textual messages, and coded messages. If desired, specific details of the components shall be customized. Customization shall include: the number of times the pre-announce tone plays, the message scroll speed, and the delay before pre-recorded audio repeats. Depending on the operation type, user-activated operations shall be distributed immediately or queued for later distribution.
8. The Home page shall provide a quick overview of Master Clock/Message Host managed operations. This shall include the next scheduled operation, the schedules that are currently active, and the next scheduled school drill. The Master Clock/Message Host shall include user specific short tutorial videos that explain various aspects of the GUI and provides built-in on demand training.
9. The Live page shall show currently active and upcoming operations. A history of recently performed operations shall confirm operations occurred as intended. Also, users shall easily initiate on-the-fly operations on the Live page by configuring and activating them on demand.
10. Routine operations shall include an unlimited number of pre-configured common audio distributions. Examples shall include announcements for special assemblies, bus arrivals, staff meetings, and festive events.
11. Operations shall be associated with eSeries scripts so that they shall be activated by users. The Master Clock/Message Host GUI shall indicate if the script is active even if it was activated via other means such as dial access code or IGUI. Other emergency operations (such as Lockdown) shall also be seamlessly integrated with the IGUI.
12. Audio files shall be used for tones or announcements while images shall be used as icons throughout the GUI to represent different operations or schedules. Audio file formats shall include (WAV and MP3) and images to support operations.
13. Access shall be user-account controlled. An unlimited number of users shall be supported with a high level of individual customization. Users shall be given access to only the pages and operations relevant to their intended roles. For each page, users shall be granted permissions to activate or configure operations and schedules from a desktop or, for certain users, from mobile devices. An administrator account shall have full access to view and make configuration changes on all pages, while an operator account shall be limited to activating routine or emergency operations and enabling or disabling schedules.
14. Users with administrative privileges shall have the ability to configure the site name, time, time zone, test zone, and import and export databases. To aid installers with initial configuration, a test mode shall be provided as well as a database import/export feature. Test mode shall redirect all activated operations to a test zone (that only the installer occupies) to prevent disrupting other people during configuration and testing. Database import/export shall allow the configuration to be exported for backup purposes or to copy to other installations.
15. The system shall be configured for an unlimited number of dedicated emergency response operations. A corresponding drill operation shall be automatically created for each emergency situation. Users shall activate emergency response operations from facility PCs or remote mobile devices.
16. The Master Clock/Message Host shall feature a Maintenance Portal. The portal shall provide trouble notifications for faults being experienced by any eSeries device on the eSeries Network.

a. The notification includes a details fault report that provides the device name, dial number and the nature of the fault. These shall be easily copied into other documents and emails.
b. The Portal shall be configured to use an email account to automatically send trouble notification emails to a list of designated addresses. These emails shall list the details of all the current faults.
c. A link to the Master Clock/Message Host web interface shall be provided in order for the recipient to perform trouble shooting actions such as viewing up to-do-date fault information, enabling service mode status, and making configuration changes.

G. Mobile Quick Access

1. The system shall include a Mobile Quick Access feature that allows staff members to quickly activate Emergency Notifications. (e.g. Lockdown) using mobile smart devices.

2. Notifications shall include the broadcast of pre-recorded audio announcements over the facility's public address speakers and textual messages to eSeries displays with a single activation.
3. The feature shall include emails and SMS messages that shall be delivered to custom lists of recipients.
4. Button options shall be customizable allowing staff a choice of notifications from their mobile device depending on the staff's authority.

H. Supervised Speaker Breakout Module

1. The Speaker Breakout Module shall provide the means of integrating traditional analog speakers and call initiating devices to the eSeries System. The Speaker Breakout Module shall also be a Single Zone Paging Adapter that can drive an amplifier to provide paging coverage in a facility. The Speaker Breakout Module shall have three relay outputs that can activate automatically during a call processing operation.
2. The Speaker Breakout Module shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power over Ethernet network switch, the Speaker Breakout Module shall place or receive calls and pages from the eSeries network. The Speaker Breakout Module shall not require any network configuration or administration to function.
3. Speech shall be transmitted through the Speaker Breakout Module in crystal-clear HD Audio. Audio shall be transmitted in the frequency range from 50 Hz to 7 kHz and shall use a maximum of 128 kbps of bandwidth during a call. Audio between the Speaker Breakout Module and Consoles shall be non-blocking.
4. The Speaker Breakout Module shall support Ceiling Inlay Speakers which shall connect to the Speaker Breakout Module via a standard CAT5 cable or conventional 8Ω/25V/70V speakers to provide paging and talkback operation from Consoles or phones via a SIP interface and an IP-PBX.
5. The volume of the speakers shall be adjustable individually, by zone, or across the entire eSeries network via the Management Interface or Control Interface. Volume controls incorporated into certain call station models shall also allow a user to adjust the speaker volume locally. Volume levels shall be set by specific functions: intercom, paging, emergency paging, and Public Channel operations.
6. Call-in capabilities shall be provided with the addition of call stations. Call stations models shall be able to initiate normal calls, emergency calls, or both. Advanced stations that provide additional features shall also be available. These features shall include Privacy mode, Do Not Disturb mode, volume control, and Public Channel select. All call stations shall also provide "message waiting" indication.
7. The Speaker Breakout Module shall also support placing normal and emergency priority call-ins from simple pushbutton call switches. Pressing the normal call switch shall initiate a normal call-in, and either pressing it three times quickly or pressing and holding it for three seconds to shall place an emergency call-in. Pressing the emergency switch once shall place an emergency call-in.
8. The Speaker Breakout Module shall have the ability to direct normal and emergency call-ins to different devices. If the device that is configured to receive the call-in loses network connectivity, the Speaker Breakout Module shall automatically search for an alternate destination. If no other suitable call-in destinations exist, the Speaker Breakout Module shall audibly and visually indicate a fault.
9. The Speaker Breakout Module shall have a call-in roll-over feature where if a call-in to the primary call destination is not answered after a pre-set amount of time, the call shall be automatically copied to a secondary call destination. If both the primary and secondary call destinations are unavailable, the call shall be redirected to a back-up Console.
10. The Speaker Breakout Module shall have the capability to be configured as a member of one or more paging zones.
11. The Speaker Breakout Module shall have a built-in 4-watt audio amplifier that shall drive up to 4 watts of audio to a small zone of 25/70 volt loudspeakers. The Speaker Breakout Module shall provide a line level audio output that can connect to an external power amplifier for applications where the speaker zone load exceeds 4 watts.
12. The Speaker Breakout Module shall be monitored for network connectivity. If the Speaker Breakout Module 's network connection is lost, targeted Consoles shall report that station as absent and display its dial number. When the Speaker Breakout Module is used with Call Stations, the Speaker Breakout Module shall also provide full supervision and monitoring for Call Station and call-in destination connectivity. If a wiring fault is detected between a Call Station and the Speaker Breakout Module, the Speaker Breakout

Module shall audibly and visually indicate the error utilizing the status LEDs on the Speaker Breakout Module. The Call Stations shall pulse their status LED to indicate a trouble condition. In case of a fault, the Management Interface or Logging Interface shall log the location, time, date and type of fault. If so configured, the Management Interface, Logging Interface, and Network Amplifiers shall also generate an alarm tone.

13. The Speaker Breakout Module's status LED that shall flash in different patterns to indicate normal operation, call-in assurance, message-waiting, a call or paging audio in progress, or to indicate an error.
14. The Speaker Breakout Module shall be equipped with three relays that can be used to operate auxiliary devices such as strobe lights, tone initiating devices and door locks.
15. The Speaker Breakout Module shall be wall-mounted using the attached mounting brackets.

I. Supervised Ethernet Termination Board Unit

1. The Ethernet Termination Board Unit shall reside on the facilities LAN providing provide two-way intercom communications between Consoles and industry standard 25 Volt speaker stations.
2. The Ethernet Termination Board Unit shall distribute program audio to speaker locations and detect call-in annunciation from call switches in room locations. It shall selectively transmit Paging, Audio Programs and Time Tone Signals originating on the eSeries Network Devices, to individual rooms, all rooms, selected rooms, or zones of loudspeakers.
3. The Ethernet Termination Board Unit shall be consistent with the ANSI/NEMA SB 40 Standard for Communications Systems for Life Safety in Schools, supporting multiple call-in locations per room. These include the support of call-in devices with LED call assurance and privacy or do-not-disturb indication for each room. Multiple devices at a room location shall be configured to place call-ins with different destinations and priority levels. If the call-in destination of these devices is a Console or an IP-PBX phone extension, the device display shall indicate the calling room location dial number, a textual room name, and the priority level of the call-in. Room locations can be configured with a primary, secondary, and back-up call-in destinations. Emergency priority call-ins placed from a room location shall be configured with a different call-in destination.
4. The Ethernet Termination Board Unit shall support a Message Waiting (MW) feature. This feature shall use the LED on call stations to indicate waiting messages to room occupants. If no one is present in a room location to respond to a call or if the room is in Privacy or DND mode, the caller has the option to activate a MW indication. This causes the LED on the call station to pulse. When a call-in is initiated from the room, it shall be directed to the device that activated the MW indication and the MW indication will be deactivated.
5. The Ethernet Termination Board Unit shall support the Privacy function on Call Stations that are equipped with a Privacy button. When pressed, the Privacy button shall place the room location in privacy mode. This shall prevent monitoring of audio in the room. In privacy mode, the LED on the Call Station shall illuminate to indicate privacy mode. When a call-in is placed from the room location, privacy mode shall automatically be suspended for the duration of the call and re-enabled afterwards. If a call is placed to the room location while in privacy mode, the caller shall be alerted to the privacy mode and given the option to connect the call, leave a message-waiting indication, or to cancel the call.
6. The Ethernet Termination Board Unit shall include support for the Do Not Disturb mode. Call Stations equipped with a Do Not Disturb (DND) button shall place the room in DND mode when pressed. In DND mode, the LED on the Call Station shall flash to indicate that the station is in the DND mode. This shall suspend zone pages and normal priority audio distributions from being broadcast into that room. DND mode shall not prevent emergency priority operations from reaching the location. If a call is initiated from a room location that is in the DND state, the DND shall be automatically suspended for the duration of the call and re-enabled afterwards.
7. The Ethernet Termination Board Unit shall also provide synchronization and correction of traditional Digital and Analog Clocks, as well as Electronic Message Displays. The digital signaling that provides support for these devices shall originate in the eSeries Network. Analog Clock correction formats supported by Legacy T2 or XL systems, shall also be supported by the Ethernet Termination Board Unit.

8. The Ethernet Termination Board Unit shall monitor the wiring of all room location call devices for call line failure. It shall analyze the wiring for an open circuit, short circuit, or short to ground conditions. In the event of a fault, the Ethernet Termination Board Unit shall detect the fault and provide trouble notification messages to devices equipped with trouble LED and buzzers which will annunciate the trouble signals.
9. The Ethernet Termination Board Unit shall be equipped with an integrated 25 watt, dual-purpose intercom/paging amplifier. It shall be used to provide amplification for two-way intercom communications to room stations, as well as amplification for paging, audio programs, and time tone signals to speaker locations. In the event that the audio load is greater than 25 watts, a line level output shall provide for the connection of an external power amplifier.
10. All speakers, when connected to the Ethernet Termination Board Unit shall reside on an “Off Bus.” This shall ensure failsafe operation, where even in the event that network connectivity is lost, a redundant audio source can be connected to the “Off Bus” and emergency paging announcements can be transmitted to all speakers connected to the Ethernet Termination Board Unit.
11. The Ethernet Termination Board Unit shall mount in a standard rack panel measuring 19" W x 1.75" H and shall occupy a single rack unit. It shall be ideally suited for use with a patch panel. Alternatively, two 50-pin, RJ-21 connectors shall provide termination facilities to a pair of terminal blocks for connecting field devices. The unit shall be powered from an external 24 VDC Power Supply.

J. Supervised Network Administrative Console

1. The Administrative Console shall be supervised and allow the operator to establish two-way communications with an intercom station, talkback speaker, or another Console using the handset or speakerphone. VOX functioning shall be automatically enabled when the handset is used. The Push-to-Talk button shall toggle the Console between talk and listen mode when the speakerphone is used. The Console shall provide a 2-line by 20-character LCD display. The display shall be adjusted to a range of angles for optimum viewing. When there are no active calls, the display shall show the Console name and dial number. If a time server is connected to the network, the display shall also show the time and date.
2. Incoming calls to a Console shall show the originating station dial number and name on the Console display. Calls shall be displayed in the order they are received. The operator shall scroll through the list of calls and answer them out of sequence. Emergency call-ins shall be distinctly annunciated both visually and audibly.
3. The Console shall allow call-ins to be forwarded to another Console, or for calls to be put on hold or transferred to another Console location. Additionally, call-ins or calls shall be forward/transfer-able to PBX telephone extensions via a SIP trunk interface.
4. The Console shall select remote audio sources connected at any location on the local area network, and distribute the audio broadcast from the source to all speakers in a facility or to selected areas such as a speaker zone or a selection of speakers. The Console shall be capable of audio source verification by attendant prior to page zone activation. In this manner, attendants shall listen to the audio source locally, including listening to pre-recorded announcements, prior to system broadcast.
5. The Console shall select a tone or a pre-recorded announcement and broadcast the tone or announcement to all facility speakers or to select areas, such as a speaker zone or a selection of speakers.
6. The Console shall be equipped with digital volume control that shall allow for the separate adjustment of the speaker listen and handset listen volumes. The levels for intercom listen, tones, and program distributions shall be independently adjusted and stored in memory.
7. The system shall allow user programming of alphanumeric architectural room names and numbers. The Console shall be capable of using 1 to 7 digit sequences for dial out and call-in identification, and shall display station numbering, station name, and call-in priority.
8. The end-user shall be allowed to choose and determine the number and location of Consoles. The end-user shall not be limited by pre-set manufacturer limitations of the number of Consoles required by this project; allowing for unrestricted future expansion. Consoles may be added at any time. Consoles added by the end-user that exceed the engineered design for this project shall be at owner’s expense. Communication between consoles or consoles and intercom stations or rooms shall not be inhibited by channel number restrictions.

9. The Console shall be capable of displaying room statuses such as Privacy and Do Not Disturb and shall have the ability to override any status limiting communication between the Console and a station with Privacy or Do Not Disturb status activated. Temporary override shall not interfere with continued activation of Privacy and Do Not Disturb after communication has been established and electively terminated.

K. Supervised Network Amplifiers

1. The Supervised Network Amplifier (subsequently referred to as Network Amplifier) shall provide a minimum of 25 watts for paging and public address and shall be capable of utilizing analog amplifiers to increase the amount of amplified signal from the network amplifier. The Network Amplifier shall be connected directly to the network switch by an RJ45 connector and shall receive signals directly from the network.
2. The Network Amplifier shall be supervised and in the event that network communications is lost, an audible alert shall sound on the Amplifier. The Network Amplifier shall provide a silence feature to mute the audible alert for 24 hours.
3. The Network Amplifier shall also be capable of receiving local input from local devices such as tape decks, iPod docks, CD players, etc. The network amplifier shall be capable of transmitting signals received from the local input to other network locations or locally to directly connected 25/70 volt or 8-ohm analog speakers.
4. Each Network Amplifier shall be capable of providing two audio inputs for local devices and shall be programmable as either a microphone or line-level input.
5. The Network Amplifier shall be controlled remotely such that audio programs, input, tones, textual messages, or announcements may be initiated by other devices connected at different locations on the local area network.
6. The Network Amplifier shall have a minimum of 4 local tone/pre-recorded announcement audio message control lines which when activated will distribute tones/pre-recorded audio messages to intended network amplifiers for re-distribution, network talk-back speakers (or a zone), and/or local 25/70 volt or 8-ohm analog speakers directly connected to amplifier. Each network amplifier shall be capable of storing four (4) pre-recorded announcements in addition to a minimum of 16 tones. Tones and announcements shall be activated locally or from other network devices.
7. The Network Amplifier shall store and transmit companion textual messages for each stored audio announcements. Textual messages shall be automatically broadcasted to the same zones along with the audio messages such that any device programmed for that zone automatically receives both the audio and textual announcement/message and automatically reproduced each or both messages to the extent of the devices' capabilities.
8. The Network Amplifier shall be capable of transmitting HD level audio as defined by Intel™ High Definition Audio specifications, June 17th, 2010 at a minimum.
9. The Network Amplifier shall shut down to protect itself should an output short circuit fault or overload occur that jeopardizes the integrity of the Network Amplifier.

L. Power Amplifiers

1. Power Amplifiers shall be used to drive groups of speakers located in corridors and outdoor locations that are assigned to speaker zones. Amplifier Zones shall be sized at 1 watt per corridor speaker, and 3.5 watts per horn. The amplifier load shall not exceed 80% capacity.
2. The Power Amplifiers shall be capable of producing an audio output of 60, 125 or 250 watts RMS at less than 1% distortion with balanced output.
3. They shall be designed to operate on a line voltage of 115 AC.

M. Call Stations

1. The Call Stations, as indicated on the drawings, shall be used to initiate calls from remote locations to eSeries Consoles. Call Stations are designed to be used in conjunction with a Multi Input Buffer Unit, IP Termination Unit (Multi-Input), or the Ethernet Termination Board Unit on a single pair of wires.

2. Call Stations with a “PUSH TO CALL” momentary contact touchpoint shall initiate a normal priority level call from a remote location when the touchpoint is pressed. A Call Assurance LED shall provide call confirmation. When a call is placed, the LED shall flash, confirming call placement. The LED shall continue to flash until the call is answered by the console operator.
3. Privacy Call Stations shall, when pressed, place the room into privacy mode, preventing monitoring of audio activity in the classroom. When in privacy mode, the LED on the station illuminates, indicating privacy status. When a call-in is initiated from the room, the privacy status shall be automatically suspended for the duration of the call and automatically re- enabled afterwards. If a console calls a room that is in Privacy, the operator shall be alerted and given the option to cancel the call, leave a message-waiting indication or to connect regardless. If they connect, the room occupants will hear the operator, but the operator will not hear the room until an occupant turns off the Privacy feature.
4. Do Not Disturb (DND) Call Stations shall, when pressed, place the room into DND mode. When enabled, the LED on the station shall illuminate, indicating DND, and scheduled events, zone pages and normal priority audio programs will not sound in the room. However, emergency pages, manual tones and high priority audio distributions shall continue to be broadcast into the room. When a call-in is initiated from the room, the DND status shall be automatically suspended for the duration of the call, and automatically re-enabled afterwards. If a console calls a room that is in DND, the operator shall be alerted and given the option to cancel the call, leave a message-waiting indication, or to force the connection regardless of DND. If they connect, the intercom call to the room shall proceed normally; this allows an immediate option to reach the rooms occupants in the event of an emergency.
5. Call Stations shall indicate waiting messages to staff members. If no one is present in a room to respond to a call, or the room is in Privacy or Do Not Disturb mode, the console operator shall have the option to leave a Message Waiting indication. If the MW option is chosen, the LED indicator on the room call stations shall begin to pulse. When a call-in is initiated from the room, the MW indication shall be automatically deactivated.
6. Emergency Call Stationsshall be capable of being paired with other call stations and, when pressed, shall initiate an emergency priority level call-in from a remote location. A Call Assurance LED shall provide call confirmation. Then a call is placed, the LED flashes to confirm call placement. The LED shall continue to flash until the call is answered by the console operator. Consistent with the NEMA SB 40-2008 Communications Systems for Life Safety in Schools standard, the Emergency Call Station shall allow the establishment of multiple call-in locations per room and a separate emergency call-in, without the investment in additional wiring infrastructure. The Emergency Call Station shall be connected with a pair of wires from the other associated call station.
7. An alternative model Emergency Call Station shall be able to operate independently without having to be paired with another call station.

N. Security Intercom Stations

1. The Security Intercom Stations, as indicated on the drawings, shall be tamper-proof in design and construction and shall provide for two-way communications as well as call-in capabilities. The faceplate shall be fabricated from 11-gauge stainless steel with a brushed, mar-resistant finish. The speaker shall be protected against tampering by three barriers located between the faceplate and the speaker cone. A Mylar speaker cone shall be used in order to prevent damage to the speaker from liquids.
2. The Security Intercom Stations shall mount onto standard, two-gang electrical boxes, of a depth of no less than 2.875". Mounting hardware shall be tamper-proof. The switch actuator shall be fabricated from solid metal, and connected to the faceplate by a pair of welded studs. It shall be no less than 1/2" in diameter and shall be situated flush to the front of the faceplate. The actuator shall activate a momentary contact switch whose movement shall be limited by a mechanical stop to prevent damage caused by heavy impact.

O. Vandal Resistant Horn/Loudspeaker

1. The Vandal Resistant Horn/Loudspeakers, as indicated on the drawings, shall be a vandal-resistant loudspeaker assembly that utilizes a double re-entrant horn compression type loudspeaker. It shall be used in locations as indicated on the drawings.

2. These are weatherproof units that are designed for outdoor installation. They are capable of delivering 16 watts of continuous power and include an integral 25/70 volt line-matching transformer. The transformer features color-coded primary taps at 16, 8, 4, 2, and 1 watts. The nominal frequency range is 350 Hz to 10 kHz, with a sensitivity of 96 dB SPL (1 watt/1 meter).
3. The Vandal Resistant Horn/Loudspeaker shall be assembled onto a 16-gauge steel baffle that incorporates a unique interwoven steel security screen for maximum speaker protection while remaining acoustically transparent. This shall prevent any object from penetrating the loudspeaker. The baffle shall be finished in a powder epoxy coating that provides a resilient surface suitable for harsh environments.
4. The Vandal Resistant Horn/Loudspeakers shall be secured to the backbox with “pin-in-torx” tamper-proof screws, which are included with the unit. The Vandal Resistant Horn/Loudspeakers shall be suitable for flush mounting using the H16 Recessed Back Box. Alternatively, surface installations shall be accommodated using the SH-16 Surface Enclosure.

P. Loudspeakers

1. The Speakers, as indicated on the drawings, shall be 24” x 24 Lay-in Tile Speaker Assemblies, 12” x 24” Lay-in Tile Speaker Assemblies, and Pre-assembled 8” Packaged Ceiling Speakers or approved equals.
2. The 24” x 24” Lay-in Tile Speaker Assembly shall incorporate an 8" cone loudspeaker, equipped with a dual 25/70 volt line-matching transformer, pre-assembled into a 24" x 24" square perforated steel baffle and combination backbox, designed to be installed flush in a suspended ceiling
3. The loudspeaker shall have a wide frequency response for general-purpose voice and music reproduction. The line-matching transformer shall have primary taps at 5, 2.5, 1.25, 0.63, and 0.32 watts. The baffle is finished in a mar-resistant, white epoxy coating. The baffle is finished in a mar-resistant, white epoxy coating.
4. The speaker assembly shall be designed to be installed in a suspended ceiling. Installation is quick and simple as the 24" x 24" is designed to fit into a common 2-foot square ceiling grid. Tie off tabs allow the assembly to be secured to the building structure or ceiling grid to address any safety concerns.
5. The 12” x 24” Lay-in Tile Speaker Assembly shall incorporate an 8" cone loudspeaker, equipped with a dual 25/70 volt line-matching transformer, pre-assembled into a 12" x 24" square perforated steel baffle and combination backbox, designed to be installed flush in a suspended ceiling.
6. The loudspeaker shall have a wide frequency response for general-purpose voice and music reproduction. The line-matching transformer shall have primary taps at 5, 2.5, 1.25, 0.63, and 0.32 watts. The baffle is finished in a mar-resistant, white epoxy coating. The baffle is finished in a mar-resistant, white epoxy coating.
7. The speaker assembly shall be designed to be installed in a suspended ceiling. Installation is quick and simple as the 12" x 24" is designed to fit into a common 2-foot square ceiling grid. Tie off tabs allow the assembly to be secured to the building structure or ceiling grid to address any safety concerns.
8. The Pre-assembled 8” Packaged Ceiling Speaker shall include the loudspeaker/transformer/baffle assembly.
9. The loudspeaker size shall be 8 inches in diameter and have a power handling capacity of 15 watts. The voice coil shall be of high-temperature bonded construction, be one inch in diameter and have an impedance of 8 ohms. The speaker shall have a frequency range of at least 65 Hz to 17,000 Hz and an axial sensitivity of 92dB at 1 m, with a 1 watt input signal @ 1000 Hz. The loudspeaker shall be equipped with a factory wired 25/70 volt line-matching transformer. The transformer shall have the primary taps at 5/16, 5/8, 1-1/4, 2-1/2, and 5 watts. The insertion loss shall be no greater than 1.0 dB. The transformer shall be mounted to the speaker with the secondary leads soldered to the speaker terminals.
10. The assembly shall include a baffle constructed of 22 gauge, cold-rolled steel finished with a mar-resistant white, semi-gloss, epoxy coating. The baffle shall have a diameter of 13".
11. The Pre-assembled 8” Packaged Ceiling Loudspeaker shall mount to a T7 support bridge, used to attach the assembly to suspended ceilings. The support bridge shall accept an enclosure, model H7, for applications where a protective enclosure is required. The H7 enclosure shall attach to the support bridge with appropriate mounting screws. The enclosure shall be a Telecor H7 or approved equal. A circular molded polystyrene damping pad shall be fitted to the inside top of the enclosure to prevent acoustical

and mechanical resonances. The pad's surface shall be molded with a triangular pattern for enhancing low frequencies and shall optimize the audio response of the enclosure.

Q. Re-entrant Horn/Loudspeakers

1. The Re-Entrant Horn/Loudspeakers, as indicated on the drawings, shall be a double re-entrant type, with a flared bell and an integral compression driver rated for 15 watts of continues audio power. The frequency response shall be 375 -14,000Hz. Nominal sensitivity shall be such that a sound pressure level of 110 dB at 1000 Hz. (on axis) at distance of one meter is produced with an input of one watt. Sound dispersion shall be no less than 100 degrees, regardless of the mounting position. The horn shall contain a weatherproof, built-in, 25/70 volt line-matching transformer. Power taps shall be at 0.48, 0.94, 1.8, 7.5 or 15 watts for a 25V line and 1, 2, 3.8, 7.5 or 15 watts for a 70 V line. The power taps shall be screwdriver adjustable. Impedance selection shall be 5,000, 2500, 1300, 666, 333, 87, or 45 ohms.
2. The unit shall include a die-cast universal mounting bracket, allowing the horn to be positioned both in the vertical and horizontal planes with a single adjustment. The wiring terminals and the screwdriver power tap shall be enclosed by a clear plastic cover for security and weather protection. The horn shall be finished in a grey epoxy. Dimensions shall be 9 1/4" deep with a diameter of 8".

R. Digital Message Display/Calendar Clock

1. The Digital Message Display/Calendar Clocks, as indicated on the drawings, shall simultaneously display the current time and date. The time is displayed in hours, minutes, and seconds. Hours and minutes are displayed with large 2.25" digits. Seconds are slightly smaller for easy distinction. The date is displayed in plain text by a 10 character, dot matrix display showing the day of the week, followed by the month and date.
2. These clocks are designed for use in conjunction with the Master Clock/Message Host and Ethernet Termination Board Unit. All secondary clocks shall be synchronized with the Master Clock/Message Host. Corrections are done instantaneously and all clocks display the identical time and date. In the event of a power failure, the eSeries System maintains accurate timekeeping during the outage. Once power is restored, all clocks shall be immediately updated with the correct time and date.
3. In addition to displaying the time, the Digital Message Display/Calendar Clocks shall display messages in the dot matrix section of the display. These messages can be used to alert personnel of an emergency or a situation of concern.
4. Messages shall be programmed using software or from a web based Graphical User Interface (GUI). Messages can be activated by the Master Clock/Message Host Event Scheduler, allowing text to be displayed at specific times and days of the week. Messages can be displayed using a variety of visual effects including scrolling or flashing single lines of text, as well as alternating between different lines of text. The dot matrix display defaults back to the date when not displaying messages.
5. The Digital Message Display/Calendar Clock shall be capable of being used as an elapsed digital timer, providing stopwatch functionality, indicating elapsed time on the six-digit display. Elapsed timer functions shall include the ability to count upwards from zero to 24 hours, as well as counting down to zero from a specified value. The elapsed timer shall be controlled using a Timer Button Panel, providing start, stop, and reset functionality. When not operating as an elapsed timer, the Display shall default back to displaying the current time.
6. The Digital Message Display/Calendar Clock shall be suitable for surface or recessed installations using the appropriate enclosure. For surface installations, the surface enclosure is required. For recessed installations, the flush enclosure is used. Two surface-mount enclosures shall be mounted back-to-back with a Dual Mounting Kit, creating a double-faced version.
7. The Digital Message Display/Calendar Clock shall be powered from a 24 VAC power source.

S. Digital Clocks

1. The Digital Clocks, shall be used in conjunction with the Master Clock/Message Host and Ethernet Termination Board Units. All secondary clocks shall be synchronized with the Master Clock/Message Host

and shall maintain identical time. They shall display the current time in hours and minutes with a four-digit, seven-segment display utilizing AlGaAs "Super-Bright" LED displays

2. In the event of a power failure, the eSeries System maintains accurate timekeeping during the outage. Once power is restored, all clocks shall be immediately updated with the correct time.
3. The 2.5” Digital Clock shall incorporate a 2.5" display which can be viewed from up to 120 feet. It shall be suitable for surface or recessed installations using the appropriate enclosure. For surface installations, the surfface enclosure is required. For recessed installations, the flush enclosure is used.
4. The 4” Digital Clock shall incorporate a 4" display which can be viewed from up to 200 feet. It shall be suitable for surface or recessed installations using the appropriate enclosure. For surface installations, the surface enclosure is required. For recessed installations, the flush enclosure is used.
5. Two surface-mount enclosures shall be mounted back-to-back with a Dual Mounting Kit, creating a double-faced version.
6. The clocks shall operate from 24 VAC power sources.

T. Analog Secondary Clocks

1. Analog Secondary Clocks shall be designed for use in conjunction with the Master Clock/Message Host and Ethernet Termination Board Units. All secondary clocks shall be synchronized with the Master Clock and shall maintain identical time.
2. These Analog Secondary Clocks shall be synchronous 3-wire units with a second hand to mark the fractions of a minute as well as the minute and hour hands. The precision timekeeping is furnished by a microprocessor based movement and correction coil. These clocks shall be powered from a 24 VAC source.
3. The microprocessor-based movement shall require only 20 mA for operation.
4. In the event of a power failure, the eSeries System maintains accurate timekeeping during the outage. Once power is restored, all Analog Clocks respond to the corrective signal transmitted by the Ethernet Termination Board Units.
5. The 12" Analog Secondary Clock is housed in a low-profile, semi-flush metal case designed for wall mounting. The low profile design eliminates the need for custom backboxes and all clocks are designed to be mounted onto single gang electrical utility boxes. In locations as indicated on the drawings, where a double face version is required, a Double Mount Housing shall be used to mount two single face Analog clocks to create a dual face 12” Analog Clock.
6. The 16" Analog Secondary Clock is housed in a low-profile, semi-flush metal case designed for wall mounting. The low profile design eliminates the need for custom backboxes and all clocks are designed to be mounted onto single gang electrical utility boxes. In locations as indicated on the drawings, where a double face version is required, a Double Mount Housing shall be used to mount two single face Analog clocks to create a dual face 16” Analog Clock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Furnish and install all material, devices, components, and equipment for a complete operational system.

C. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

E. All housings are to be located as indicated.

F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

J. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.3 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.5 FINAL ACCEPTANCE TEST

A. The Final Acceptance Testing shall be provided to the Owner or the Owner’s designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will 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.

C. 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.

3.6 COMISSIONING

A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

B. Schedule training with Owner through the owner’s representative, with at least seven days advance notice.

3.7 OCCUPANCY ADJUSTMENTS

A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.8 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner's representative.

END OF SECTION

SECTION 28 31 11
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Addressable interface device.
9. Digital alarm communicator transmitter.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician, Level III minimum.

c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

a. Frequency of testing of installed components.
b. Frequency of inspection of installed components.
c. Requirements and recommendations related to results of maintenance.

d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Existing Siemens Building Technologies, Inc.; Fire Safety Division.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

   1. Manual stations.
   2. Heat detectors.
   3. Smoke detectors.
   4. Duct smoke detectors.
   5. Verified automatic alarm operation of smoke detectors.
   6. Automatic sprinkler system water flow.
   7. Heat detectors in elevator shaft and pit.
   8. Fire-extinguishing system operation.
   9. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

   1. Continuously operate alarm notification appliances.
   2. Identify alarm at fire-alarm control unit.
   3. Transmit an alarm signal to the remote alarm receiving station.
   4. Unlock electric door locks in designated egress paths.
   5. Release fire and smoke doors held open by magnetic door holders.
   6. Activate voice/alarm communication system.
   7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
   8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.

9. Activate stairwell and elevator-shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Recall elevators to primary or alternate recall floors.
12. Activate emergency lighting control.
13. Activate emergency shutoffs for gas and fuel supplies.
14. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System 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 primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

   a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 2 line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

   a. Initiating Device Circuits: Style D.
   b. Notification Appliance Circuits: Style Z.
   c. Signaling Line Circuits: Style 2.
   d. Install no more than 50 addressable devices on each signaling line circuit.

2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

   a. Initiating Device Circuits: Style A.
   b. Notification Appliance Circuits: Style W.
   c. Signaling Line Circuits: Style 1.
   d. Install no more than 50 addressable devices on each signaling line circuit.

D. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center.

1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.

   a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
   b. Programmable tone and message sequence selection.
   c. Standard digitally recorded messages for "Evacuation" and "All Clear."

d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

H. 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 signals shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

J. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

3. Detector Cable: Rated detection temperature 155 deg F (68 deg C). NRTL listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short- circuit wires at the location of elevated temperature.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

D. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:

   a. 75 cd.
   b. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

E. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.9 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix Ain NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

H. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

K. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

L. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 8 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. 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.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

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. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "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 "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. 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 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

ENGINEERING SPECIFICATION
Stand Alone Emergency Voice Evacuation Control Panel

PART 1.0 - GENERAL

1.1. DESCRIPTION:

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled voice evacuation control panel.
B. The voice evacuation panel shall comply with NFPA 72 requirements.

C. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.\

1.2 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories Inc

B. The system shall be certified for seismic applications in accordance with the International Building Code (IBC). For OSHPD applications in California the system shall be Pre-Approved for seismic applications. The basis for qualification of seismic approval shall be via shake table testing.

1.2. SCOPE:

A. A microprocessor-controlled voice evacuation control panel shall be installed in accordance with the project specifications and drawings.

1.3 Voice Evacuation Control Panel

A. The FACP shall be a NOTIFIER NFV-25/50 series (FireVoice 25/50 series) and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall distribute and control emergency voice messages over the speaker circuits.

B. The system shall provide the capability to interface to distributed voice evacuation control panels from the same manufacturer.

C. Shall have as minimum requirements:

A. Integral 25 Watt, 25 Vrms audio amplifier with optional converter for 70.7-volt systems. The system shall be capable of expansion to 50 watts total via the insertion of an additional 25-watt audio amplifier module into the same cabinet.

b. Speaker circuit that can be wired both Class A or B.

c. Integral Digital Message Generator with a memory capacity for up to 60 seconds of messaging. The Digital Message Generator shall be capable of producing five distinct messages (12 seconds each). These messages shall field programmable without the use of additional equipment.

d. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.

e. The Voice Control Panel will be capable of detecting and annunciating the following conditions: Loss of Power (AC and DC), System Trouble, Ground Fault, Alarm, Microphone Trouble, Message Generator Trouble, Tone Generator Trouble, and Amplifier Fault.

f. An option shall exist for serial integration between the NFV-25/50 and compatible fire alarm control panels from the same manufacturer.

g. An option shall exist for fire fighters telephone operation.

4. The Voice Control Panel shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generation.

5. Speaker outputs shall be fully power-limited.

6. Amplifiers will be supplied power independently to eliminate a short on one circuit from affecting other circuits.

7. The Voice Control Panel will provide full supervision on both active (alarm or music) and standby conditions.

8. An optional zone splitter version shall be available that permits splitting speaker circuits into 8 specific zones.

9. An optional distributed amplifier unit shall be available that permits splitting speaker circuits into up to a total of 24 zones when two distributed amplifiers are combined with the master unit.

D. Speakers:

1. All speakers shall operate on 25 or 70 VRMS with field selectable output taps from 0.5 to 2.0 Watts.

2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).

3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.

4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 10.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Open and short notification appliance circuits and verify that trouble signal actuates.

C. Ground all circuits and verify response of trouble signals.

D. Check presence and audibility of tone at all alarm notification devices.

E. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying voice messages.

3.3. FINAL INSPECTION:

A. At the final inspection a minimum NICET Level II technician shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor or installing dealer shall provide a user manual indicating "Sequence of Operation."

END OF SECTION

SECTION 283112
INTRUSION, CCTV AND ACCESS CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes a Unify system for access control, intrusion detection.

1.3 DEFINITION

A. CCTV: Closed-circuit television.

B. CPU: Central processing unit.

C. Credential: Data assigned to an entity and used to identify that entity.

D. dpi: Dots per inch.

E. DTS: Digital Termination Service. A microwave-based, line-of-sight communication provided directly to the end user.

F. GFI: Ground fault interrupter.

G. 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.

H. I/O: Input/Output.

I. LAN: Local area network.

J. Location: A Location on the network having a PC-to-controller communications link, with additional controllers at the Location connected to the PC-to-controller link with a TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.

K. PC: Personal computer. Applies to the central station, workstations, and file servers.

L. PCI Bus: Peripheral Component Interconnect. A peripheral bus providing a high-speed data path between the CPU and the peripheral devices such as a monitor, disk drive, or network.

M. PDF: Portable Document Format. The file format used by the Acrobat document-exchange-system software from Adobe.

N. RAS: Remote access services.

O. RF: Radio frequency.

P. ROM: Read-only memory. ROM data are maintained through losses of power.

Q. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

R. TWAIN: Technology without an Interesting Name. A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.

S. UPS: Uninterruptible power supply.

T. USB: Universal serial bus.

U. WAN: Wide area network.

V. WAV: The digital audio format used in Microsoft Windows.

W. WMP: Windows media player.

X. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

Y. Windows: Operating system by Microsoft Corporation.

Z. Workstation: A PC with software that is configured for specific, limited security-system functions.

AA. WYSIWYG: What You See Is What You Get. Text and graphics appear on the screen the same as they will in print.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

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

1. Diagrams for cable management system.
2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
3. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics including the following:

a. Workstation outlets, jacks, and jack assemblies.
b. Patch cords.

c. Patch panels.

4. Cable Administration Drawings: As specified in "Identification" Article.
5. Battery and charger calculations for central station, workstations, and controllers.

B. Samples: For workstation outlets, jacks, jack assemblies, and faceplates. For each exposed product and for each color and texture specified.

C. Other Action Submittals:

1. Project planning documents as specified in Part 3.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Microsoft Windows software documentation.
2. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
3. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
4. System installation and setup guides with data forms to plan and record options and setup decisions.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

B. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.

C. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in air-conditioned temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer Gentec, Bosch and Axis.

B. Installation company must have on staff a (RCDD) registered communication distribution designer certified by Building Industry Consulting Service International, and Genetec certified installer and programmer.

C. Comply with NFPA 70, "National Electrical Code."

D. Comply with SIA DC-01 and SIA DC-03 and SIA DC-07.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Central Station, Workstations, and Controllers:

1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F, and not more than 80 percent relative humidity, noncondensing.
1. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
2. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
3. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 WARRANTY

A. Provide for a period of two (2) years commencing from the date of final system acceptance, including annual inspections of the system.

B. During the warranty period report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours after request by Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

1.10 OCCUPANCY ADJUSTMENTS

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. Provide up to three on-site assistance visits within one year of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Genetec, no substitutions
2. Bosch, no substitutions
3. Axis, no substitutions

2.2 DESCRIPTION

A. Intrusion and Access System: Server-based central station and field-installed controllers, connected by a high-speed electronic-data transmission network.

B. System Software: Based on Genetec Security Center central-station, workstation operating system, server operating system, and application software. Software shall have the following capabilities:
1. Multiuser and multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
2. Graphical user interface to show pull-down menus and a menu-tree format that complies with interface guidelines of Microsoft Windows.
3. System license for the entire system including capability for future additions that are within the indicated system size limits specified in this Section.
4. Open-architecture system that allows importing and exporting of data and interfacing with other systems that are compatible with Microsoft Windows.
5. Password-protected operator login and access.
6. Open-database-connectivity compliant.
7. Integration with VMS and Intercom door stations
8. Integration with Bosch Intrusion System

C. Network connecting the central station and workstations shall be connected using Microsoft Windows-based TCP/IP with a capacity of connecting up to 99 workstations. System shall be portable across multiple communication platforms without changing system software.

D. Network(s) connecting PCs and controllers shall consist of one or more of the following:

1. Local area, IEEE 802.3 Fast Ethernet 100 BASE TX with a star topology network based on TCP/IP.

2. Direct-connected, RS-232 cable from the COM port of the central station to the first controller, then RS-485 cable to interconnect the remaining controllers at that Location.
3. Dial-up and cable modem connection using a standard cable or dial-up telephone line.

PART 3 - OPERATION

3.1 Security and Access Control system shall use a single database for access-control, intrusion and credential-creation functions.

3.2 Distributed Processing: A fully distributed processing system.

A. Access-control information, including time, date, valid codes, access levels, and similar data, shall be downloaded to controllers so each controller can make access-control decisions.

B. Intermediate controllers for access control are prohibited.

C. In the event that communications with the central controller are lost, controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the central station.

3.3 Number of Locations:

A. Support at least 50 separate Locations using a single PC/server with combinations of direct-connect or TCP/IP LAN connections to each Location.

B. Each Location shall have its own database and history in the central station.

C. Locations may be combined to share a common database.

3.4 Data Capacity:

A. Different card-reader formats.

B. Graphic file types for importing maps.

3.5 Location Capacity:

A. 128 reader-controlled doors.

B. 50,000 total-access credentials.

C. 2048 supervised alarm inputs.

D. 2048 programmable outputs.

E. 32,000 custom action messages per Location to instruct operator on action required when alarm is received.

F. System Network Requirements:

1. System components shall be interconnected and shall provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
2. Communication shall not require operator initiation or response and shall return to normal after partial- or total-network interruption such as power loss or transient upset.
3. System shall automatically annunciate communication failures to the operator and shall identify the communications link that has experienced a partial or total failure.
4. Communications controller may be used as an interface between the central-station display systems and the field device network. Communications controller shall provide functions required to attain the specified network communications performance.

3.6 Central station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Central station shall control system networks to interconnect all system components, including workstations and field-installed controllers.

3.7 Field equipment shall include controllers, sensors, and controls.

3.8 Controllers shall serve as an interface between the central station and sensors and controls.

3.9 Data exchange between the central station and the controllers shall include down-line transmission of commands, software, and databases to controllers.

3.10 The up-line data exchange from the controller to the central station shall include status data such as intrusion alarms, status reports, and entry-control records.

3.11 Controllers are classified as alarm-annunciation or entry-control type.

3.12 System Response to Alarms:

1. Field device network shall provide a system end-to-end response time of 4 second(s) or less for every device connected to the system.
2. Alarms shall be annunciated at the central station within one second of the alarm occurring at a controller or at a device controlled by a local controller, and within 100 ms if the alarm occurs at the central station.
3. Alarm and status changes shall be displayed within 100 ms after receipt of data by the central station.
4. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within five seconds of alarm receipt at the security console.
5. This response time shall be maintained during system heavy load.
6. False-Alarm Reduction: The design of the central station and controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.

3.13 Error Detection:

A. Use a cyclic code method to detect single- and double-bit errors, burst errors of eight bits or fewer, and at least 99 percent of all other multibit and burst errors between controllers and the central station.

B. Interactive or product error-detection codes alone will not be acceptable.

C. A message shall be in error if one bit is received incorrectly.

D. Retransmit messages with detected errors.

E. Allow for an operator-assigned two-digit decimal number to each communications link representing the number of retransmission attempts.

F. Central station shall print a communication failure alarm message when the number of consecutive retransmission attempts equals the assigned quantity.

G. Monitor the frequency of data transmission failure for display and logging.

3.14 Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

3.15 Door Hardware Interface:

A. Comply with requirements in Section 087100 "Door Hardware" and Section 087111 "Door Hardware (Descriptive Specification)" for door hardware required to be monitored or controlled by the security access system.

B. Electrical characteristics of controllers shall match the signal and power requirements of door hardware.

PART 4 - APPLICATION SOFTWARE

4.1 System Software: Based on Genetec Security Center central-station and workstation operating system and application software.

A. Multiuser multitasking shall allow independent activities and monitoring to occur simultaneously at different workstations.

B. Graphical user interface shall show pull-down menus and a menu-tree format.

C. Capability for future additions within the indicated system size limits.

D. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.

E. Password-protected operator login and access.

4.2 Peer Computer Control Software: Detect a failure of a central computer and cause the other central computer to assume control of all system functions without interruption of operation. Both central computers shall have drivers to support this mode of operation.

4.3 Application Software: Interface between the alarm annunciation and entry-control controllers to monitor sensors, operate displays, report alarms, generate reports, and help train system operators.

A. Reside at the central station, workstations, and controllers as required to perform specified functions.

B. Operate and manage peripheral devices.

C. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.

D. Import custom icons into graphics to represent alarms and I/O devices.

E. Globally link I/O so that any I/O can link to any other I/O within the same Location without requiring interaction with the host PC. This operation shall be at the controller.

F. Globally code I/O links so that any access-granted event can link to any I/O with the same Location without requiring interaction with the host PC. This operation shall be at the controller.

G. Messages from PC to controllers and controllers to controllers shall be on a polled network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.

H. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-controller communications methods by changing the polling frequency and the amount of time the system waits for a response.

I. Automatic and encrypted backups for database and history backups shall be automatically stored at the Genetec Security Center Server and encrypted with a nine-character alphanumeric password that must be used to restore or read data contained in backup.

J. Operator audit trail for recording and reporting all changes made to database and system software.

K. Support network protocol and topology, TCP/IP, Novel Netware, Digital Pathworks, Banyan Vines, LAN/WAN, and RAS.

4.4 Workstation Software:

A. Password levels shall be individually customized at each workstation to allow or disallow operator access to program functions for each Location.

B. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.

4.5 Controller Software:

A. Controllers shall operate as autonomous, intelligent processing units.

1. Controllers shall make decisions about access control, alarm monitoring, linking functions, and door-locking schedules for their operation, independent of other system components.
2. Controllers shall be part of a fully distributed processing-control network.
3. The portion of the database associated with a controller, and consisting of parameters, constraints, and the latest value or status of points connected to that controller, shall be maintained in the controller.

B. The following functions shall be fully implemented and operational within each controller:

1. Monitoring inputs.
2. Controlling outputs.
3. Automatically reporting alarms to the central station.
4. Reporting of sensor and output status to the central station on request.
5. Maintaining real time, automatically updated by the central station at least once a day.
6. Communicating with the central station.
7. Executing controller resident programs.
8. Diagnosing.
9. Downloading and uploading data to and from the central station.

C. Controller Operations at a Location:

1. Up to 10 controllers connected to TIA 485-A communications loop. Globally operating I/O linking and anti-passback functions between controllers within the same Location without central-station or workstation intervention. Linking and anti-passback shall remain fully functional within the same Location even when the central station or workstations are off-line.
2. In the event of communication failure between the central station and a Location, there shall be no degradation in operations at the controllers at that Location. Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
3. Buffered events shall be handled in a first-in-first-out mode of operation.

D. Individual Controller Operation:

1. Controllers shall transmit alarms, status changes, and other data to the central station when communications circuits are operable. If communications are not available, controllers shall function in a stand-alone mode; operational data, including the status and alarm data normally transmitted to the central station, shall be stored for later transmission to the central station. Storage capacity for the latest 1024 events shall be provided at each controller.
2. Card-reader ports of a controller shall be custom configurable for at least [**120**] different card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different controllers or within the same controller.
3. Controllers shall provide a response to card readers or keypad entries in less than 0.25 seconds, regardless of system size.
4. Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to their proper working state. This shall happen without any operator intervention.
5. Initial Startup: When controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each controller.
6. On failure for any reason, controllers shall perform an orderly shutdown and force controller outputs to a predetermined failure-mode state, consistent with the failure modes shown and the associated control device.
7. After power is restored, following a power failure, startup software shall initiate self-test diagnostic routines, after which controllers shall resume normal operation.
8. After controller failure, if the database and application software are no longer resident, controllers shall not restart but shall remain in the failure mode until repaired. If database

and application programs are resident, controllers shall immediately resume operation. If not, software shall be restored automatically from the central station.

4.6 Communications Monitoring:

A. System shall monitor and report status of TIA 485-A communications loop of each Location.

B. Communication status window shall display which controllers are currently communicating, a total count of missed polls since midnight, and which controller last missed a poll.

C. Communication status window shall show the type of CPU, the type of I/O board, and the amount of RAM for each controller.

4.7 Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the central station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

4.8 PC-to-Controller Communications:

A. Central-station or workstation communications shall use the following:
1. Direct connection using serial ports of the Server.
2. TCP/IP LAN interface cards.

B. Each serial port used for communications shall be individually configurable for "direct communications." Serial ports shall have adjustable data transmission rates and shall be selectable under program control.

C. Use multiport communications board if more than two serial ports are needed.

1. Use a 4-, 8-, or 16-serial port configuration that is expandable to 32- or 64-serial ports.
2. Connect the first board to an internal PCI bus adapter card.
3. Direct serial, TCP/IP, and dial-up, cable, or satellite communications shall be alike in the monitoring or control of the system except for the connection that must first be made to a dial-up or voice-over IP Location.
4. TCP/IP network interface card (NIV) shall have an option to set the poll-frequency and message-response time-out settings.
5. PC-to-controller and controller-to-controller communications (direct, dial-up, or TCP/IP) shall use a polled-communication protocol that checks sum and acknowledges each message. All communications in this subparagraph shall be verified and buffered and retransmitted if not acknowledged.

D. Direct Serial or TCP/IP PC-to-Controller Communications:
1. Communication software on the PC shall supervise the PC-to-controller communications link.
2. Loss of communications to any controller shall result in an alarm at all PCs running the communication software.
3. When communications are restored, all buffered events shall automatically upload to the PC, and any database changes shall be automatically sent to the controller.

E. Controller-to-Controller Communications:

1. TIA 485-A, four-wire, point-to-point, regenerative (repeater) communications network methodology.
2. TIA 485-A communications signal shall be regenerated at each controller.

4.9 Database Downloads:

A. All data transmissions from Server to a Location, and between controllers at a Location, shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted.

B. If a controller is reset for any reason, it shall automatically request and receive a database download from the PC. The download shall restore data stored at the controller to their normal working state and shall take place with no operator intervention.

C. Software shall provide for setting downloads via dial-up connection to once per 24-hour period, with time selected by the operator.

D. Software shall provide recording for rise rooms in accordance to Senate Bill 507 .

4.10 Operator Interface:

A. Inputs in system shall have two icon representations, one for the normal state and one for the abnormal state.

B. When viewing and controlling inputs, displayed icons shall automatically change to the proper icon to display the current system state in real time. Icons shall also display the input's state, whether armed or bypassed, and if the input is in the armed or bypassed state due to a time zone or a manual command.

C. Outputs in system shall have two icon representations, one for the secure (locked) state and one for the open (unlocked) state.

D. Icons displaying status of the I/O points shall be constantly updated to show their current real-time condition without prompting by the operator.

E. The operator shall be able to scroll the list of I/Os and press the appropriate toolbar button, or right click, to command the system to perform the desired function.

F. Graphic maps or drawings containing inputs, outputs, and override groups shall include the following:

1. Database to import and store full-color maps or drawings and allow for input, output, and override group icons to be placed on maps.
2. Maps to provide real-time display animation and allow for control of points assigned to them.
3. System to allow inputs, outputs, and override groups to be placed on different maps.
4. Software to allow changing the order or priority in which maps will be displayed.

G. Override Groups Containing I/Os:

1. System shall incorporate override groups that provide the operator with the status and control over user-defined "sets" of I/Os with a single icon.
2. Icon shall change automatically to show the live summary status of points in that group.
3. Override group icon shall provide a method to manually control or set to time-zone points in the group.
4. Override group icon shall allow the expanding of the group to show icons representing the live status for each point in the group, individual control over each point, and the ability to compress the individual icons back into one summary icon.

H. Schedule Overrides of I/Os and Override Groups:

1. To accommodate temporary schedule changes that do not fall within the holiday parameters, the operator shall have the ability to override schedules individually for each input, output, or override group.
2. Each schedule shall be composed of a minimum of two dates with separate times for each date.
3. The first time and date shall be assigned the override state that the point shall advance to when the time and date become current.
4. The second time and date shall be assigned the state that the point shall return to when the time and date become current.

I. Copy command in database shall allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.

J. Operator Access Control:

1. Control operator access to system controls through password-protected operator levels. System operators and managers with appropriate password clearances shall be able to change operator levels for operators.
2. Three successive attempts by an operator to execute functions beyond their defined level during a 24-hour period shall initiate a software tamper alarm.
3. A minimum of passwords shall be available with the system software. System shall display the operator's name or initials in the console's first field. System shall print the operator's name or initials, action, date, and time on the system printer at login and logoff.
4. The password shall not be displayed or printed.
5. Each password shall be definable and assignable for the following:
   a. Selected commands to be usable.
   b. Access to system software.
   c. Access to application software.
   d. Individual zones that are to be accessed.
   e. Access to database.

4.11 Operator Commands:

A. Command Input: Plain-language words and acronyms shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be an image, word, a phrase, or an acronym.

B. Command inputs shall be acknowledged, and processing shall start in not less than two second(s).

C. Tasks that are executed by operator's commands shall include the following:

1. Acknowledge Alarms: Used to acknowledge that the operator has observed the alarm message.
2. Place Zone in Access: Used to remotely disable intrusion-alarm circuits emanating from a specific zone. System shall be structured so that console operator cannot disable tamper circuits.
3. Place Zone in Secure: Used to remotely activate intrusion-alarm circuits emanating from a specific zone.
4. System Test: Allows the operator to initiate a system-wide operational test.
5. Zone Test: Allows the operator to initiate an operational test for a specific zone.
6. Print reports.
7. Change Operator: Used for changing operators.
8. Display Graphics: Used to show any graphic displays implemented in the system. Graphic displays shall be completed within 20 seconds from time of operator command.
9. Run system tests.
10. Generate and format reports.
11. Request help with the system operation.

D. Include in main menus.

E. Provide unique, descriptive, context-sensitive help for selections and functions with the press of one function key.

F. Provide navigation to specific topic from within the first help window.

G. Help shall be accessible outside the application program.

4.12 Entry-Control Commands:

1. Revise number of times entry control in first four subparagraphs below can be changed to suit Project. Coordinate with options in "Time Zones" and "Access Levels" paragraphs in "System Database" Article.
2. Lock (secure) or unlock (open) each controlled entry and exit up to four times a day through time-zone programming.
3. Arm or disarm each monitored input up to four times a day through time-zone programming.
4. Enable or disable readers or keypads up to two times a day through time-zone programming.
5. Enable or disable cards or codes up to four times a day per entry point through access-level programming.

4.13 Command Input Errors: Show operator input assistance when a command cannot be executed because of operator input errors. Assistance screen shall use plain-language words and phrases to explain why the command cannot be executed. Error responses that require an operator to look up a code in a manual or other document are not acceptable. Conditions causing operator assistance messages include the following:

A. Command entered is incorrect or incomplete.

B. Operator is restricted from using that command.

C. Command addresses a point that is disabled or out of service.

D. Command addresses a point that does not exist.

E. Command is outside the system's capacity.

4.14 Alarms:

A. System Setup:

1. Assign manual and automatic responses to incoming-point status change or alarms.
2. Automatically respond to input with a link to other inputs, outputs, or operator-response plans; unique sound with use of WAV files; and maps or images that graphically represent the point location.
3. Sixty-character message field for each alarm.
4. Operator-response-action messages shall allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup shall assign messages to access point and/or burglary zone depending the device triggering it.
5. Secondary messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
6. Allow 25 secondary messages with a field of four lines of 60 characters each.
7. Store the most recent 1000 alarms for recall by the operator using the report generator.

B. Software Tamper:

1. Annunciate a tamper alarm when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system shall generate a software tamper alarm.
2. Annunciate a software tamper alarm when an operator or other individual makes three consecutive unsuccessful attempts to invoke functions beyond the authorization level.
3. Maintain a transcript file of the last 5000 commands entered at each central station to serve as an audit trail. System shall not allow write access to system transcript files by any person, regardless of their authorization level.
4. Allow only acknowledgment of software tamper alarms.
   a. Read access to system transcript files shall be reserved for operators with the highest password authorization level available in system.
   b. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
   c. Multimedia Alarm Annunciation: WAV files to be associated with alarm events for audio annunciation or instructions.
   d. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.
   e. Alarm Automation Interface: High-level interface to central-station alarm automation software systems. Allows input alarms to be passed to and handled by automation systems in the same manner as burglar alarms, using a TIA 232-F ASCII interface.
   f. CCTV Alarm Interface: Allow commands to be sent to CCTV systems during alarms (or input change of state) through serial ports.
   g. Camera Control: Provides operator ability to select and control cameras from graphic maps.

C. Alarm Monitoring: Monitor sensors, controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm shall not be considered acknowledgment of other alarms nor shall it inhibit reporting of subsequent alarms.

D. Displayed alarm data shall include type of alarm, location of alarm, and secondary alarm messages.

E. Printed alarm data shall include type of alarm, location of alarm, date and time (to nearest second) of occurrence, and operator responses.

F. Maps shall automatically display the alarm condition for each input assigned to that map if that option is selected for that input location.

G. Alarms initiate a status of "pending" and require the following two handling steps by operators:

1. First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Resolved."
2. Second Operator Step: Operators enter the resolution or operator comment, giving the disposition of the alarm event. The alarm shall then clear.

H. Each workstation shall display the total pending alarms and total unresolved alarms.

I. Each alarm point shall be programmable to disallow the resolution of alarms until the alarm point has returned to its normal state.

J. Alarms shall transmit to the central station in real time except for allowing connection time for dial-up locations.

K. Alarms shall be displayed and managed from a minimum of four different windows.

1. Input Status Window: Overlay status icon with a large red blinking icon. Selecting the icon will acknowledge the alarm.
2. History Log Transaction Window: Display name, time, and date in red text. Selecting red text will acknowledge the alarm.
3. Alarm Log Transaction Window: Display name, time, and date in red. Selecting red text will acknowledge the alarm.
4. Graphic Map Display: Display a steady colored icon representing each alarm input location. Change icon to flashing red when the alarm occurs. Change icon from flashing red to steady red when the alarm is acknowledged.

L. Once an alarm is acknowledged, the operator shall be prompted to enter comments about the nature of the alarm and actions taken. Operator's comments may be manually entered or selected from a programmed predefined list, or a combination of both.

M. For locations where there are regular alarm occurrences, provide programmed comments. Selecting that comment shall clear the alarm.

N. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.

O. Identical alarms from the same alarm point shall be acknowledged at the same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.

P. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and controllers.

Q. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed.

R. Monitor Display: Display text and graphic maps that include zone status integrated into the display. Colors are used for the various components and current data. Colors shall be uniform throughout the system.

S. Color Code:

1. FLASHING RED: Alerts operator that a zone has gone into an alarm or that primary power has failed.
2. STEADY RED: Alerts operator that a zone is in alarm and alarm has been acknowledged.
3. YELLOW: Advises operator that a zone is in access.
4. GREEN: Indicates that a zone is secure and that power is on.

4.15 Graphics:

A. Support 32,000 graphic display maps and allow import of maps from a minimum of 16 standard formats from another drawing or graphics program.

B. Allow I/O to be placed on graphic maps by the drag-and-drop method.

C. Operators shall be able to view the inputs, outputs, and the point's name by moving the mouse cursor over the point on the graphic map.

D. Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic maps associated with I/Os.

E. Each graphic map shall have a display-order sequence number associated with it to provide a predetermined order when toggled to different views.

F. Camera icons shall have the ability to be placed on graphic maps that, when selected by an operator, will open a video window, display the camera associated with that icon, and provide pan-tilt-zoom control.

G. Input, output, or camera placed on a map shall allow the ability to arm or bypass an input, open or secure an output, or control the pan-tilt-zoom function of the selected camera.

1. System test software enables operators to initiate a test of the entire system or of a particular portion of the system.

H. Test Report: The results of each test shall be stored for future display or printout. The report shall document the operational status of system components.

1. Report-Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest-priority activity. Report-generation mode shall be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.

I. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of the period; and the default printer.

J. Printing on Request: An operator may request a printout of any report.

K. Alarm Reports: Reporting shall be automatic as initially set up. Include alarms recorded by system over the selected time and information about the type of alarm [**(such as door alarm, intrusion alarm, tamper alarm, etc.)**], the type of sensor, the location, the time, and the action taken.

L. Access and Secure Reports: Document zones placed in access, the time placed in access, and the time placed in secure mode.

M. Custom Reports: Reports tailored to exact requirements of who, what, when, and where. As an option, custom report formats may be stored for future printing.

N. Automatic History Reports: Named, saved, and scheduled for automatic generation.

O. Cardholder Reports: Include data, or selected parts of the data, as well as the ability to be sorted by name, card number, imprinted number, or by any of the user-defined fields.

P. Cardholder by Reader Reports: Based on who has access to a specific reader or group of readers by selecting the readers from a list.

Q. Cardholder by Access-Level Reports: Display everyone that has been assigned to the specified access level.

R. Who Is "In" (Muster) Report:

1. Emergency Muster Report: One-click operation on toolbar launches report.
2. Cardholder Report. Contain a count of persons who are "In" at a selected Location and a detailed listing of name, date, and time of last use, sorted by the last reader used or by the group assignment.

S. Panel Labels Reports: Printout of control-panel field documentation including the actual location of equipment, programming parameters, and wiring identification. Maintain system installation data within system database so that data are available on-site at all times.

T. Activity and Alarm On-Line Printing: Activity printers for use at workstations; prints all events, or alarms only.

U. History Reports: Custom reports that allow the operator to select any date, time, event type, device, output, input, operator, Location, name, or cardholder to be included or excluded from the report.

1. Initially store history on the hard disk of the host PC.
2. Permit viewing of the history on workstations or print history to any system printer.
3. The report shall be definable by a range of dates and times with the ability to have a daily start and stop time over a given date range.
4. Each report shall depict the date, time, event type, event description, and device; or I/O name, cardholder group assignment, and cardholder name or code number.
5. Each line of a printed report shall be numbered to ensure that the integrity of the report has not been compromised.
6. Total number of lines of the report shall be given at the end of the report. If the report is run for a single event such as "Alarms," the total shall reflect how many alarms occurred during that period.

V. Reports shall have the following four options:

1. View on screen.
2. Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to the system.
3. "Save to File" with full path statement.
4. System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.

W. Custom Code List Subroutine: Allow the access codes of system to be sorted and printed according to the following criteria:

1. Active, inactive, or future activate or deactivate.
2. Code number, name, or imprinted card number.
3. Group, Location access levels.
4. Start and stop code range.
5. Codes that have not been used since a selectable number of days.
6. In, out, or either status.
7. Codes with trace designation.

X. The reports of system database shall allow options so that every data field may be printed.

Y. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the data-entry windows.

Z. Anti-Passback:

1. System shall have global and local anti-passback features, selectable by Location. System shall support hard and soft anti-passback.
2. Hard Anti-Passback: Once a credential holder is granted access through a reader with one type of designation (IN or OUT), the credential holder may not pass through that type of reader designation until the credential holder passes through a reader of opposite designation.
3. Soft Anti-Passback: Should a violation of the proper IN or OUT sequence occur, access shall be granted, but a unique alarm shall be transmitted to the control station, reporting the credential holder and the door involved in the violation. A separate report may be run on this event.
4. Timed Anti-Passback: A controller capability that prevents an access code from being used twice at the same device (door) within a user-defined amount of time.

5. Provide four separate zones per Location that can operate without requiring interaction with the host PC (done at controller). Each reader shall be assignable to one or all four anti-passback zones. In addition, each anti-passback reader can be further designated as "Hard," "Soft," or "Timed" in each of the four anti-passback zones. The four anti-passback zones shall operate independently.
6. The anti-passback schemes shall be definable for each individual door.
7. The Master Access Level shall override anti-passback.
8. System shall have the ability to forgive (or reset) an individual credential holder or the entire credential-holder population anti-passback status to a neutral status.

AA. Visitor Assignment:

BB. Provide for and allow an operator to be restricted to only working with visitors. The visitor badging subsystem shall assign credentials and enroll visitors. Allow only those access levels that have been designated as approved for visitors.

CC. Provide an automated log of visitor name, time and doors accessed, and name of person contacted.

DD. Allow a visitor designation to be assigned to a credential holder.

EE. Security access system shall be able to restrict the access levels that may be assigned to credentials issued to visitors.

FF. Allow operator to recall visitors' credential-holder file once a visitor is enrolled in the system.

GG. The operator may designate any reader as one that deactivates the credential after use at that reader. The history log shall show the return of the credential.

HH. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.

II. Time and Attendance:

1. Time and attendance reporting shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
2. Shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
3. System software setup shall allow designation of selected access-control readers as time and attendance hardware to gather the clock-in and clock-out times of the users at these readers.
4. Reports shall show in and out times for each day, total time in for each day, and a total time in for period specified by the user.
5. Allow the operator to view and print the reports, or save the reports to a file.
6. Alphabetically sort reports on the person's last name, by Location or location group. Include all credential holders or optionally select individual credential holders for the report.

4.16 Training Software: Enables operators to practice system operation, including alarm acknowledgment, alarm assessment, response force deployment, and response force

communications. System shall continue normal operation during training exercises and shall terminate exercises when an alarm signal is received at the console.

4.17 Entry-Control Enrollment Software: Database management functions that allow operators to add, delete, and modify access data as needed.

A. The enrollment station shall not have alarm response or acknowledgment functions.

B. Provide multiple, password-protected access levels. Database management and modification functions shall require a higher operator access level than personnel enrollment functions.

C. The program shall provide means to disable the enrollment station when it is unattended, to prevent unauthorized use.

D. The program shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations. In the case of personnel identity-verification subsystems, this shall include biometric data. Allow entry of personnel identifying information into the system database using menu selections and data fields. The data field names shall be customized during setup to suit user and site needs. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.

E. Cardholder Data: Provide 99 user-defined fields. System shall have the ability to run searches and reports using any combination of these fields. Each user-defined field shall be configurable, using any combination of the following features:

1. MASK: Determines a specific format with which data must comply.
2. REQUIRED: Operator is required to enter data into field before saving.
3. UNIQUE: Data entered must be unique.
4. DEACTIVATE DATE: Data entered will be evaluated as an additional deactivate date for all cards assigned to this cardholder.
5. NAME ID: Data entered will be considered a unique ID for the cardholder.

F. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.

G. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.

H. Batch card printing.

I. Default card data can be programmed to speed data entry for sites where most card data are similar.

J. Enhanced ASCII File Import Utility: Allows the importing of cardholder data and images.

K. Card Expire Function: Allows readers to be configured to deactivate cards when a card is used at selected devices.

PART 5 - SYSTEM DATABASE

5.1 Database and database management software shall define and modify each point in database using operator commands. Definition shall include parameters and constraints associated with each system device.

5.2 Database Operations:

A. System data management shall be in a hierarchical menu-tree format, with navigation through expandable menu branches and manipulated with use of menus and icons in a main menu and system toolbar.

B. Navigational Aids:

1. Toolbar icons for add, delete, copy, print, capture image, activate, deactivate, and muster report.
2. Point and click feature to facilitate data manipulation.
3. Next and previous command buttons visible when editing database fields to facilitate navigation from one record to the next.
4. Copy command and copy tool in the toolbar to copy data from one record to create a new similar record.

C. Data entry shall be automatically checked for duplicate and illegal data and shall be verified for valid format.

D. System shall generate a memo or note field for each item that is stored in database, allowing the storing of information about any defining characteristics of the item. Memo field is used for noting the purpose for which the item was entered, reasons for changes that were made, and the like.

5.3 File Management:

A. File management shall include database backup and restoration system, allowing selection of storage media, including 3.5-inch floppy disk, Zip and Jaz drives, and designated network resources.

B. Operations shall be both manual and automatic modes. The number of automatic sequential backups before the oldest backup will be overwritten; FIFO mode shall be operator selectable.

C. Backup program shall provide manual operation from any PC on the LAN and shall operate while system remains operational.

5.4 Operator Passwords:

A. Support up to 50,000 individual system operators, each with a unique password on an alpha numeric format.

B. Allow passwords to be case sensitive.

C. Passwords shall not be displayed when entered.

D. Passwords shall have unique and customizable password profile and allow several operators to share a password profile. Include the following features in the password profile:

1. Predetermine the highest-level password profile for access to all functions and areas of program.
2. Allow or disallow operator access to any program operation, including the functions of View, Add, Edit, and Delete.
3. Restrict doors to which an operator can assign access.

E. Operators shall use a user name and password to log on to system. This user name and password shall be used to access database areas and programs as determined by the associated profile.

F. Make provision to allow the operator to log off without fully exiting program. User may be logged off but program will remain running while displaying the login window for the next operator.

5.5 Access Card/Code Operation and Management: Access authorization shall be by card, by a manually entered code (PIN), or by a combination of both (card plus PIN).

A. Access authorization shall verify the facility code first, the card or card-and-PIN validation second, and the access level (time of day, day of week, date), anti-passback status, and number of uses last.

B. Use data-entry windows to view, edit, and issue access levels. Access-authorization entry-management system shall maintain and coordinate all access levels to prevent duplication or the incorrect creation of levels.

C. Allow assignment of multiple cards/codes to a cardholder.

D. Allow assignment of up to four access levels for each Location to a cardholder. Each access level may contain any combination of doors.

E. Each door may be assigned four time zones.

F. Access codes may be up to 11 digits in length.

G. Software shall allow the grouping of locations so cardholder data can be shared by all locations in the group.

H. Visitor Access: Issue a visitor badge for data tracking or photo ID purposes without assigning that person a card or code.

I. Cardholder Tracing: Allow for selection of cardholder for tracing. Make a special audible and visible annunciation at control station when a selected card or code is used at a designated code reader. Annunciation shall include an automatic display of the cardholder image.

J. Allow each cardholder to be given either an unlimited number of uses or a number from one to 9999 that regulates the number of times the card can be used before it is automatically deactivated.

K. Provide for cards and codes to be activated and deactivated manually or automatically by date. Provide for multiple deactivate dates to be preprogrammed.

5.6 Security Access Integration:

A. Photo ID badging and photo verification shall use the same database as the security access and may query data from cardholder, group, and other personal information to build a custom ID badge.

B. Automatic or manual image recall and manual access based on photo verification shall also be a means of access verification and entry.

C. System shall allow sorting of cardholders together by group or other characteristic for a fast and efficient method of reporting on, and enabling or disabling, cards or codes.

5.7 Key control and tracking shall be an integrated function of cardholder data.

A. Provide the ability to store information about which conventional metal keys are issued and to whom, along with key construction information.

B. Reports shall be designed to list everyone who possesses a specified key.

5.8 Facility Codes: System shall accommodate up to 2048 facility codes per Location, with the option of allowing facility codes to work at all doors or only at particular doors.

5.9 Operator Comments:

A. With the press of one appropriate button on the toolbar, the user shall be permitted to enter operator comments into the history at any time.

B. Automatic prompting of operator comment shall occur before the resolution of each alarm.

C. Operator comments shall be recorded by time, date, and operator number.

D. Comments shall be sorted and viewed through reports and history.

E. The operator may enter comments in two ways; either or both may be used:
   1. Manually entered through keyboard data entry (typed), up to 65,000 characters per each alarm.
   2. Predefined and stored in database for retrieval on request.

F. System shall have a minimum of 999 predefined operator comments with up to 30 characters per comment.

5.10 Group:

A. Group names may be used to sort cardholders into groups that allow the operator to determine the tenant, vendor, contractor, department, division, or any other designation of a group to which the person belongs.

B. System software shall have the capacity to assign one of 32,000 group names to an access authorization.

C. Make provision in software to deactivate and reactivate all access authorizations assigned to a particular group.

D. Allow sorting of history reports and code list printouts by group name.

5.11 Time Zones:

A. Each zone consists of a start and stop time for seven days of the week and three holiday schedules. A time zone is assigned to inputs, outputs, or access levels to determine when an input shall automatically arm or disarm, when an output automatically opens or secures, or when access authorization assigned to an access level will be denied or granted.

B. Up to four time zones may be assigned to inputs and outputs to allow up to four arm or disarm periods per day or four lock or unlock periods per day; up to three holiday override schedules may be assigned to a time zone.

C. Data-entry window shall display a dynamically linked bar graph showing active and inactive times for each day and holiday, as start and stop times are entered or edited.

D. System shall have the capacity for time zones for each Location.

5.12 Holidays:

A. Three different holiday schedules may be assigned to a time zone. Holiday schedule consists of date in format MM/DD/YYYY and a description. When the holiday date matches the current date of the time zone, the holiday schedule replaces the time-zone schedule for that 24-hour period.

B. System shall have the capacity for 50,000 holidays.

C. Three separate holiday schedules may be applied to a time zone.

D. Holidays have an option to be designated as occurring on the designated date each year. These holidays remain in the system and will not be purged.

E. Holidays not designated to occur each year shall be automatically purged from the database after the date expires.

5.13 Access Levels:

A. System shall allow for the creation of up to 50,000 access levels.

B. One level shall be predefined as the Master Access Level. The Master Access Level shall work at all doors at all times and override any anti-passback.

C. System shall allow for access to be restricted to any area by reader and by time. Access levels shall determine when and where an Identifier is authorized.

D. System shall be able to create multiple door and time-zone combinations under the same access level so that an Identifier may be valid during different time periods at different readers even if the readers are on the same controller.

5.14 User-Defined Fields:

A. System shall provide a minimum of 99 user-defined fields, each with up to 50 characters, for specific information about each credential holder.

B. System shall accommodate a title for each field; field length shall be 20 characters.

C. A "Required" option may be applied to each user-defined field that, when selected, forces the operator to enter data in the user-defined field before the credential can be saved.

D. A "Unique" option may be applied to each user-defined field that, when selected, will not allow duplicate data from different credential holders to be entered.

E. Data format option may be assigned to each user-defined field that will require the data to be entered with certain character types in specific spots in the field entry window.

F. A user-defined field, if selected, will define the field as a deactivate date. The selection shall automatically cause the data to be formatted with the windows MM/DD/YYYY date format. The credential of the holder will be deactivated on that date.

G. A search function shall allow any one user-defined field or combination of user-defined fields to be searched to find the appropriate cardholder. The search function shall include a search for a character string.

H. System shall have the ability to print cardholders based on and organized by the user-defined fields.

5.15 Code Tracing:

A. System shall perform code tracing selectable by cardholder and by reader.

B. Any code may be designated as a "traced code" with no limit to how many codes can be traced.

C. Any reader may be designated as a "trace reader" with no limit to which or how many readers can be used for code tracing.

D. When a traced code is used at a trace reader, the access-granted message that usually appears on the monitor window of the central station shall be highlighted with a different color than regular messages. A short singular beep shall occur at the same time the highlighted message is displayed on the window.

E. The traced cardholder image (if image exists) shall appear on workstations when used at a trace reader.

5.16 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

B. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."

C. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

D. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

PART 6 - EQUIPMENT

6.1 CENTRAL STATION SERVER:

1. Standard unmodified Server of modular design. Intel® Xeon® E3-1270v6 3.80 Ghz.
2. Power Supply: Minimum capacity of **250**W.
3. Real-Time Clock:
4. Accuracy: Plus or minus one minute per month.
5. Time-Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; resettable by software.
6. Clock shall function for one year without power.
7. Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.
8. Serial Ports: Provide two TIA 232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
9. Parallel Port: An enhanced parallel port.
10. LAN Adapter Card: [**10/100**] Mbps PCI bus, internal network interface card.
11. MANUFACTIRER PART # GENETEC STREAM VAULT 1000

6.2 NON-PROPRIETARY HARDWARE INTERFACE:

1. A fixed map display may be used as another status indicator, supplementing the monitor display of the central station.
2. Processor: Onboard Intel Atom E3825 1.33GHz dual-core CPU.
3. System memory: 2GB of DDR3 DRAM 16GB on-board SATA Flash (SSD) for OS, firmware and database
4. Communications: Two (2) 10/100/1000 Mbps Gigabit Ethernet ports Four RS-485 ports (embedded).
5. Electrical: 9-16VDC or PoE+ (IEEE 802.3at) on one (1) Ethernet port.
6. Mechanical: Appliance dimensions (L × W): 6.89 × 4.22 inches (17.5 × 10.7 cm)
7. Environment: Temperature: 32°F to 122°F (0°C to 50°C) operational Relative humidity: Operating 5% to 95%, non-condensing For indoor use only, or within a NEMA Type 4 enclosure CONTROLLERS
8. Warranty: 24 months.
9. Certifications: UL 294 and ULC S319, CE approval, RoHS compliant, FCC Class A, EN60839-11-1
10. Downstream device support: 32 HID VertX downstream modules over RS-485 (across four ports) 32 Mercury Security EP panels (up to 256 readers) 32 Axis A1001 network

door controllers 128 ASSA ABLOY IP locks (PoE or WiFi) 64 ASSA ABLOY Aperio-enabled wireless locks 64 SALTO SALLIS wireless locks 256 Allegion Schlage AD-Series hardwired and wireless locks 256 SimonsVoss SmartIntego locks.

11. MANUFACTURER PART # GENETEC SYNERGIS CLOUD LINK

6.3 INTRUSION DETECTION

A. Panel: Bosh B9512G-C

1. Communications: Ethernet 10/100 full-duplex (N/A for “E” control panels).
2. Environmental considerations: Relative humidity 5% to 93% at +90°F (+32°C), non-condensing Temperature (operating) +32°F to +122°F (0°C to +49°C).
3. Power requirements: Current draw (maximum) Idle 125 mA; alarm 155 mA Output (alarm) 1.3 A at 12 VDC Output (auxiliary, continuous power, and switched auxiliary combined) 800 mA at 12 VDC nominal Voltage (operating): 12 VDC nominal Voltage (AC) 16.5 - 18 VAC
4. Number of… Areas 4 Custom functions 4 Events 1024 Passcode users 50, plus 1 installer passcode.
5. Points: 48 (8 on-board, up to 40 off-board and virtual) Programmable outputs 43 (3 on-board, up to 40 off-board and virtual) RF points 40.
6. Manufacturer Part # B942W Keypad – White

6.4 ACOUSTIC-TYPE, GLASS-BREAK SENSORS:

A. Detect unique, airborne acoustic energy spectrum caused by breaking glass.

1. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot range.
2. Hookup Cable: Factory installed, not less than 72 inches.
3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor controller or at central-station control unit.
4. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover
5. Bosh # DS1101I

6.5 DOOR AND WINDOW SWITCHES

A. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.

B. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

C. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.

D. Bosh #: ISN-CSD70-B/W and ISN-CSM35 where needed.

E. Bosh #: ISN-CMET-4418 (overhead doors contacts)

6.6 MICROWAVE-PIR DUAL-TECHNOLOGY MOTION SENSORS

A. Description: Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.

B. Device Performance: An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.
   1. Minimum Detection Pattern: A room 20 by 30 feet.
   2. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps across 2 adjacent segments of detector's field of view.
   3. Microwave Sensor Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps. Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
   4. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.

C. Model #'s

   1. Bosh # ISC-TDL1-WA148G.
   2. Bosh #: Hallway motion detectors (long and narrow throw) Bosh ISC-PDL1-WA18G
   2. Bosh #: Ceiling Mounted Part # DS9370 (white)

D. REQUEST TO EXIT
   1. Alarm Control # for Request to exit button. TS-60
   2. Bosh #: for motion sensor to release exit doors DS150i/DS151i.

6.7 CAMERAS

A. Outdoor cameras wall mounted: Axis M3115-LVE, Axis P3727-PLE using Corner mount(T91A64, T91D61, and T94N01D), Axis P3807-PVE.

B. Indoor cameras wall/ceiling mounted: Axis M3058-PLVE, Axis M3085-V, Axis P3727-PLE, Axis P3807-PVE, AXIS P4705-PLVE.

C. Entrance Gate Camera: AXIS A8207-VE Mk II

D. All work to be performed by Axis Certified Gold partner and Genetec certified partner.

E. Computer Hardware:
   1. Close Circuit TV display source
   2. Provide small form factor computer for VMS user viewer.
   3. Player motherboard shall have the following minimum features:
      a. 4 th Generation Intel ® Core™ i7-4770 or better.

b. 8 GB of RAM or better.
c. 64-bit operating system.
d. 120 GB Solid State Drive for OS and Security Center applications.
e. GbE network interface card.
f. NVIDIA ® QUADRO K620 2 GB video card.
g. Intel® Express Chipset.

4. Motherboard shall be equipped with the following connectors:
   a. One DIMM slot supporting up to 32 GB of memory
   b. 128 GB Storage Capacity
   c. High definition multimedia interface (HDMI*)
   d. RJ-45 LAN connector
   e. Motherboard shall come with a 3-year warranty
   f. Enclosure, with cooling fan.
   g. Computer shall be capable of operating from 120 VAC, 60 Hz power.
5. Player shall be bundled with the following accessories:
   a. Power Supply
   b. Video Cable
   c. Acceptable products: Intel NUC Approved equivalent

F. Displays
1. Provide flat panel LCD displays for VMS user viewer
2. Displays shall be rated for 24x7 commercial grade use and utilize LCD technology.
3. The aspect ratio shall be 16:9.
4. The size shall be 55” diagonal.
5. Monitor shall be capable of operating from 120 VAC, 60 Hz power.
   a. Displays shall be equipped with the following inputs:
   b. The aspect ratio shall be 16:9.
   c. The size shall be 55” diagonal.
   d. Monitor shall be capable of operating from 120 VAC, 60 Hz power.
   e. Displays shall be equipped with the following inputs:
      1) DVI-D
      2) DisplayPort 1.2
      3) HDMI 2.0
      4) Acceptable products: Samsung QM55H Approved equivalent
      5) Display Mount
         a) Mount shall be designed to support one landscape-oriented monitor.
         b) Mount shall be capable of supporting the size and weight of the display and associated computer.
         c) Provide a Media Device Storage enclosure per display, to be attached to the display mount.
         d) Attach mount to the building structure, and ensure it is installed to the manufacturer's recommendations.
         e) Wall mounted or millwork mounted when monitor is placed against gypsum or millwork, with media player mounted on the back of the display.
         f) Displays should not be attached to bare iron columns, instead should be pole mounted from above in front of the column.
         g) Acceptable products: Peerless ST650 Tilting Wall Mount, Peerless PLCM-UNL-CP with Media Device Storage and Mounting, Accessories, Approved equivalent.

6.8 CABLES

A. General Cable Requirements: Comply with requirements in Section 280513 "Conductors and Cables for Electronic Safety and Security" and as recommended by system manufacturer for integration requirement.

B. PVC-Jacketed, TIA 232-F Cables:
   1. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum-foil/polyester-tape shielded pairs with 100 percent shield coverage; PVC jacket.
   2. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
   3. NFPA 70, Type CM.
   4. Flame Resistance: UL 1581 vertical tray.

C. Plenum-Type, TIA 232-F Cables:
   1. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum-foil/polyester-tape shielded pairs with 100 percent shield coverage; plastic jacket.
   2. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
   3. NFPA 70, Type CMP.
   4. Flame Resistance: NFPA 262 flame test.
   5. TIA 485-A communications require two twisted pairs with a distance limitation of 4000 ft. (1220 m).
   6. PVC-Jacketed, TIA 485-A Cables: Two pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.

D. Plenum-Type, TIA 485-A Cables:
   1. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket.
   2. NFPA 70, Type CMP.
   3. Flame Resistance: NFPA 262 flame test.
   4. Retain one of first two paragraphs below or allow Contractor to choose. First paragraph allows use of multiconductor cables instead of a separate cable for each reader or keypad; if retaining, retain the remaining paragraphs that refer to readers and keypads to allow use of multiconductor cables. Retain uniform shielding characteristics or differentiate on Drawings where 100 percent shielding is required or where less shielding is allowed. Retain insulating materials based on engineer's preference, considering manufacturer's written instructions. When revising cable paragraphs pertaining to readers and keypads, verify that the new combination of conductor size, insulation material, shielding, and jacket is commercially available.
   5. The connection of card readers and Wiegand keypads to the controller requires a three-pair, No. 22 or 20 AWG cable with an overall braided shield. Maximum distance from controller to reader is 250 ft. (76 m) with No. 22 AWG wire, 500 ft. (152 m) with No. 20 AWG wire, or 750 ft. (228 m) with No. 18 AWG wire. The three pairs provide one pair for power, one pair for data, and one pair for two separate digital control lines. Readers with a buzzer or other options require additional conductors.

E. Multiconductor, PVC, Reader and Wiegand Keypad Cables:
   1. No. 22 AWG, paired and twisted multiple conductors, stranded (7x30) tinned copper conductors, semirigid PVC insulation, overall aluminum-foil/polyester-tape shield with 100

percent shield coverage, plus tinned copper braid shield with 65 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CMG.
3. Flame Resistance: UL 1581 vertical tray.
4. For TIA 232-F applications.

F. Paired, PVC, Reader and Wiegand Keypad Cables:
1. Three pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, individual aluminum-foil/polyester-tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CM.
3. Flame Resistance: UL 1581 vertical tray.

G. Paired, PVC, Reader and Wiegand Keypad Cables:
1. Three pairs, twisted, No. 20 AWG, stranded (7x28) tinned copper conductors, polyethylene (polyolefin) insulation, individual aluminum-foil/polyester-tape shielded pairs each with No. 22 AWG, stranded (19x34) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CM.
3. Flame Resistance: UL 1581 vertical tray.

H. Paired, Plenum-Type, Reader and Wiegand Keypad Cables:
1. Three pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, individual aluminum-foil/polypropylene-tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and fluorinated-ethylene-propylene jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.

I. Multiconductor, Plenum-Type, Reader and Wiegand Keypad Cables:
1. Six conductors, No. 20 AWG, stranded (7x28) tinned copper conductors, fluorinated-ethylene-propylene insulation, overall aluminum-foil/polyester-tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and fluorinated-ethylene-propylene jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.
4. Coordinate first four paragraphs below with power requirements of locks specified in Section 087100 "Door Hardware" and Section 087111 "Door Hardware (Descriptive Specification)." Lock wire size recommendations are for the power draw of 500 mA or less, with an inrush current of not more than 1 A. Twelve- to 24-V lock wire from controller to door requires a two-conductor cable. Maximum distance from controller to lock is 250 ft. (76 m) with No. 18 AWG wire, and 500 ft. (152 m) with No. 16 AWG wire.

J. Paired, Lock Cables:
1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
2. NFPA 70, Type CMG.
3. Flame Resistance: UL 1581 vertical tray.

K. Paired, Plenum-Type, Lock Cables:
1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.

2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.

L. Paired, Lock Cables:
1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
2. NFPA 70, Type CMG.
3. Flame Resistance: UL 1581 vertical tray.

M. Paired, Plenum-Type, Lock Cables:
1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.
4. Input cables in first two paragraphs below connect monitored devices to controllers. Input requires a two-conductor, No. 22 AWG cable; distance limitation is 1000 ft. (305 m) maximum. Cable shielding is optional but required for UL-labeled systems.

N. Paired, Input Cables:
1. One pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, overall aluminum-foil/polyester-tape shield with No. 22 AWG, stranded (7x30) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CMR.
3. Flame Resistance: UL 1666 riser flame test.

O. Paired, Plenum-Type, Input Cables:
1. One pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, aluminum-foil/polyester-tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.
4. AC transformer cables in first two paragraphs below connect the power transformers to the controllers if the transformers are remotely mounted from the controllers. AC transformer cables require a single-pair cable with a maximum distance of 25 ft. (8 m) for 18 AWG cable.

P. Paired, AC Transformer Cables:
1. One pair, twisted, No. 18 AWG, stranded (7x26) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
2. NFPA 70, Type CMG.

Q. Paired, Plenum-Type, AC Transformer Cables:

R. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 flame test.

S. Elevator Travel Cables:
1. Steel center core with shielded, twisted pairs, No. 20 AWG conductor size.

2. Steel center core support shall be preformed, flexible, low-torsion, zinc-coated, steel wire rope; insulated with 60 deg C flame-resistant PVC and covered with a nylon or cotton braid.
3. Shielded pairs shall be insulated copper conductors; color-coded, insulated with 60 deg C flame-resistant PVC; each pair shielded with bare copper braid for 85 percent coverage.
4. Electrical grade, dry jute filler.
5. Helically wound synthetic fiber binder.
6. Rayon or cotton braid applied with 95 percent coverage.
7. 60 deg C PVC jacket specifically compounded for flexibility and abrasion resistance; and complying with UL VW-1 and CSA FT1 flame rated.

T. LAN cabling in paragraph below is used for PC-to-PC communications.
1. LAN Cabling:
a. Comply with requirements in Section 280513 "Conductors and Cables for Electronic Safety and Security."
b. NFPA 262.

U. Underground cabling: Please provide water resistant/water blocking type, equal to West Penn “Aquaseal”.

6.9 TRANSFORMERS

A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 7 - ENROLLMENT CENTER

7.1 Thru Active Directory Software

7.2 Equipment for enrolling personnel into, and removing personnel from, system database, using Active Directory or server.

7.3 Enrollment equipment shall support encoding of credential cards including cryptographic and other internal security checks as required for system.

A. Allow only authorized entry-control enrollment personnel to access the enrollment equipment using passwords.

B. Include enrollment-subsystem configuration controls and electronic diagnostic aids for subsystem setup and troubleshooting with the central station.

C. Enrollment-station records printer shall meet requirements of the report printer.

7.4 Entry-Control Enrollment Software:

A. Shall include database management functions for the system and shall allow an operator to change and modify the data entered in the system as needed.

B. Software shall not have alarm response or acknowledgment functions as a programmable function.

C. Multiple, password-protected access levels shall be provided at the enrollment station.

D. Database management and modification functions shall require a higher operator-access level than personnel enrollment functions.

E. Software shall provide a means for disabling the enrollment station when it is unattended, to prevent unauthorized use.

F. Software shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations to include a credential unit in use at the installation.

G. In the case of personnel identity-verification subsystems, this data shall include biometric data.

H. Software shall allow entry of this data into the system database files through the use of simple menu selections and data fields. The data field names shall be customized to suit user and site needs.

I. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.

7.5 System Capacity: Number of badges shall be limited only by hard disk space. Badge templates and images shall be in color, supporting the maximum color capability of Microsoft Windows.

7.6 DOOR AND GATE HARDWARE INTERFACE

A. Exit Device with Alarm: Operation of the exit device shall generate an alarm and annunciate a local alarm. Exit device and alarm contacts are specified in Section 087100 "Door Hardware."

B. Exit Alarm: Operation of a monitored door shall generate an alarm. Exit devices and alarm contacts are specified in Section 087100 "Door Hardware."

C. Electric Door Strikes: Use end-of-line resistors to provide power-line supervision. Signal switches shall transmit data to controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and they shall report a forced entry. Power and signal shall be from the controller. Electric strikes are specified in Section 087100 "Door Hardware."

D. Electromagnetic Locks: End-of-line resistors shall provide power-line supervision. Lock status sensing signal shall positively indicate door is secure. Power and signal shall be from the controller. Electromagnetic locks are specified in Section 087100 "Door Hardware."

E. Vehicle Gate Operator: Interface electrical operation of gate with controls in this Section. Vehicle gate operators shall be connected, monitored, and controlled by the security access controllers. Vehicle gate and accessories are specified in Section 323113 "Chain Link Fences and Gates."

F. Intercom integration: Interface intercom audio and video via software with electrical operation of gate.

PART 8 - EXECUTION

8.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

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

8.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA/EIA 606-A, Administration Standard for Commercial Telecommunications Infrastructure, RCDD certification, Genetec Authorize dealer and certification

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

D. Record setup data for control station and workstations.

E. For each Location, record setup of controller features and access requirements.

F. Propose start and stop times for time zones and holidays and match up access levels for doors.

G. Set up groups, facility codes, linking, and list inputs and outputs for each controller.

H. Assign action message names and compose messages.

I. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.

J. Prepare and install alarm graphic maps.

K. Develop user-defined fields.

L. Develop screen layout formats.

M. Propose setups for guard tours and key control.

N. Discuss badge layout options, design badges.

O. Complete system diagnostics and operation verification.

P. Prepare a specific plan for system testing, startup, and demonstration.

Q. Develop acceptance test concept and, on approval, develop specifics of the test.

R. Develop cable and asset-management system details, input data from construction documents. Include system schematics and Visio Technical Drawings in electronic format.

S. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

8.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."

B. Install cables and wiring according to requirements in Section 280513 "Conductors and Cables for Electronic Safety and Security."

C. Installation: UL 681.

B. Wiring Method: Install wiring in raceways except in accessible indoor ceiling spaces. Secure from building structure steel (no from walls) by means of J-hooks. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be ¾” inch. Control and data transmission. Wiring shall not share conduit with other building wiring systems. Wiring shall not be exposed below ceiling.

D. Wiring Method: Install wiring in raceway and cable tray 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. Use NRTL-listed plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

E. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and fiber-optic rating of components, and that ensure Category 6 and fiber-optic performance of completed and linked signal paths, end to end.

F. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

G. Install end-of-line resistors at the field device location and not at the controller or panel location.

8.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Retain subparagraph below to require a factory-authorized service representative to assist Contractor with inspections, tests, and adjustments.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Retain first paragraph below to describe tests and inspections to be performed.

E. Tests and Inspections:

F. Retain subparagraphs below unless testing will be performed by Owner-engaged testing and inspecting agency.

G. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-B.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-B.1.

H. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

I. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

J. See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

K. Devices and circuits will be considered defective if they do not pass tests and inspections.

L. Prepare test and inspection reports.

8.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service.

B. Complete installation and startup check according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

C. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

8.6 PROTECTION

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured with an activated burglar alarm and access-control system reporting to a central station complying

with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

8.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. See Section 017900 "Demonstration and Training."

B. Develop separate training modules for the following:

C. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.

D. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.

E. Security personnel.

F. Hardware maintenance personnel.

G. Corporate management.

END OF SECTION 283112

SECTION 311100
CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. Cleaning and grubbing on project site of trees, stumps, brush, roots, vegetation, logs rubbish and other objectionable matter within limits described in specifications or as shown on plans.

B. Cleaning and grubbing shall be in advance of grading operation except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided objectionable matter is removed as specified.

C. Dispose of all debris resulting from clearing and grubbing work.

1.02 PROTECTION OF ADJACENT WORK:

A. Protect all areas outside indicated construction areas.

B. Protect existing improvements, adjacent property, utilities and other facilities, and trees and plants not to be removed from injury or damage.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide materials required to perform work as specified.

PART 3 - EXECUTION

3.01 CLEARING:

A. Clear all areas covered by dikes, roads, structures and embankments within project limits unless otherwise shown in plans.

B. Remove all saplings, brush, down-timber and debris unless shown or directed otherwise.

C. Use tree wound paint to treat scars, gashes or limbs stubs on trees not removed.

3.02 GRUBBING:

A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction templates for the following items:

1. Footings = 18-inches below bottom of footing.
2. Sidewalks (or other types of walks) = 12-inches below bottom of walk.
3. Roadways or Streets = 18-inches below bottom of subgrade
4. Parking Areas = 18-inches below bottom of subgrade
5. Grassed Areas = 18-inches below top soil
6. Fills = 24-inches below bottom of fill

B. Blasting not permitted.

3.03 REMOVAL OF DEBRIS AND CLEANUP

A. Burning is not permitted.

B. Dispose of all waste materials not burned by removal from site.

C. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.

END OF SECTION

SECTION 312200
TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. Excavation, shoring, dewatering, pipe bleeding, trench backfill, compaction, grading and cleanup of all pipeline trenching for the project.

B. All work must be done in accordance with these specifications and the safety requirements of the State and OSHA Standards.

1.02 JOB CONDITIONS

A. Site Acceptance
   1. Accept site in condition existing during Contract time frame.
   2. Ground water/surface water found during construction are conditions of the contract and responsibility of Contractor.

B. Adverse Weather
   1. Place no backfill that is excessively wet or frozen.
   2. Place no backfill in excessively wet or frozen trenches.

PART 2 – PRODUCT

2.01 MATERIAL CLASSIFICAITONS

A. Materials for backfill shall be classified for the purpose of quality control in accordance with the 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 2.10B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:
   1. Class I: Well-graded sands and gravels, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW,SW)
   2. Plasticity Index: Non-plastic
   3. Gradation: D60/D10 – greater than 4 percent. Amount passing No. 200 ≤ 5%.
   4. Class II: Poorly-graded gravels and sands, silty sands and gravels, little to moderate fines (GM, GP, SP, and SM)
   5. Plasticity Index: Non-plastic to 4
   6. Gradation (GP, SP): Amount passing No. 200 Sieve – less than 5%.
   7. Gradation (GM, SM): Amount passing No. 200 Sieve – 12% to 50%
   8. Class III: Clayey gravels and sands, poorly graded mixtures of sand, gravel, and clay (GC, SC)
      a. Plasticity Index

2.02 PIPE BEDDING AND BACKFILL

A. The type of bedding shall be stated on the Plans or in the Specification. Determination of source of materials for bedding and backfill to meet the stated conditions shall be responsibility of Contractor, but use of such materials shall be subject to approval of Engineer.

B. Excavated Material Backfill
   1. Excavated material may be used in the trench backfill, provided that all hard rock and stones having any dimensions greater than 6" and frozen earth debris and roots larger than 2" are removed for the initial backfill. Plasticity Index shall be less than 30. Excavated backfill material must be approved by Engineer for bedding material.

C. Select Backfill
   1. Select Backfill shall be gravel, fine rock cuttings, sand, sandy loam or loam free from excessive clay. Rock cuttings shall have no dimensions greater than 2 inches. Plasticity Index shall be between 7 and 22. Select backfill must be approved by Engineer.

D. Sand Backfill

1. Sand backfill shall be clean, hard, durable, uncoated grains, free from lumps and organic material. All materials must pass a No. 8 Sieve.

E. Granular Backfill
   1. Granular backfill shall be free flowing, such as sand or hydraulically grade stone fines, or mixed sand and gravel, or sandy loam. The material shall be free from lumps, stones over 2 inches in diameter, clay and organic matter.

F. Controlled Density Fill
   1. Use high slump mixture of portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal. Provide mixture with minimum 28-day compressive strength of 70 psi with no measurable shrinkage or surface settlement.

2.03 CRADLING ROCK

A. Use crushed rock or stone with 70-100% passing 1> inch sieve and no more than 50% passing 1 inch sieve.

2.04 SHEETING, SHORING AND BRACING

A. Use sound timber or structural steel.

B. Use shapes and sizes as required.

PART 3 - EXECUTION

3.01 GENERAL

A. Dewatering
   1. Execute work "dry". No pipe or conduits shall be laid or concrete poured on excessively wet soil.
   2. Prevent surface water from flowing into excavation.
   3. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering.
   4. No Sanitary sewer shall be used for disposal of trench water.

B. Protection of Existing Utilities:
   1. Notify all utilities of location and schedule of work.
   2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility and Engineer of conflicts between existing and proposed facilities.
   3. Repair, relay or replace existing utilities damaged, destroyed or disrupted during work. Unless specified otherwise, replacement will be at the Contractors expense.

C. Sheeting, Shoring and Bracing
   1. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.
   2. Leave Sheeting and shoring in place where removal might cause damage to work or otherwise indicated on drawings.
   3. When movable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade
   1. Grades may be adjusted 1.5 feet (plus or minus) from plan grades to suit unforeseen construction conflicts or conditions with approval of Engineer.
   2. No additional compensation will be made for such changes.

3.02 EXCAVATION AND TRENCHING

A. General
   1. Method of excavation at Contractor's option.
   2. Excavate by hand under tree roots 3 inches and larger, and under and around structures and utilities.
   3. Stockpile and replace topsoil to a minimum of 4-inches for surface restoration in grassed or agricultural areas.

B. Trench Characteristics
   1. Depth
      a. As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated.
   2. Width
      a. Keep width of trench as narrow as possible and yet provide adequate room for backfilling and jointing.
      b. Maximum width as follows:

Pipe Size	Maximum Trench
Inches	Width
4	2-feet 0-inches
6	2-feet 0-inches
8	2-feet 4-inches
10	2-feet 4-inches
12	2-feet 6-inches
15	2-feet 9-inches
18	3-feet 0-inches
Over 18	Pipe O.D. + 12-inches

   3. Trench walls must be vertical below top of pipe and may be vertical or sloped above pipe to conform to excavating codes.
   4. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.
   5. Trench bottom shall be free of large stones and other foreign material.

3.03 SOFT, SPONGY OR UNSTABLE MATERIALS

A. Stop work and notify Engineer.

B. Perform remedial work as directed.

C. If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by Engineer.

3.04 ROCK EXCAVATION

A. Excavate any rock to maintain minimum 6-inch clearance around pipe.

B. Dispose of rock material not suitable for backfill as directed by Engineer.

C. Use of explosives not permitted without prior written authorization from owner and Engineer.

D. Provide Special Hazard Insurance covering liability for blasting operations.

3.05 BEDDING

A. Place after bottom of trench has been excavated to proper depth and grade.

B. Place, compact and shape bedding material to conform to barrel of pipe to insure continuous firm bedding for fill length of pipe.

C. Provide bedding as described in following table unless indicated otherwise on Plans or in Special Conditions.

Pipe Material	Minimum Bedding Class
1. Vitrified Clay Pipe	Class C*
2. Non-reinforced Concrete Pipe	Class C*
3. Reinforced Concrete Pipe	Class D*
4. Ductiole Iron Pipe	Class D*
5. Steel Cylinder	Class C*
6. Flexible or Composite Pipe (PVC)	Class 1**

*Refers to standard detail, "Pipe Envelope Requirements"

**Refers to standard detail, "Bedding Detail"

3.06 TRENCH BACKFILL

A. Use excavated material for backfill unless otherwise specified.

B. Use Sand Backfill for all trenches within 5 feet of buildings and beneath walks, parking areas, paved streets or existing exposed utilities, unless otherwise specified in the plans.

C. Initial Backfill
   1. Place after pipe has been bedded and checked for alignment, grade and internal obstructions.
   2. Carry out in an orderly fashion after authorization to cover pipe has been given.
   3. Allow no more than 300 feet of trench to be open at one time.
   4. Do not backfill until concrete or mortar has sufficiently cured.
   5. Record location of connections and appurtenances before backfilling.
   6. Place by hand and hand tamp to not less than 12-inches above top of pipe, in approximately 4-inch layers.
   7. Backfill simultaneously on both sides of pipe to prevent displacement.
   8. Place cushion of 4-foot backfill above pipe envelope before using heavy compacting equipment.

D. Subsequent Backfill
   1. Place backfill into trench at an angle so that impact on installed pipe is minimized.
   2. Compaction of all backfill material shall be performed in an manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
   3. Area under or within 5-feet of pavement; and under or within 2-feet of utilities, buildings, or walks shall be mechanically compacted to the top of the subgrade in 6-inch lifts to a minimum of 95% Standard Proctor Density.
   4. Areas not subject to vehicular traffic shall be backfilled in layers not more than 12-inches in depth.
   5. Compaction method is at discretion of Contractor with following exceptions:
      a. If in Owner's opinion compaction method presents potential damage to pipe, it will not be allowed.
      b. Compaction of any backfill material by flooding or jetting is not allowed.
   6. Mound excavated materials no greater than 6-inches in open areas only.
   7. Fill upper portion of trench with topsoil as specified hereinbefore.

E. Controlled Density Fill
   1. Use where shown on plans.
   2. Provide suitable forms to limit volume of control density fill material.
   3. Prevent flow of material into existing drain lines.
   4. Protect exposed utility lines during placement.
   5. Place material in accordance with suppliers' written recommendations unless directed otherwise by Engineer

3.07 EXCESS MATERIAL

A. Waste of excess excavated material shall be the responsibility of the Contractor.

3.08 TESTING

A. Unless specified elsewhere, testing will be responsibility of Owner.

B. Standard Proctor Density
   1. ASTM D698.
   2. One (1) required for each type of material encountered.

C. In Place Density
   1. ASTM D1556 (Sand Cone)
   2. ASTM D2167 (Balloon)

3. ASTM D3017 (Nuclear)

D. One (1) test per each 400 cubic yards of backfill placed.

END OF SECTION

SECTION 312350
GROUND WATER HANDLING

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations, and foundation beds in a stable condition, and controlling ground water conditions for tunnel excavations.

B. Protecting work against surface runoff and rising flood waters.

C. Disposing of removed water.

1.02 REFERENCES

A. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

B. Federal Register 40 CFR (Vol. 53. No. 222) Part 122, EPA Administrator permit Programs (NPDES), Para 122.26 (b)(14) Storm Water Discharge.

1.03 DEFINITIONS

A. Ground water control includes both dewatering and depressurization of water-bearing soil layers using well points, for either vacuum or educator systems, or deep wells. Use of sump pumps does not constitute ground water control.

1. Dewatering is lowering the water table and intercepting seepage which would otherwise emerge from slopes or bottoms of excavations or into tunnels and shafts, and disposing of removed water.
2. Depressurization is reduction of piezometric pressure within a soil strata not controlled by dewatering alone.

B. Control of excavation drainage by sump pumping includes operating the sump pump and drainage facilities installed to collect water in the sump.

C. Control of surface drainage is diversion of surface water away from excavations.

1.04 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations as needed to identify ground water conditions and to provide parameters for installation and operation of ground water control systems. Perform pump tests, if necessary, to determine drawdown characteristics of water bearing layers.

B. Develop a ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926, to produce the following results:

1. Reduce hydrostatic pressure affecting excavations to the following levels as determined by piezometer observations.
   a. For structural excavations, reduce the piezometric level to at least 3 feet below the excavation bottom elevation or within 2 feet above the top of clay layers.
   b. Where hydrostatic pressure in a confined water-bearing layer exist below the excavation, depressurize this zone to eliminate risk of uplift or other instability of the excavation or installed works.
2. Develop stable subgrade for subsequent construction operations.
3. Reduce hydrostatic pressure for tunnel excavations as necessary to maintain face stability, grade control, and to control seepage into tunnel.

C. Provide drainage of seepage water and surface water, as well as water from any other source entering the excavation. Excavation drainage may include placement of drainage materials such as crushed stone and filter fabric, together with sump pumping.

D. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

E. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, if they affect potentially contaminated areas.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Comply with the Texas Natural Resource Conservation Commission regulations and Texas Water Well Driller Association for development, drilling, and abandonment of wells used in dewatering system.

B. Where potentially contaminated areas are indicated on the Drawings, monitor ground water discharge for contamination in accordance with the Project Engineer's instructions.

PART 2-PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Equipment and materials are at the option of Contractor as necessary to achieve desired results for ground water control. Ground water control systems may include single-stage or multiple-stage well point systems, educator and ejector-type systems, deep wells, or combinations of these equipment types. Excavation drainage and surface drainage may also include sump pumping subsidiary to bid item.

B. Maintain equipment in good repair and operating order.

C. Arrange for standby equipment and materials where required.

PART 3-EXECUTION

3.01 GROUND WATER CONTROL

A. Install, operate and maintain the ground water control system in a manner compatible with construction methods and site conditions. Notify Project Engineer in writing of any changes made to accommodate field conditions and changes to the Work.

B. For above ground piping in ground water control system, include a length of clear transparent piping between every well point and discharge header so that discharge from each installation can be visually monitored.

C. Replace installations that produce noticeable amounts of sediments after development.

D. Provide additional ground water control installations, or change the methods, if the installation does not achieve satisfactory results.

E. Do not allow piezometric pressure levels to rise until foundation concrete has achieved design strength.

F. During backfilling, dewatering may be reduced to maintain water level a minimum of 5 feet below prevailing level of backfill. However, do not allow that water level to result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place.

G. Remove ground water control installations.
   1. Remove pumping system components and piping when ground water control is no longer required.
   2. Remove monitoring wells when directed by the Project Engineer.
   3. Grout abandoned well.
      a. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

3.02 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of the ground water control systems.

B. Replace inoperable or damaged system components as necessary to maintain operation.

C. Keep monitoring system piping accessible for observation,

3.03 MONITORING AND RECORDING

A. Observe and record elevation of water level daily as long as ground water control system is in operation. Observe levels weekly thereafter until the Work is completed or piezometers or wells are removed. Initiate more frequent observation when the Project Engineer determines that more frequent monitoring and recording are required.

3.04 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations. This includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Drive surface water and seepage water into sumps and pump it into drainage channels, setting basins, or storm drains.

END OF SECTION

SECTION 312500
EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

PART 1-GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to provide erosion and sediment control for the duration of the construction period including furnishing, installing and maintaining erosion and sediment control structures and procedures and the proper removal when no longer required.

B. The intent of this specification is to provide guidelines for the Contractor to adhere to all State, Federal, and Local environmental regulations. It is also the intent to provide preventive measures to keep sediment from entering any storm water system, including open channels. It is the Contractor's responsibility to adhere to all State, Federal and Local requirements. While the Owner may require the Contractor to install erosion control devices during construction, this will in no way relieve the Contractor of his responsibility.

1.02 QUALITY ASSURANCE

A. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Plans are not represented as being comprehensive, but rather to convey the intent to provide complete slope protection and erosion control for both the Owner's and adjacent property.

B. Erosion control measures shall be established at the beginning of construction and maintained during the entire length of construction. On-site areas which are subject to severe erosion and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation are to be identified and receive additional erosion control measures as directed by the Owner or the Engineer.

C. All land-disturbing activities shall be planned and conducted to minimize the size of the area to be exposed at any one time and to minimize the time of exposure.

D. Surface water runoff originating upgrade of exposed area shall be controlled to reduce erosion and sediment loss during the period of exposure.

E. When the increase in the peak rates and velocity of storm water runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving ditch or stream, the Contractor shall install measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream as directed by the Owner or the Engineer.

F. All land-disturbing activities shall be planned and conducted so as to minimize off-site sedimentation damage.

G. The Contractor shall be responsible for periodically cleaning out and disposing of all sediment once the storage capacity of the drainage feature or structure receiving the sediment is reduced by one-half. The Contractor shall also be responsible for cleaning out and disposing of all sediment at the time of completion of the Work.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS, and shall include:

B. Manufacturer’s Literature: Descriptive data of installation methods and procedures.

C. Certificates: Manufacturer’s certification that materials meet specification requirements.

1.04 JOB CONDITIONS; CODES AND ORDINANCES

A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional erosion and sediment control measures during construction, Contractor shall provide such measures.

PART 2 - PRODUCTS

2.01 MATERIALS

A. STRAW BALES: Straw bales shall weigh a minimum of fifty (50) pounds and shall be at least 30" in length. Bales shall be composed entirely of vegetable matter and be free of seeds. Binding shall be either wire or nylon string, jute or cotton binding is unacceptable. Bales shall be used for not more than three months before being replaced. However, if weather conditions cause biological degradation of the straw bales, they shall be replaced sooner than the three month time period to prevent a loss of structural integrity of the dike.

B. SILT FENCE: Silt fence fabric shall be a nylon reinforced polypropylene fabric which has a built-in cord running the entire length of the top edge of the fabric. The fabric must meet the following minimum criteria:

1. Tensile Strength, ASTM D4632 90 lbs.,
2. Puncture Rating, ASTM D4833 60 lbs.,
3. Mullen Burst Rating, ASTM D3786 200 psi,
4. Apparent Opening Size, U.S. Sieve No. 40
5. Silt fence shall be "Enviro Fence" preassembled silt fence, AMXCO Silt Stop prefabricated silt fence, AMOCO Style 2155 preassembled silt fence or approved equal.

C. SILT FENCE POSTS: A minimum 2" x 2" (nominal) x 54" pressure treated wood posts of Number 2 Grade southern yellow pine or approved equal.

D. SAND BAG: Sand bag material shall be polypropylene, polyethylene, polyamide or cotton burlap woven fabric, minimum unit weight four (4) ounces per square yard, mullen burst strength exceeding 300 psi and ultraviolet stability exceeding 70%. Length shall be 24 to 30 inches, width shall be 16 to 18 inches and thickness shall be six (6) to eight (8) inches and having an approximate weight of 40 pounds. Sand bags shall be filled with coarse grade sand, free from deleterious material. All sand shall pass through a No. 10 sieve.

E. P.V.C. PIPE: Pipe shall be SDR-35 polyvinyl chloride having a minimum nominal internal diameter of 4". Pipes shall be sized for anticipated flows.

F. SOIL RETENTION BLANKET: Soil retention blankets shall consist of a geocomposite of excelsior or fiber blanket with an extruded plastic net attached to the tope side. The plastic net shall be photodegradable, and the excelsior or fiber blanket shall be made smolder resistant without the use of chemicals. Soil retention blankets shall be high velocity type to resist severe runoff. The soil retention blanket shall be one (1) of the following classes and types:

1. Class 1. "Slope Protection"
   a. Type A. Slopes of 3:1 or flatter - Clay soils
   b. Type B. Slopes of 3:1 or flatter - Sandy soils
   c. Type C. Slopes steeper than 3:1 - Clay soils
   d. Type D. Slopes steeper than 3:1 - Sandy soils
2. Class 2. "Flexible Channel Liner"
   a. Type E. Short-term duration (Up to 2 Years)
      1) Shear Stress (tD)< 1.0 lb./sq. ft.
   b. Type F. Short-term duration (Up to 2 Years)
      1) Shear Stress (td) 1.0 to 2.0 lb./sq. ft.
   c. Type G. Long-term duration (Longer than 2 Years)
      1) Shear Stress (td) > 2.0 to < 5.0 lb./sq. ft.
   d. Type H. Long-term duration (Longer than 2 Years)
      1) Shear Stress (td) greater than 0 Equal to 5.0 lb./sq. ft.

The Contractor has the option of selecting an approved soil retention blanket provided that selection conforms to the following list of approved soil retention blankets for slope protection applications:

3. CLASS I. SLOPE PROTECTION
   a. TYPE A: Slopes of 3:1 or Flatter-Clay Soils
      1) Airtrol® ANTI-WASH®/GEOJUTE® (Regular)

2) Contech Standards®
3) Contech Standards Plus®
4) Green Triangle Regular®
5) Green Triangle Superior®
6) GREENSTREAK® PEC MAT
7) Curlex®
8) North American Green® S150
9) North American Green® S75
10) North American Green® SC150
11) POLYJUTEÔ 407/GT
12) SOIL SAVER®
13) TerraJute®
14) Verdyol® ERO-MAT®
15) Xcel Regular®
16) Xcel Superior®

b. TYPE B: Slopes of 3:1 or Flatter-Sandy Soils
1) Contech Standards®
2) Contech Standards Plus®
3) GEOCOIR®/DEKOWE® 700
4) Green Triangle Superior®
5) Green Triangle Regular®
6) North American Green® S75
7) North American Green® SC150
8) North American Green® S150
9) POLYJUTEÔ 407/GT
10) TerraJute®
11) Verdyol® ERO-MAT®
12) Xcel Superior®
13) Xcel Regular®

c. TYPE C: Slopes Steeper than 3:1-Clay Soils
1) Airtrol®
2) ANTI-WASH®/GEOJUTE® (Regular)
3) Contech Standards Plus®
4) Curlex®
5) Green Triangle Superior®
6) GREENSTREAK® PEC-MAT
7) North American Green® SC150
8) North American Green® S150
9) POLYJUTEÔ 407/GT
10) SOIL SAVER®
11) TerraJute®
12) Xcel Superior®

d. TYPE D: Slopes Steeper than 3:1-Sandy Soils
1) Contech Standards Plus®
2) GEOCOIR®/DEKOWE® 700
3) Green Triangle Superior®
4) North American Green® S150
5) North American Green® SC150
6) POLYJUTEÔ 407GT
7) TerraJute®
8) Xcel Superior®

4. CLASS II: FLEXIBLE CHANNEL LINER PROTECTION

PART 3 - EXECUTION

3.01 INSTALLATION

A. TEMPORARY STRAW BALE DIKE

1. Straw bales shall be embedded a minimum of 4" and securely anchored using 2" x 2" wood stakes driven through the bales into the ground a minimum of 6". Straw bales are to be placed directly adjacent to one another leaving no gap between them.
2. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale. Additional bales shall be placed behind the first row where the bales abut each other. The additional bale is used to prevent unfiltered runoff from escaping between the bales.
3. The excavated soil shall be backfilled against the barrier. Backfill shall conform to ground level on the downhill side and shall be built up to 4" above ground level on the uphill side. Loose straw shall be scattered over the area immediately uphill from a straw barrier.

B. SILT FENCE

1. The purpose of a silt fence is to intercept and detain water-borne sediment from unprotected areas to a limited extent. The Contractor shall excavate a 6" by 6" trench for site fence bedding along the lower perimeters of the site where necessary to prevent sediment from entering any drainage system. The Contractor shall install the silt fence in accordance with the manufacturer's recommendations and instructions. Silt fence is used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. This fence shall remain in place until the disturbed area is permanently stabilized. Silt fence should not be used where there is a concentration of water in a channel or drainage way or where soil conditions prevent a minimum toe-in depth of 6" or installation of support post to depth of 12". Fabric shall overlap at abutting ends a minimum of 3' and shall be jointed such that no leakage or bypass occurs. If concentrated flow occurs after installation, corrective action must be taken such as placing rock berm in the areas of concentrated flow.

C. SAND BAG BERM

1. The purpose of a sandbag berm is to intercept sediment-laden water from disturbed areas such as construction in steam beds, create a retention pond, detain sediment and release water in sheet flow.
2. A temporary sand bag berm shall be installed across a channel or right of way in a developing or disturbed area and should be used when the contributing drainage area is greater than 5 acres. The berm shall be a minimum height of 18", measured from the top of the existing ground at the upslope toe to the top of the berm. The berm shall be sized to have a minimum width of 48" measured at the bottom of the berm and 18" measured at the top of the berm.
3. The sand bag berm shall be inspected after each rain. The sand bags shall be reshaped or replaced as needed during inspection. Additional inspections shall be made daily by the responsible party and when the silt reaches 6", the accumulated silt shall be removed and disposed of at an approved site in a manner that will not contribute to additional siltation. The sand bag berm shall be left in place until all upstream areas are stabilized and accumulated silt removed; removal must be done by hand.

D. SOIL RETENTION BLANKETS

1. A soil retention blanket (SRB) is a geotextile or biodegradable fabric placed over disturbed areas to limit the effects of erosion due to rainfall impact and runoff across barren soil. Soil retention blankets are manufactured by a wide variety of vendors addressing a wide variety of conditions such as vegetation establishment and high velocity flow. Blankets are used in areas which are difficult to stabilize such as steep slopes, drainage swales or high pedestrian traffic areas.

2. The soil retention blanket, whether installed as slope protection or as flexible channel liner, shall be placed within 24 hours after seeding or sodding operations have been completed, or as approved by the Engineer. Prior to placing the blanket, the area to be covered shall be relatively free of all rocks or clods over 1-1/2" in maximum dimension and all sticks or other foreign material which will prevent the close contact of the blanket with the soil. The area shall be smooth and free of ruts and other depressions. If as a result of rain, the prepared bed becomes crusted or eroded or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's expense.
3. Installation and anchorage of the soil retention blanket shall be in accordance with the manufacturer's recommendations.

E. PROTECTION OF BARE AREAS
1. Apply seeding and soil retention blanket to bare areas including new embankment areas, fills, stripped areas, graded areas or otherwise disturbed areas, which have a grade greater than 5% or which will be exposed for more than 30 days.
2. Bare working areas on which it is not practical or desirable to install seeding and soil retention blankets, as determined by the Engineer, such as areas under proposed building slabs, shall be temporarily sloped to drain at a minimum of 0.2% and a maximum of 5% grade. These areas shall then be "trackwalked" with a crawler dozer traveling up and down the slope to form the effect of small "terraces" with the tracks of the dozer. Apply a minimum of three (3) coverages to each area with the dozer tracks.
3. Route runoff from the areas through the appropriate silt fence system.
4. Protect earth spoil areas by "trackwalking" and silt fences.

F. INTERCEPTOR SWALE
1. Interceptor swales may have a v-shape or be trapezoidal with a flat bottom and side slopes of 3:1 or flatter. These are used to shorten the length of exposed slope by intercepting runoff and can also serve as perimeter swales preventing off-site runoff from entering the disturbed area or prevent sediment-laden runoff from leaving the construction site or disturbed area. The outflow from a swale must be directed to a stabilized outlet or sediment trapping device. The swales should remain in place until the disturbed area is permanently stabilized.
2. Stone Stabilization shall be used when grades exceed 2% or velocities exceed 6' per second and shall consist of a layer of crushed stone 3" thick, or flexible channel liner soil retention blankets. Stabilization shall extend across the bottom of the swale and up both sides of the channel to minimum height of 3" above the design water surface elevation based on a two year storm.
3. Interceptor swale shall be installed across exposed slopes during construction and should intercept no more than five (5) acres of runoff. Swales shall have a minimum bottom width of 2'-0" and a maximum depth of 1'-6" with side slopes of 3:1 or flatter. Swale must have positive drainage for its entire length to an outlet. When the slope exceeds 3%, or velocities exceed 4' per second (regardless of slope), stone stabilization is required. Check dams are also recommended to reduce velocities in the swales possibly reducing the amount of stabilization necessary. Swales should be inspected on a weekly basis during wet weather and repairs should be made promptly to maintain a consistent cross section.
4. All trees, brush, stumps, obstructions and other material shall be removed and disposed of so as not to interfere with the proper functioning of the swale.
5. The swale shall be excavated or shaped to line, grade, and cross-section as required to meet criteria specified herein and be free of bank projections or other irregularities which will impede normal flow.
6. All earth removed and not needed in construction shall be disposed of in an approved spoils site so that it will be conveyed to a sediment trapping device.
7. Diverted runoff from a disturbed or exposed upland area shall be conveyed to a sediment trapping device.

8. The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet.
9. Minimum compaction for the swale shall be 90% standard proctor.

G. LOCATION OF EROSION AND SEDIMENT CONTROL STRUCTURES

1. Locate erosion and sediment control structures as required to prevent erosion and removal of sediment from the project site. Silt fences shall be required for disturbed areas and soil stockpiles/spoil areas. Each silt fence installation shall have a minimum net length (exclusive of embedments into diversion dikes or other ineffective areas) of 25'. The runoff from a maximum of one (1) acre of disturbed area or soil stockpile/ spoil area shall be routed through any individual silt fence installation.
2. Install diversion dikes to divert runoff to the silt fence installation.
3. Install silt traps at the inlet (upstream) end of the drainage structures, including open channels, through which runoff from disturbed areas or soil stockpiles/spoil areas may drain.
4. Provide an overall erosion and sediment control system which protects disturbed areas and soil stockpiles/spoil areas. The system shall be modified by the Contractor from time to time to effectively control erosion and sediment during construction.

3.02 MAINTENANCE

A. Maintain erosion and sediment control structures and procedures in full working order at all times during construction. This shall include any necessary repair or replacement of items which have become damaged or ineffective. Remove sediment on a regular basis which accumulates in sediment control devices and place the material in approved earth spoil areas or return the material to the area from which it eroded.

B. Upon completion of construction, properly remove the temporary erosion and sediment control structures and complete the area as indicated.

C. Soil retention blankets will not require removal if installed on a finished graded area specified to receive seeding.

3.03 FIELD QUALITY CONTROL

A. In the event of conflict between the requirements and storm water pollution control laws, rules or regulations or other Federal, State or Local agencies, the more restrictive laws, rules or regulations shall apply.

END OF SECTION

SECTION 321216
DENSE-GRADED HOT-MIX ASPHALT (METHOD)

PART 1 GENERAL

1.01 DESCRIPTION:

A. Construct a pavement layer composed of a compacted, dense-graded mixture of aggregate and asphalt binder mixed hot in a mixing plant.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of all material sources. Notify the Engineer before changing any material source or formulation. When the Contractor makes a source or formulation change, the Engineer will verify that the requirements of this Item are met and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify compliance.

B. Aggregate. Furnish aggregates from sources that conform to the requirements shown in Table 1, and as specified in this Section, unless otherwise shown on the plans. Provide aggregate stockpiles that meet the definition in this Section for either coarse aggregate or fine aggregate. When reclaimed asphalt pavement (RAP) is allowed by plan note, provide RAP stockpiles in accordance with this Section. Aggregate from RAP is not required to meet Table 1 requirements unless otherwise shown on the plans. Supply mechanically crushed gravel or stone aggregates that meet the definitions in Tex-100-E. The Engineer will designate the plant or the quarry as the sampling location. Samples must be from materials produced for the project. The Engineer will establish the surface aggregate classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in Tex-200-F, Part II. Do not add material to an approved stockpile from sources that do not meet the aggregate quality requirements of the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) unless otherwise approved.

1. Coarse Aggregate. Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Provide aggregates from sources listed in the BRSQC. Provide aggregate from nonlisted sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the Engineer to sample, test, and report results for nonlisted sources.
   a. Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements apply only to aggregates used on the surface of travel lanes, unless otherwise shown on the plans. The SAC for sources on the Department's AQMP is listed in the BRSQC.
2. RAP. RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement. Crush or break RAP so that 100% of the particles pass the 2-in. sieve.
   a. RAP from either Contractor- or Department-owned sources, including RAP generated during the project, is permitted only when shown on the plans. Department-owned RAP, if allowed for use, will be available at the location shown on the plans. When RAP is used, determine asphalt content and gradation for mixture design purposes. Perform other tests on RAP when shown on the plans.
   b. When RAP is allowed by plan note, use no more than 30% RAP in Type A or B mixtures unless otherwise shown on the plans. For all other mixtures, use no more than 20% RAP unless otherwise shown on the plans.
   c. Do not use RAP contaminated with dirt or other objectionable materials. Do not use the RAP if the decantation value exceeds 5% and the plasticity index is greater than

8. Test the stockpiled RAP for decantation in accordance with the laboratory method given in Tex-406-A, Part I. Determine the plasticity index using Tex-106-E if the decantation value exceeds 5%. The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction.

d. Do not intermingle Contractor-owned RAP stockpiles with Department-owned RAP stockpiles. Remove unused Contractor-owned RAP material from the project site upon completion of the project. Return unused Department-owned RAP to the designated stockpile location.

3. Fine Aggregate. Fine aggregates consist of manufactured sands, screenings, and field sands. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with Tex-408-A to verify the material is free from organic impurities. At most 15% of the total aggregate may be field sand or other uncrushed fine aggregate. With the exception of field sand, use fine aggregate from coarse aggregate sources that meet the requirements shown in Table 1, unless otherwise approved. If 10% or more of the stockpile is retained on the No. 4 sieve, test the stockpile and verify that it meets the requirements in Table 1 for coarse aggregate angularity (Tex-460-A) and flat and elongated particles (Tex-280-F).

Table 1

Aggregate Quality Requirements

Property	Test Method	Requirement
Coarse Aggregate		
SAC	AQMP	As shown on plans
Deleterious material, %, max	Tex-217-F, Part 1	1.5
Decantation, %, max	Tex-217-F, Part II	1.5
Micro-Deval abrasion, %, max	Tex-461-A	Note 1
Los Angeles abrasion, %, max	Tex-410-A	40
Magnesium sulfate soundess, 5 cylces, %, max	Tex-411-A	30[2]
Coarse aggregate angularity, 2 crushed faces, %, min	Tex-460-A, Part I	85[3]
Flat and elongated particles @ 5:1, %, max	Tex-280-F	10
Fine Aggregate		
Linear shrinkage, %, max	Tex-107-E	3
Combined Aggregate		
Sand equivalent, %, min	Tex-203-F	45

1. Not used for aceptance purposes. Used by the Engineer as an indicator of the need for further investigation.

2. Unless otherwise shown on the plans.

3. Unless otherwise shown on the plans. Only applies to crushed gravel.

4. Aggregates, without mineral filler, RAP, or additives, combined as used in the job-mix formula (JMF).

Table 2

Gradation Requirements for Fine Aggregate

Sieve Size	% Passing by Weight or Volume
3/8"	100
#8	70-100
#200	0-30

C. Mineral Filler. Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, cement, or fly ash. Mineral filler is allowed unless otherwise shown

on the plans. Do not use more than 2% hydrated lime or cement, unless otherwise shown on the plans. The plans may require or disallow specific mineral fillers. When used, provide mineral filler that:

1. is sufficiently dry, free-flowing, and free from clumps and foreign matter;
2. does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
3. meets the gradation requirements in Table 3:

Table 3	
Gradation Requirements for Mineral Filler	
Sieve Size	**% Passing by Weight or Volume**
#8	100
#200	55-100

D. Baghouse Fines. Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.

E. Asphalt Binder. Furnish the type and grade of performance-graded (PG) asphalt binder specified on the plans in accordance with Section 300.2.J, “Performance-Graded Binders.”

F. Tack Coat. Unless otherwise shown on the plans or approved, furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, “Asphalts, Oils, and Emulsions.” Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use. If required, verify that emulsified asphalt proposed for use meets the minimum residual asphalt percentage specified in Item 300, “Asphalts, Oils, and Emulsions.” The Engineer will obtain at least 1 sample of the tack coat binder per project and test it to verify compliance with Item 300. The Engineer will obtain the sample from the asphalt distributor immediately before use.

G. Additives. When shown on the plans, use the type and rate of additive specified. Other additives that facilitate mixing or improve the quality of the mixture may be allowed when approved. If lime or a liquid antistripping agent is used, add in accordance with Item 301, “Asphalt Antistripping Agents.” Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime back into the drum.

2.02 EQUIPMENT

A. Provide required or necessary equipment in accordance with Item 320, “Equipment for Asphalt Concrete Pavement.”

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Design, produce, store, transport, place, and compact the specified paving mixture in accordance with the requirements of this Item. Unless otherwise shown on the plans, provide the mix design. The Department will perform quality assurance (QA) testing. Provide quality control (QC) testing as needed to meet the requirements of this Item.

B. Mixture Design:

1. Design Requirements. Use a Level II specialist certified by a Department-approved hot-mix asphalt certification program to develop the mixture design. Have the Level II specialist sign the design documents. Unless otherwise shown on the plans, use the typical weight design example given in Tex-204-F, Part I, to design a mixture meeting the requirements listed in Tables 1 through 6. Use an approved laboratory to perform the Hamburg Wheel test and provide results with the mixture design, or provide the laboratory mixture and request that the Department perform the Hamburg Wheel test. The Construction Division maintains a list of approved laboratories. Furnish the Engineer with representative samples of all materials used in the mixture design. The Engineer will verify the mixture design. If the design cannot be verified by the Engineer, furnish another mixture design. The Contractor may submit a new mixture design at any time during the project. The Engineer will approve all mixture designs before the Contractor can begin

production. Provide the Engineer with a mixture design report using Department-provided software. Include the following items in the report:

a. the combined aggregate gradation, source, specific gravity, and percent of each material used;
b. results of all applicable tests;
c. the mixing and molding temperatures;
d. the signature of the Level II person or persons who performed the design;
e. the date the mixture design was performed; and
f. a unique identification number for the mixture design.

Table 4

Master Gradation Bands (% Passing by Weight or Volume) and Volumetric Properties

Sieve Size	A Coarse Base	B Fine Base	C Coarse Surface	D Fine Surface	E Fine Mixture
1-1/2"	98.0-100.0	-	-	-	-
1"	78.0-94.0	98.0-100.0	-	-	-
3/4"	64.0-85.0	84.0-98.0	95.0-100.0	-	-
1/2"	50.0-70.0	-	-	98.0-100.0	-
3/8"	-	60.0-80.0	70.0-85.0	85.0-100.0	98.0-100.0
#4	30.0-50.0	40.0-60.0	43.0-63.0	50.0-70.0	80.0-86.0
#8	22.0-36.0	29.0-43.0	32.0-44.0	35.0-46.0	38.0-48.0
#30	8.0-23.0	13.0-28.0	14.0-28.0	15.0-29.0	12.0-27.0
#50	3.0-19.0	6.0-20.0	7.0-21.0	7.0-20.0	6.0-19.0
#200	2.0-7.0	2.0-7.0	2.0-7.0	2.0-7.0	2.0-7.0
Design VMA[1], % Minimum					
-	12.0	13.0	14.0	15.0	16.0
Plant-Produced VMA, % Minimum					
-	11.0	12.0	13.0	14.0	15.0

1) Voids in Mineral Aggregates.

Table 5

Laboratory Mixture Design Properties

Property	Test Method	Requirement
Target laboratory-molded density, %	Tex-207-F	96.0[1]
Tensile strength (dry), psi (mlded to 93% ±1% density	Tex-226-F	85-200 [2]
Boil test [3]	Tex-530-C	-

2) Unless otherwise shown on the plans.
3) May exceed 200 psi when approved and may be waived when approved.
4) Used to establish baseline for comparison to production results. May be waived when approved.

Table 6

Hamburg Wheet Test Requirements [1]

High-TemperatureBinder Grade	Minimum # of Passes[2] @ .05" Rut Depth, Tested @ 122ºF
PG 64 or lower	10,000
PG 70	15,000

PG 76 or higher	20,000

1) Tested in accordance with Tex-242-F
2) May be decreased or waived when shown on the plans.

C. Job-Mix Formula Approval. The job-mix formula (JMF) is the combined aggregate gradation and target asphalt percentage used to establish target values for mixture production. JMF is the original laboratory mixture design used to produce the trial batch. The Engineer and the Contractor will verify JMF based on plant-produced mixture from the trial batch unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF. If the JMF is not verified by the Engineer from the trial batch, adjust the JMF or redesign the mix and produce as many trial batches as necessary to verify the JMF.

1. Provide the Engineer with split samples of the mixtures and blank samples used to determine the ignition oven correction factors. The Engineer will determine the aggregate and asphalt correction factors from the ignition oven using Tex-236-F.
2. The Engineer will use a Texas gyratory compactor calibrated in accordance with Tex-914-F in molding production samples.
3. The Engineer will perform Tex-530-C and retain the tested sample for comparison purposes during production. The Engineer may waive the requirement for the boil test.

D. JMF Field Adjustments. Produce a mixture of uniform composition closely conforming to the approved JMF.

1. If, during initial days of production, the Contractor or Engineer determines that adjustments to the JMF are necessary to achieve the specified requirements, or to more nearly match the aggregate production, the Engineer may allow adjustment of the JMF within the tolerances of Table 7 without a laboratory redesign of the mixture.
2. The Engineer will adjust the asphalt content to maintain desirable laboratory density near the optimum value while achieving other mix requirements.

Table 7

Operational Tolerances

Description	Test Method	Allowable Difference from JMF Target
Individual % retained for #8 sieve and larger	Tex-200-F or Tex-236-F	±5.0[1]
Individual % retained for sieves smaller than #8 and larger than #200		±3.0[1]
% passing the #200 sieve		±2.0[1]
Asphalt content, %	Tex-236-F	±0.3[1]
Laboratory-molded density, %	Tex-207-F	±1.0
VMA, %, min		Note 2

1) When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the percent passing the #200 sieve will be considered out of tolerance when outside the master grading limits.
2) Test and verify that Table 4 requirements are met.

E. Production Operations. Perform a new trial batch when the plant or plant location is changed. The Engineer may suspend production for noncompliance with this Item. Take corrective action and obtain approval to proceed after any production suspension for noncompliance.

1. Operational Tolerances. During production, do not exceed the operational tolerances in Table 7. Stop production if testing indicates tolerances are exceeded on:
   a. 3 consecutive tests on any individual sieve,
   b. 4 consecutive tests on any of the sieves, or
   c. 2 consecutive tests on asphalt content.

1) Begin production only when test results or other information indicate, to the satisfaction of the Engineer, that the next mixture produced will be within Table 7 tolerances.

2. Storage and Heating of Materials. Do not heat the asphalt binder above the temperatures specified in Item 300, “Asphalts, Oils, and Emulsions” or outside the manufacturer’s recommended values. On a daily basis, provide the Engineer with the records of asphalt binder and hot-mix asphalt discharge temperatures in accordance with Item 320, “Equipment for Asphalt Concrete Pavement.” Unless otherwise approved, do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr.
3. Mixing and Discharge of Materials. Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F. The Department will not pay for or allow placement of any mixture produced at more than 350°F. Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant.

F. Hauling Operations. Before use, clean all truck beds to ensure mixture is not contaminated. When a release agent is necessary to coat truck beds, use a release agent on the approved list maintained by the Construction Division.

G. Placement Operations. Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot mix by at least 6 in. Place mixture so longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly. Place mixture within the compacted lift thickness shown in Table 8, unless otherwise shown on the plans or allowed.

Table 8

Compacted Lift Thickness and Required Core Height

Mixture Type	Compacted Lift Thickness	
	Minimum (in.)	Maximum (in.)
A	3.00	6.00
B	2.50	5.00
C	2.00	4.00
D	1.50	3.00
F	1.25	2.50

1. Weather Conditions. Place mixture when the roadway surface temperature is 60°F or higher unless otherwise approved. Measure the roadway surface temperature with a handheld infrared thermometer. Unless otherwise shown on the plans, place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.
2. Tack Coat. Clean the surface before placing the tack coat. Unless otherwise approved, apply tack coat uniformly at the rate directed by the Engineer. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a thin, uniform tack coat to all contact surfaces of curbs, structures, and all joints. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Roll the tack coat with a pneumatic-tire roller when directed. The Engineer may use Tex-243-F to verify that the tack coat has adequate adhesive properties. The Engineer may suspend paving operations until there is adequate adhesion.

H. Lay-Down Operations
1. Minimum Mixture Placement Temperatures. Use Table 9 for suggested minimum mixture placement temperatures.

2. Windrow Operations. When hot mix is placed in windrows, operate windrow pickup equipment so that substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

Table 9	
Suggested Minimum Mixture Placement Temperature	
High-TemperatureBinder Grade	**Minimum Placement Temperature (Before Entering Paver)**
PG 64 or lower	260ºF
PG 70	270ºF
PG 76	280ºF
PG 82 or higher	290ºF

I. Compaction. Use air void control unless ordinary compaction control is specified on the plans. Avoid displacement of the mixture. If displacement occurs, correct to the satisfaction of the Engineer. Ensure pavement is fully compacted before allowing rollers to stand on the pavement. Unless otherwise directed, use only water or an approved release agent on rollers, tamps, and other compaction equipment. Keep diesel, gasoline, oil, grease, and other foreign matter off the mixture. Unless otherwise directed, operate vibratory rollers in static mode when not compacting, when changing directions, or when the plan depth of the pavement mat is less than 1-1/2 in. Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with the rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas. Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. When directed, sprinkle the finished mat with water or limewater to expedite opening the roadway to traffic.

1. Air Void Control. Compact dense-graded hot-mix asphalt to contain from 5% to 9% in-place air voids. Do not increase the asphalt content of the mixture to reduce pavement air voids.
   a. Rollers. Furnish the type, size, and number or rollers required for compaction, as approved. Use a pneumatic-tire roller to seal the surface, unless otherwise shown on the plans. Use additional rollers as required to remove any roller marks.
   b. Air Void Determination. Unless otherwise shown on the plans, obtain 2 roadway specimens at each location selected by the Engineer for in-place air void determination. The Engineer will measure air voids in accordance with Tex-207-F and Tex-227-F. Before drying to a constant weight, cores may be predried using a Corelok or similar vacuum device to remove excess moisture. The Engineer will use the average air void content of the 2 cores to calculate the in-place air voids at the selected location.
   c. Air Voids Out of Range. If the in-place air void content in the compacted mixture is below 5% or greater than 9%, change the production and placement operations to bring the in-place air void content within requirements. The Engineer may suspend production until the in-place air void content is brought to the required level, and may require a test section as described in Section 340.4.H.1.d, “Test Section.”
   d. Test Section. Construct a test section of 1 lane-width and at most 0.2 mi. in length to demonstrate that compaction to between 5% and 9% in-place air voids can be obtained. Continue this procedure until a test section with 5% to 9% in-place air voids can be produced. The Engineer will allow only 2 test sections per day. When a test section producing satisfactory in-place air void content is placed, resume full production.
2. Ordinary Compaction Control. Furnish the type, size, and number or rollers required for compaction, as approved. Furnish at least 1 medium pneumatic-tire roller (minimum 12-ton weight). Use the control strip method given in Tex-207-F, Part IV, to establish rolling patterns that achieve maximum compaction. Follow the selected rolling pattern unless changes that affect compaction occur in the mixture or placement conditions.

When such changes occur, establish a new rolling pattern. Compact the pavement to meet the requirements of the plans and specifications. When rolling with the 3-wheel, tandem or vibratory rollers, start by first rolling the joint with the adjacent pavement and then continue by rolling longitudinally at the sides. Proceed toward the center of the pavement, overlapping on successive trips by at least 1 ft., unless otherwise directed. Make alternate trips of the roller slightly different in length. On superelevated curves, begin rolling at the low side and progress toward the high side unless otherwise directed.

J. Irregularities. Immediately take corrective action if surface irregularities, including but not limited to segregation, rutting, raveling, flushing, fat spots, mat slippage, color, texture, roller marks, tears, gouges, streaks, or uncoated aggregate particles, are detected. The Engineer may suspend production or placement operations until the problem is corrected. At the expense of the Contractor and to the satisfaction of the Engineer, remove and replace any mixture that does not bond to the existing pavement or that has other surface irregularities identified above.

END OF SECTION

SECTION 321260
ASPHALTS, OILS AND EMULSIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide asphalt cements, cutback and emulsified asphalts, performance-graded asphalt binders, and other miscellaneous asphalt materials as specified on the plans.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide asphalt materials that meet the stated requirements when tested in accordance with the referenced Department, AASHTO, and ASTM test methods. Refer to the Material Inspection Guide (maintained by the Construction Division), Section 11. “Asphalt Inspection, Quality Control and Quality Assurance,” for sampling and testing requirements. Acronyms used in this Item are defined in Table 1.

Table 1

Acronyms

Test Procedure Designations	
Tex	Department
T or R	AASHTO
D	ASTM
Polymer Modifier Designations	
P	polymer-modified
SBR or L	styrene-butadiene rubber (latex)
SBS	styrene-butadiene-styrene block co-polymer
TR	tire rubber (from ambient temperature grinding of truck and passenger tires
AC	asphalt cement
AE	asphalt emulsion
AE-P	asphalt emulsion prime
A-R	asphalt-rubber
C	cationic
EAP&T	emulsified asphalt prime and tack
H-suffix	harder residue (lower penetration)
HF	high float
MC	medium-curing
MS	medium-setting
PCE	prime, cure, and erosion control
PG	performance grade
RC	rapid-curing
RS	rapid-setting
S-suffix	stockpile usage
SCM	special cutback material
SS	slow-setting

B. Asphalt Cement. Asphalt cement must be homogeneous, water-free, and nonfoaming when heated to 347°F, and must meet Table 2 requirements.

Table 2

Asphalt Cement

Property	Test	Viscosity Grade

	Procedure	AC-0.6		AC-1.5		AC-3		AC-5		AC-10	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity 140ºF, poise 275ºF, poise	T 202	40 0.4	80 -	100 0.7	200 -	250 1.1	350 -	400 1.4	600 -	800 1.9	1,200 -
Penetration, 77ºF, 100g 5 sec	T 49	350	-	250	-	210	-	135	-	85	-
Flash point, C.O.C., ºF	T 48	425	-	425	-	425	-	425	-	450	-
Solubility in trichloreothylene, %	T 44	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Spot test	Tex-509-C	Neg.		Neg.		Neg.		Neg.		Neg.	
Tests on residue from Thin-Film Oven Test: Viscosity, 140ºF, poise Ductility[1], 77ºF 5cm/min., cm	T 179 T 202 T 51	- 100	180 -	- 100	450 -	- 100	900 -	- 100	1,500 -	- 100	3,000 -

1. If AC-0.6 or AC-1.5 ductility at 77°F is less than 100 cm, material is acceptable if ductility at 60°F is more than 100 cm.

C. Polymer-Modified Asphalt Cement. Polymer-modified asphalt cement must be smooth and homogeneous, and comply with the requirements of Table 3. If requested, supply samples of the base asphalt cement and polymer additives.

Table 3

Polymer-Modified Asphalt Cement

Property	**Test Procedure**	**Polymer-Modified Viscosity Grade**							
		AC-5		**AC-10**		**AC-15P**		**AC-20-5TR**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Polymer		SBR		SBR		SBS		TR	
Polymer content, % (solids basis)	Tex-533-C	2.0	-	2.0	-	3.0	-	5.0	-
Dynamic shear, G*/sin d, 64°C,10 rad/s, kPa	T 315	-	-	-	-	-	-	1.0	-
Viscosity 140ºF, poise 275ºF, poise	T 202 T 202	700 -	- 7.0	1,300 -	- 8.0	1,500 -	- 8.0	2,000-	- 10.0
Penetration, 77°F, 100 g, 5 sec.	T 49	120	-	80	-	100	150	75	115
Ductility, 5cm/min., 39.2°F, cm	T 51	70	-	60	-	-	-	-	-
Elastic recovery, 50°F, %	T-539-C	-	-	-	-	55	-	55	-
Softening point, °F	T 53	-	-	-	-	-	-	120	-
Polymer separation, 48 hr	Tex-540-C	None		None		None		None	
Flash point, C.O.C., °F	T 48	425	-	425	-	425	-	425	-
Tests on residue from Thin-Film Oven Test: Retained penetration ratio, 77°F	T 179 T 49	-	-	-	-	0.60	1.00	0.60	1.00
Tests on residue from RTFOT aging and pressure aging: Creep stiffness	Tex-541-C and R 28								

S, -18°C, MPa	T 313	-	-	-	-	-	-	-	300
m-value, -18°C		-	-	-	-	-	-	0.300	-

D. Cutback Asphalt. Cutback asphalt must meet the requirements of Tables 4, 5, and 6 for the specified type and grade. If requested, supply samples of the base asphalt cement and polymer additives.

Table 4

Rapid-Curing Cutback Asphalt

Property	Test Procedure	Type-Grade					
		RC-250		RC-800		RC-3000	
		Min	Max	Min	Max	Min	Max
Kinematic viscosity, 140°F, cSt	T 201	250	400	800	1,600	3,000	6,000
Water, %	T 55	-	0.2	-	0.2	-	0.2
Flash point, T.O.C., °F	T 79	80	-	80	-	80	-
Distillation test:Distillate, percentage by volume of total distillate to 680°F	T 78						
to 437°F		40	75	35	70	20	55
to 500°F		65	90	55	85	45	75
to 600°F		85	-	80	-	70	-
Residue from distillation, vol %		70	-	75	-	82	-
Tests on distillation residue:							
Penetration, 100 g, 5 sec, 77°F	T49	80	120	80	120	80	120
Ductility, 5 cm/min., 77°F, cm	T51	100	-	100	-	100	-
Solubility in trichloroethylene, %	T44	99.0	-	99.0	-	99.0	-
Spot test	Tex-509-C	Neg.		Neg.		Neg.	

Table 5

Medium-Curing Cutback Asphalt

Property	Test Procedure	Type-Grade							
		MC-30		MC-250		MC-800		MC-3000	
		Min	Max	Min	Max	Min	Max	Min	Max
Kinematic viscosity, 140°F, cSt	T 201	30	60	250	500	800	1,600	3,000	6,000
Water, %	T 55	-	0.2	-	0.2	-	0.2	-	0.2
Flash point, T.O.C., °F	T 79	100	-	150	-	150	-	150	-
Distillation test:	T 78								
Distillate, percentage by volume of total distillate to 680°F									
to 437°F		-	25	-	10	-	-	-	-
to 500°F		40	70	15	55	-	35	-	15
to 600°F		75	93	60	87	45	80	15	75
Residue from distillation, volume %		50	-	67	-	75	-	80	-
Test on distillation residue:									
Penetration, 100 g, 5 sec., 77°F	T49	120	250	120	250	120	250	120	250
Ductility, 5 cm/min., 77°F, cm[1]	T51	100	-	100	-	100	-	100	-
Solubility in trichloroethylene, %	T44	99.0	-	99.0	-	99.0	-	99.0	-
Spot test	Tex-509-C	Neg,		Neg.		Neg.		Neg.	

Table 6

Special-Use Cutback Asphalt

Property	Test Procedure	Type–Grade					
		MC-2400L		SCM I		SCM II	
		Min	Max	Min	Max	Min	Max
Kinematic viscosity, 140°F, cSt	T 201	2,400	4,800	500	1,000	1,000	2,000
Water, %	T 55	-	0.2	-	0.2	-	0.2
Flash point, T.O.C., °F	T 79	150	-	175	-	175	-
Distillation test:	T 78						
Distillate, percentage by volume of total distillate to 680°F							
to 437°F		-	-	-	-	-	-
to 500°F		-	35	-	0.5	-	0.5
to 600°F		35	80	20	60	15	50
Residue from distillation, volume %		78	-	76	-	82	-
Tests on distillation residue:							
Polymer		SBR		-		-	
Polymer content, % (solids basis)	Tex-533-C	2.0	-	-	-	-	-
Penetration, 100 g, 5 sec., 77°F	T 49	150	300	180	-	180	-
Ductility, 5 cm/min., 39.2°F, cm	T 51	50	-	-	-	-	-
Solubility in trichloroethylene, %	T 44	99.0	-	99.0	-	99.0	-

E. Emulsified Asphalt. Emulsified asphalt must be homogeneous, not separate after thorough mixing, and meet the requirements for the specified type and grade in Tables 7, 8, 9, and 10.

Table 7

Emulsified Asphalt

Property	Test Procedure	Type-Grade									
		Rapid-Setting		Medium-Setting				Slow-Setting			
		HFRS-2		MS-2		AES-300		SS-1		SS-1H	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72										
77°F, sec		-	-	-	-	75	400	20	100	20	100
122°F, sec.		150	400	100	300	-	-	-	-	-	-
Sieve test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Miscibility	T 59	-		-		-		Pass		Pass	
Cement mixing, %	T 59	-	-	-	-	-	-	-	2.0	-	2.0
Coating ability and water resistance:	T 59										
dry aggregate/after spray		-		-		GoodFair		-		-	
wet aggregate/after spray		-		-		Fair/Fair		-		-	
Demulsibility, 35 ml of 0.02 N $CaCl_2$ %	T 59	50	-	-	30	-	-	-	-	-	-
Storage stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1
Freezing test, 3 cycles[1]	T 59	-		Pass		-		Pass		Pass	
Distillation test:	T 59										
Residue by distillation, % by wt.		65	-	65	-	65	-	60	-	60	-
Oil distillate,% by vol of emulsion		-	0.5	-	0.5	-	5	-	0.5	-	0.5
Tests on residue from distillation:											
Penetration, 77°F, 100 g, 5 sec.	T 49	100	140	120	160	300	-	120	160	70	100

Solubility in trichloroethylene, %	T 44	97.5	-	97.5		97.5	-	97.5	-	97.5	-
Ductility, 77°F, 5 cm/min., cm	T 51	100	-	100		100	-	100	-	80	-
Float test, 140°F, sec.	T 50	1200	-	-		-	-	-	-	-	-

1. Applies only when the Engineer designates material for winter use.

Table 8

Cationic Emulsified Asphalt

Property	Test Procedure	Type-Grade											
		Rapid-Setting				Medium-Setting				Slow-Setting			
		CRS-2		CRS-2H		CMS-2		CMS-2S		CSS-1		CSS-1H	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72												
77°F, sec		-	-	-	-	-	-	-	-	20	100	20	100
122°F, sec.		150	400	150	400	100	300	100	300	-	-	-	-
Sieve test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Cement mixing, %	T 59	-	-	-	-	-	-	-	-	-	2.0	-	2.0
Coating ability and water resistance:	T 59												
dry aggregate/after spray		-		-		-		-		-		-	
wet aggregate/after spray		-		-		-		-		-		-	
Demulsibility, 35 ml of 0.8% sodium dioctyl sulfosuccinate %	T 59	70	-	70	-	-	-	-	-	-	-	-	-
Storage stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1	-	1
Particle charge	T 59	Positive		Positive		Positive		Positive		Positive		Positive	
Distillation test:	T 59												
Residue bydistillation, % by wt.		65	-	65	-	65	-	65	-	60	-	60	-
Oil distillate, % by volume of emulsion		-	0.5	-	0.5	-	7	-	5	-	0.5	-	0.5
Tests on residuefrom distillation:													
Penetration, 77°F, 100 g, 5 sec.	T 49	120	160	70	110	120	200	300	-	120	160	70	110
Solubility in trichloroethylene, %	T 44	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-
Ductility, 77°F, 5 cm/min., cm	T 51	100	-	80	-	100	-	-	-	100	-	80	-

Table 9

Polymer-Modified Emulsified Asphalt

Property	Test Procedur	Type–Grade		
		Rapid-Setting	Medium-Setting	Slow-Setting

	e	RS-1P		HFRS-2P		AES-150P		AES-300P		AES-300S		SS-1P	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol 77°F, sec. 122°F, sec.	T 72	- 50	- 200	- 150	- 400	75 -	400 -	75 -	400 -	75 -	400 -	30 -	100 -
Sieve test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Miscibility	T 59	-		-		-		-		-		Pass	
Coating ability and water resistance: dry aggregate/ after spray wet aggregate/ after spray	T 59	- -		- -		Good/Fair Fair/Fair		Good/Fair Fair/Fair		Good/Fair Fair/Fair		- -	
Demulsibility, 35 ml of 0.02 N CaC1[2]%	T 59	60	-	50	-	-	-	-	-	-	-	-	-
Storage stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1	-	1
Breaking index, g	T-542-C	-	80	-	-	-	-	-	-	-	-	-	-
Distillation test:[1] Residue by distillation,% by wt. Oil distillate, % by volumeof emulsion	T 59	65 -	- 3	65 -	- 0.5	65 -	- 3	65 -	- 5	65 -	- 7	60 -	- 0.5
Tests on residue from distillation: Polymer content wt. %(solids basis)	Tex-533-C	-	-	3.0	-	-	-	-	-	-	-	3.0	-
Penetration, 77°F, 100 g, 5 sec.	T 49	225	300	90	140	150	300	300	-	300	-	100	140
Solubility intrichloroethylene ,%	T 44	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-
Viscosity, 140°F, poise	T 202	-	-	1500	-	-	-	-	-	-	-	1300	-
Float test, 140°F,sec.	T 50	-	-	1200	-	1200	-	1200	-	1200	-	-	-
Ductility[2], 39.2°F, 5 cm/min., cm	T 51	-	-	50	-	-	-	-	-	-	-	50	-
Elastic recovery[2], 50°F, %	Tex-539-C	55	-	55	-	-	-	-	-	-	-	-	-
Tests on RTFO curing of distillation residue Elastic recovery,	Tex-541-C Tex-539-C	-	-	-	-	50	-	50	-	30	-	-	-

50°F, %													

1. Exception to T 59: Bring the temperature on the lower thermometer slowly to 350°F ±10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 ±5 min. from the first application of heat.
2. HFRS-2P must meet one of either the ductility or elastic recovery requirements.

Table 10

Polymer-Modified Cationic Emulsified Asphalt

Property	**TestProcedure**	**Type-Grade**					
		Rapid-Setting				**Slow-Setting**	
		CRS-1P		**CRS-2P**		**CSS-1P**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**
Viscosity, Saybolt Furol							
77°F, sec.	T 72	-	-	-	-	20	100
122°F, sec.		50	150	150	400	-	-
Sieve test, %	T 59	-	0.1	-	0.1	-	0.1
Demulsibility, 35 ml of 0.8% sodium dioctyl sulfosuccinate, %	T 59	60	-	70	-	-	-
Storage stability, 1 day, %	T 59	-	1	-	1	-	1
Breaking index, g	Tex-542-C	-	80	-	-	-	-
Particle charge	T 59	Positive		Positive		Positive	
Distillation test:[1]							
Residue by distillation, % by weight	T 59	65	-	65	-	62	-
Oil distillate, % by volume of emulsion		-	3	-	0.5	-	0.5
Tests on residue from distillation:							
Polymer content, wt. % (solids basis)	Tex-533-C	-	-	3.0	-	3.0	-
Penetration, 77°F, 100 g, 5 sec.	T 49	225	300	90	150	55	90
Viscosity, 140°F, poise	T 202	-	-	1,300	-	-	-
Solubility in trichloroethylene, %	T 44	97.0	-	97.0	-	97.0	-
Softening point, °F	T 53	-	-	-	-	135	-
Ductility, 77°F, 5 cm/min., cm	T 51	-	-	-	-	70	-
Ductility[2] ,39.2°F, 5 cm/min., cm	T 51	-	-	50	-	-	-
Elastic recovery[2], 50°F, %	Tex-539-C	45	-	55	-	-	-

2. Exception to T 59: Bring the temperature on the lower thermometer slowly to 350°F ±0°F. Maintain at this temperature for 20 min. Complete total distillation in 60 ±5 min. from the first application of heat.
3. CRS-2P must meet one of either the ductility or elastic recovery requirements.

F. Specialty Emulsions. Specialty emulsions may be either asphalt-based or resin-based and must meet the requirements of Table 11

Table 11

Specialty Emulsions

Property	**Test Procedure**	**Type-Grade**					
		Medium-Setting				**Slow-Setting**	
		AE-P		**EAP&T**		**PCE[1]**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**

Viscosity, Saybolt Furol	T 72						
77ºF, sec.		-	-	-	-	10	100
122ºF, sec.		15	150	-	-	-	-
Sieve test, %	T 59	-	0.1	-	0.1	-	0.1
Miscibility[2]	T 59	-		pass		pass	
Demulsibility, 35 ml of 0.10 Na $CaCl_2$, %	T 59	-	70	-	-	-	-
Storage stability, 1 day, %	T 59	-	1	-	1	-	-
Particle size[5], % by volume 2.5 □m	Tex-238-F[3]	-	-	90	-	90	-
Asphalt emulsion distillation to 500°F followed by Cutback asphalt distillation of residue to 680ºF:	T 59 & T 78						
Residue after both distillations, % by wt.		4025	-	-	-	-	-
Total oil distillate from both distillations, % by volume of emulsion			40	-	-	-	-
Residue by distillation, % by wt.	T 59						
Residue by evaporation[4], % by wt.	T 59						
Tests on residue after all distillation(s):							
Viscosity, 140°F, poise	T 202	-	-	800	-	-	-
Kinematic viscosity5, 140ºF, cSt	T 201	-	-	-	-	100	350
. Flash point C.O.C., ºF	T 48	-	-	-	-	400	-
Solubility in trichloroethylene, %	T 44	97.550	-	-	-	-	-
Float test, 122ºF, sec.	T 50		200	-	-	-	-

1. Supply with each shipment of PCE:
   a. a copy of a lab report from an approved analytical lab, signed by a lab official, indicating the PCE formulation does not meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste;
   b. a certification from the producer that the formulation supplied does not differ from the one tested and that no listed RCRA hazardous wastes or PCBs have been mixed with the product; and
   c. a Material Safety Data Sheet.
2. Exception to T 59: In dilution, use 350 ml of distilled or deionized water and a 1,000-ml beaker.
3. Use Tex-238-F, beginning at “Particle Size Analysis by Laser Diffraction,” with distilled or deionized water as a medium and no dispersant, or use another approved method.
4. Exception to T 59: Leave sample in the oven until foaming ceases, then cool and weigh.
5. PCE must meet either the kinematic viscosity requirement or the particle size requirement.

G. Recycling Agent. Recycling agent and emulsified recycling agent must meet the requirements in Table 12. Additionally, recycling agent and residue from emulsified recycling agent, when added in the specified proportions to the recycled asphalt, must meet the properties specified on the plans.

Table 12

Recycling Agent and Emulsified Recycling Agent

Property	**Test Procedure**	**Recycling Agent**		**Emulsified Recycling Agent**	
		Min	Max	Min	Max
Viscosity, Saybolt Furol, 77°F, sec.	T 72	-	-	15	100
Sieve test, %	T 59	-	-	-	0.1
Miscibility[1]	T 59	-		No coagulation	
Residue by evaporation[2], % by wt.	T 59	-	-	60	-

Tests on recycling agent or residue from evaporation:					
Flash point, C.O.C., ºF	T 48	400	-	400	-
Kinematic viscosity,	T 201				
140°F, cSt		75	200	75	200
275°F, cSt		-	10.0	-	10.0

1. Exception to T 59: Use 0.02 N $CaC1_2$ solution in place of water.
2. Exception to T 59: Maintain sample at 300°F until foaming ceases, then cool and weigh.

H. Crumb Rubber Modifier. Crumb rubber modifier (CRM) consists of automobile and truck tires processed by ambient temperature grinding.

CRM must be:

1. free from contaminants including fabric, metal, and mineral and other nonrubber substances;
2. free-flowing; and
3. nonfoaming when added to hot asphalt binder.

When tested in accordance with Tex-200-F, Part I, using a 50-g sample, the rubber gradation must meet the requirements of the grades in Table 13.

Table 13

CRM Gradations

Sieve Size (% Passing)	Grade A		Grade B		Grade C		Grade D	Grade F
	Min	Max	Min	Max	Min	Max		
#8	100	-	-	-	-	-	As shown on the plans	As approved
#10	95	100	100	-	-	-		
#16	-	-	70	100	100	-		
#30	-	-	25	60	90	100		
#40	-	-	-	-	45	100		
#50	0	10	-	-	-	-		
#200	-	-	0	5	-	-		

I. Crack Sealer. Polymer modified asphalt-emulsion crack sealer must meet the requirements of Table 14. Rubber-asphalt crack sealer must meet the requirements of Table 15.

Table 14

Polymer-Modified Asphalt Emulsion Crack Sealer

Property	Test Procedure	Min	Max
Rotational viscosity, 77°F, cP	D 2196, Method A	10,000	25,000
Sieve test, %	T 59	-	0.1
Storage stability, 1 day, %	T 59	-	1
Evaporation Residue by evaporation, % by wt.	Tex-543-C	65	-
Tests on residue from evaporation:			
Penetration, 77°F, 100 g, 5 sec	T 49	35	75
Softening point, °F	T 53	140	-
Ductility, 39.2°F, 5 cm/min., cm	T 51	100	-

Table 15

Rubber-Asphalt Crack Sealer

Property	Test Procedure	Class A		Class B	
		Min	Max	Min	Max

CRM content, Grade A or B, % by wt.	Tex-544-C	22	26	-	-
CRM content, Grade B, % by wt.	Tex-544-C	-	-	13	17
Virgin rubber content[1], % by wt.		-	-	2	-
Flash point[2], COC, ºF	T 48	400	-	400	-
Penetration[3], 77ºF, 150g, 5 sec.	T 49	30	50	30	50
Penetration[3], 32ºF, 200g, 60 sec.	T 49	12	-	12	-
Softening point, ºF	T 53	-	-	170	-
Bond[4]	D5329	-		Pass	

1. Provide certification that the min. % virgin rubber was added.
2. Before passing the test flame over the cup, agitate the sealing compound with a 3/8- to 1/2-in. (9.5- to 12.7-mm) wide, square-end metal spatula in a manner so as to bring the material on the bottom of the cup to the surface, i.e., turn the material over. Start at one side of the thermometer, move around to the other, and then return to the starting point using 8 to 10 rapid circular strokes. Accomplish agitation in 3 to 4 sec. Pass the test flame over the cup immediately after stirring is completed.
3. Exception to T 49: Substitute the cone specified in ASTM D 217 for the penetration needle.
4. No crack in the crack sealing materials or break in the bond between the sealer and the mortar blocks over 1/4 in. deep for any specimen after completion of the test.

J. Asphalt-Rubber Binders. Asphalt-rubber (A-R) binders are mixtures of asphalt binder and CRM, which have been reacted at elevated temperatures. The A-R binders meet D 6114 and contain a minimum of 15% CRM by weight. Types I or II, containing CRM Grade C, are used for hot mixed aggregate mixtures. Types II or III, containing CRM Grade B, are used for surface treatment binder. Table 16 describes required binder properties.

Table 16

A-R Binders

Property	Test Procedure	Binder Type					
		Type I		Type II		Type III	
		Min	Max	Min	Max	Min	Max
Apparent viscosity, 347°F, cP	D 2196, Method A	1,500	5,000	1,500	5,000	1,500	5,000
Penetration, 77°F, 100 g, 5 sec.	T 49	25	75	25	75	50	100
Penetration, 39.2°F, 200 g, 60 sec.	T 49	10	-	15	-	25	-
Softening point, °F	T 53	135	-	130	-	125	-
Resilience, 77°F, %	D 5329	25	-	20	-	10	-
Flash point, C.O.C., °F	T 48	450	-	450	-	450	-
Tests on residue from Thin-Film Oven Test: Retained penetration ratio, 39.2°F, 200 g, 60 sec., % of original	T 179 T 49	75	-	75	-	75	-

K. Performance-Graded Binders. PG binders must be smooth and homogeneous, show no separation when tested in accordance with Tex-540-C, and meet Table 17 requirements.

Separation testing is not required if:

1. a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer,
2. the binder is blended on site in continuously agitated tanks, or
3. binder acceptance is based on field samples taken from an in-line sampling port at the hot mix plant after the addition of modifiers.

Table 17
Performance-Graded Binders

Property and Test Method	Performance Grade																	
	PG 58			PG 64				PG 70				PG 76				PG 82		
	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28
Average 7-day max pavement design temperature, °C[1]	< 58			< 64				< 70				< 76				< 82		
Min pavement design temperature, °C[1]	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28
ORIGINAL BINDER																		
Flash point, T 48, Min, °C	230																	
Viscosity, T 316:[2,3] Max, 3.0 Pa×s, test temperature °C	135																	
Dynamic shear, T 315:4 G*/sin(□□, Min, 1.00 kPaTest temperature @ 10 rad/sec., °C	58			64				70				76				82		
Elastic recovery, D 6084, 50°F, % Min	-	-	30	-	-	30	50	-	30	50	60	30	50	60	70	50	60	70
ROLLING THIN-FILM OVEN (Tex-541-C)																		
Mass loss, Tex-541-C, Max, %	1.0																	
Dynamic shear, T 315: G*/sin(□□, Min, 2.20 kPa Test temperature @10 rad/sec., °C	58			64				70				76				82		
PRESSURE AGING VESSEL (PAV) RESIDUE (R 28)																		
PAV aging temperature, °C	100																	
Dynamic shear, T 315: G*/sin(□□, Max, 5000 kPaTest temperature @ 210 rad/sec., °C Test temperature @ 210 rad/sec., °C	25	22	19	28	25	22	19	28	25	22	19	28	25	22	19	28	25	22
Creep stiffness, T 313:[5,6] S,max, 300 MPa *m*-value, min, 0.300 Test temperature @ 60 sec.,°C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18
Direct tension, T 314:[6]	-	-	-	-6	-	-	-	-6	-	-	-	-6	-	-	-	-6	-	-

Failure strain, min,1.0%	1	1	2	1	1	2	1	1	2	1	1	2	1	1
Test temperature @, 1.0 mm/min., °C	2	8	4	2	8	4	2	8	4	2	8	4	2	8

4. Pavement temperatures are estimated from air temperatures using an algorithm contained in a Department-supplied computer program, may be provided by the Department, or by following the procedures outlined in AASHTO MP 2 and PP28.
5. This requirement may be waived at the Department's discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed, and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).
6. Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.
7. For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of G*/sin(□) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).
8. Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.
9. If creep stiffness is below 300 MPa, direct tension test is not required. If creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement.The *m*-value requirement must be satisfied in both cases.

2.02 EQUIPMENT

A. Provide all equipment necessary to transport, store, sample, heat, apply, and incorporate asphalts, oils and emulsions.

PART 3 – EXECUTION

3.01 CONSTRUCTION

A. Typical Material Use. Table 18 shows typical materials used for specific applications, Theses are typical uses only. Circumstances may require use of other material.

Table 18

Typical Material Use

Material Application	Typically Used Materials
Hot-mixed, hot-laid asphalt mixtures	PG binders, A-R binders Types I and II
Surface treatment	AC-5, AC-10, AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-20-5TR, HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P, A-R binders Types II and III
Surface treatment (cool weather)	RS-1P, CRS-1P, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, MC-2400L
Precoating	AC-5, AC-10, PG 64-22, SS-1, SS-1H, CSS-1, CSS-1H
Tack coat	PG Binders, SS-1H, CSS-1H, EAP&T
Fog Seal	SS-1, SS-1H, CSS-1, CSS-1H
Hot-mixed, cold-laid asphalt mixtures	AC-0.6, AC-1.5, AC-3, AES-300, AES-300P, CMS-2, CMS-2S

Patching mix	MC-800, SCM I, SCM II, AES-300S
Recycling	AC-0.6, AC-1.5, AC-3, AES-150P, AES-300P, recycling agent, emulsified recycling agent
Crack sealing	SS-1P, polymer mod AE crack sealant, rubber asphalt crack sealers (Class A, Class B)
Microsurfacing	CSS-1P
Prime	MC-30, AE-P, EAP&T, PCE
Curing membrane	SS-1, SS-1H, CSS-1, CSS-1H, PCE
Erosion control	SS-1, SS-1H, CSS-1, CSS-1H, PCE

B. Storage and Application Temperatures. use storage and application temperatures in accordance with Table 19. Store and apply materials at the lowest temperature yielding satisfactory results. Follow the manufacturer's instructions for any agitation requirements in storage. Manufacturer's instructions regarding recommended application and storage temperatures supercede those of Table 19.

Table 19

Storage and Application Temperatures

Type–Grade	Application		Storage Maximum (°F)
	Recommended Range, °F	Maximum Allowable (°F)	
AC-0.6, AC-1.5, AC-3	200-300	350	350
AC-5, AC-10	275-350	350	350
AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-20-5TR	300-375	375	360
RC-250	125-180	200	200
RC-800	170-230	260	260
RC-3000	215-275	285	285
MC-30, AE-P	70-150	175	175
MC-250	125-210	240	240
MC-800, SCM I, SCM II	175-260	275	275
MC-3000,MC-2400L	225-275	290	290
HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P, CMS-2, CMS-2S, AES-300, AES-300S, AES-150P, AES-300P	120-160	180	180
SS-1, SS-1H, CSS-1, CSS-1H, PCE, EAP&T, SS-1P, RS-1P, CRS-1P, CSS-1P, recycling agent, emulsified recycling agent, polymer mod AE crack sealant	50-130	140	140
PG binders	275-350	350	350
Rubber asphalt crack sealers (Class A, Class B)	350-375	400	-
A-R binders Types I, II, and III	325-425	425	425

END OF SECTION

SECTION 321270
FLEXIBLE BASE

PART 1 GENERAL

1.01 DESCRIPTION

A. Construct a foundation course composed of flexible base.

PART 2 -PRODUCTS

2.01 MATERIALS

A. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed materials at any time before compaction throughout the duration of the project to assure specification compliance. Use Tex-100-E material definitions.

B. Aggregate. Furnish aggregate of the type and grade shown on the plans and conforming to the requirements of Table 1. Each source much meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified. Do not use additives such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1, unless shown on the plans.

Table 1
Material Requirements

Property	Test Method	Grade 1	Grade 2	Grade 3	Grade 4
Master gradation sieve size (% retained)	Tex-110-E				As shown on the plans
2-1/2 in.		-	0	0	
1-3/4 in.		0	0-10	0-10	
7/8 in.		10-35	-	-	
3/8 in.		30-50	-	-	
No. 4		45-65	45-75	45-75	
No. 40		70-85	60-85	50-85	
Liquid limit, % max.[1]	Tex-104-E	35	40	40	As shown on the plans
Plasticity index, max. [1]	Tex-106-E	10	12	12	As shown on the plans
Plasticity index, min. [1]		As shown on the plans			
Wet ball mill, % max.[1]	Tex-116-E	40	45	-	As shown on the plans
Wet ball mill, % max. increase passing the No. 40 sieve.		20	20	-	
Classification[3]	Tex-117-E	1.0	1.1-2.3	-	As shown on the plans
Min. compressive strength3, psi lateral pressure 0 psi lateral pressure 15 psi		45 175	35 175	- -	As shown on the plans

1) Determine plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
2) When a soundness value is required by the plans, test material in accordance with Tex-411-A.
3) Meet both the classification and the minimum compressive strength, unless otherwise shown on the plans.

1. Material Tolerances. The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation. When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4. The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.
2. Material Types. Do not use fillers or binders unless approved. Furnish the type specified on the plans in accordance with the following.
    a. Type A. Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.
    b. Type B. Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.
    c. Type C. Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I. Blending of 2 or more sources is allowed.
    d. Type D. Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete must meet the requirements in Section 247.2.A.3.b, “Recycled Material (Including Crushed Concrete) Requirements,” and be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.
    e. Type E. As shown on the plans.
3. Recycled Material. Recycled asphalt pavement (RAP) and other recycled materials may be used when shown on the plans. Request approval to blend 2 or more sources of recycled materials.
    a. Limits on Percentage. When RAP is allowed, do not exceed 20% RAP by weight unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans.
    b. Recycled Material (Including Crushed Concrete) Requirements.
        1) Contractor Furnished Recycled Materials. When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of Table 1 for the grade specified. Certify compliance with DMS-11000, “Evaluating and Using Nonhazardous Recyclable Materials Guidelines,” for Contractor furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5% deleterious material when tested in accordance with Tex-413-A. For RAP, do not exceed a maximum percent loss from decantation of 5.0% when tested in accordance with Tex-406-A. Test RAP without removing the asphalt.
        2) Department Furnished Required Recycled Materials. When the Department furnishes and requires the use of recycled materials, unless otherwise shown on the plans:
            (a) Department required recycled material will not be subject to the requirements in Table 1,
            (b) Contractor furnished materials are subject to the requirements in Table 1 and this Item,
            (c) the final product, blended, will be subject to the requirements in Table 1, and
            (d) for final product, unblended (100% Department furnished required recycled material), the liquid limit, plasticity index, wet ball mill, classification, and compressive strength is waived.
            (e) Crush Department-furnished RAP so that 100% passes the 2 in. sieve. The Contractor is responsible for uniformly blending to meet the percentage required.

3) Department Furnished and Allowed Recycled Materials. When the Department furnishes and allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of Table 1 and the plans.

c. Recycled Material Sources. Department-owned recycled material is available to the Contractor only when shown on the plans. Return unused Department-owned recycled materials to the Department stockpile location designated by the Engineer unless otherwise shown on the plans. The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Remove Contractor-owned recycled materials from the project and dispose of them in accordance with federal, state, and local regulations before project acceptance. Do not intermingle Contractor-owned recycled material with Department-owned recycled material unless approved by the Engineer.

C. Water. Furnish water free of industrial wastes and other objectionable matter.

D. Material Sources. When non-commercial sources are used, expose the vertical faces of all strata of material proposed for use. Secure and process the material by successive vertical cuts extending through all exposed strata, when directed.

2.02 EQUIPMENT

A. Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with Item 210, “Rolling.” Provide proof rollers in accordance with Item 216, “Proof Rolling,” when required.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

Stockpile base material temporarily at an approved location before delivery to the roadway. Build stockpiles in layers no greater than 2 ft. thick. Stockpiles must have a total height between 10 and 16 ft. unless otherwise shown on the plans. After construction and acceptance of the stockpile, loading from the stockpile for delivery is allowed. Load by making successive vertical cuts through the entire depth of the stockpile.

Do not add or remove material from temporary stockpiles that require sampling and testing before delivery unless otherwise approved. Charges for additional sampling and testing required as a result of adding or removing material will be deducted from the Contractor’s estimates.

Haul approved flexible base in clean trucks. Deliver the required quantity to each 100-ft. station or designated stockpile site as shown on the plans. Prepare stockpile sites as directed. When delivery is to the 100-ft. station, manipulate in accordance with the applicable Items.

B.

C. When new base is required to be mixed with existing base, deliver, place, and spread the new flexible base in the required amount per station. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

When shown on the plans or directed, proof roll the roadbed in accordance with Item 216, “Proof Rolling,” before pulverizing or scarifying. Correct soft spots as directed.

D. Compaction. Compact using density control unless otherwise shown on the plans. Multiple lifts are permitted when shown on the plans or approved. Bring each layer to the moisture content directed. When necessary, sprinkle the material in accordance with Item 204, “Sprinkling.”

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. On superelevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph as directed.

Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted. Continue work until specification requirements are met. Perform the work at no additional expense to the Department.

1. Ordinary Compaction. Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing approved material as required, reshaping, and recompacting.
2. Density Control. Compact to at least 100% of the maximum density determined by Tex-113-E unless otherwise shown on the plans. Determine the moisture content of the material at the beginning and during compaction in accordance with Tex-103-E.
   The Engineer will determine roadway density of completed sections in accordance with Tex-115-E. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.

E. Finishing. After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the plans or as directed.

   In areas where surfacing is to be placed, correct grade deviations greater than 1/4 in. in 16 ft. measured longitudinally or greater than 1/4 in. over the entire width of the cross-section. Correct by loosening, adding, or removing material. Reshape and recompact in accordance with Section 247.4.C, “Compaction.”

F. Curing. Cure the finished section until the moisture content is at least 2 percentage points below optimum or as directed before applying the next successive course or prime coat.

PART 2 PRODUCTS

END OF SECTION

SECTION 321280
PRIME COAT

PART 1 GENERAL

1.01 GENERAL DESCRIPTION

A. Prepare and treat existing or newly constructed surface with a bituminous material. Apply blotter material as required.

PART 2- PRODUCTS

2.01 MATERIALS

A. Bituminous: Use material of the type and grade shown on the plans in accordance with Item 300, “Asphalts, Oils, and Emulsions.”

B. Blotter: Unless otherwise shown on the plans or approved, use either base course sweepings obtained from cleaning the base or native sand as blotter materials.

2.02 EQUIPMENT

A. Provide applicable equipment in accordance with Article 316.3, “Equipment.”

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. General: Apply the mixture when the air temperature is 60°F and above, or above 50°F and rising. Measure the air temperature in the shade away from artificial heat. The Engineer will determine when weather conditions are suitable for application. Do not permit traffic, hauling, or placement of subsequent courses over freshly constructed prime coats. Maintain the primed surface until placement of subsequent courses or acceptance of the work.

B. Surface Preparation: Prepare the surface by sweeping or other approved methods. When directed, before applying bituminous material, lightly sprinkle the surface with water to control dust and ensure absorption.

C. Application:

1. Bituminous. The Engineer will select the application temperature within the limits recommended in Item 300, “Asphalts, Oils, and Emulsions.” Apply material within 15°F of the selected temperature. Distribute the material smoothly and evenly at the rate selected by the Engineer. When directed, roll the freshly applied prime coat with a pneumatic-tire roller to ensure penetration.
2. Blotter. Spread blotter material before allowing traffic to use a primed surface. When “Prime Coat and Blotter” is shown on the plans as a bid item, apply blotter material to primed surface at the rate shown in the plans or as directed. When “Prime Coat” is shown on the plans as a bid item, apply blotter to spot locations or as directed to accommodate traffic movement through the work area. Remove blotter material before placing the surface. Dispose of blotter material according to applicable state and federal requirements.

SECTION 321313
CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 THE GENERAL CONDITIONS, SPECIAL PROVISIONS AND APPLICABLE REQUIREMENTS OF DIVISION 1 – GENERAL REQUIREMENTS ARE HEREBY MADE A PART OF THIS SECTION.

1.02 SCOPE

A. This work consists of street pavement, sidewalk, curb and gutter or rip rap slope pavement composed of Portland Cement Concrete with or without reinforcement, constructed on subgrade or base courses prepared in accordance with these specifications and to the lines, grades, thicknesses and typical cross-sections shown on the plans. Reinforcement, when required, will be subsidiary to the specified Concrete Pavement.

1.03 SUBMITTALS SHALL BE IN ACCORDANCE WITH SECTION 01 33 00, SUBMITTALS, AND SHALL INCLUDE

A. Manufacturer's Literature: Descriptive data of installation methods and procedures.

B. Certificates: Manufacturer's certification that materials meet specification requirements.

PART 2 - PRODUCTS

2.01 JOINT FILLER AND SEALER

A. Joint sealants and expansion joint filler materials shall conform to "Item #433, JOINT SEALANTS & FILLERS" in the 1993 edition of TXDOT Standard Specifications for Construction of Highways, Streets and Bridges.

2.02 STEEL REINFORCEMENT

A. Reinforcing bars shall conform to the requirements of AASHTO M31 or M53, Grade 60. Fabricated bar mats may be used if they conform to the requirements of AASHTO M54.

2.03 DOWELS AND TIE BARS

A. Dowels and tie bars shall conform to the requirements of AASHTO M31 or M53, Grade 60 or Grade 40, as specified on the plans. Tie bars shall be deformed meeting the requirements of AASHTO M31 or M53. Dowel and tie bars may conform to the requirements of AASHTO M 42, except that rail steel shall not be used for tie bars that are to be bent or restraightened during construction. Dowel bars shall be plain round bars of the size specified and the ends shall be sawed. Before delivery to the construction site, a minimum of two-thirds of the length of each dowel bar shall be painted with one coat of lead or tar paint. Prior to placement of concrete, the dowels shall be coated with grease if specified on the plans.

2.04 WATER

A. Water used in mixing or curing shall be as clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product as possible. Water will be tested in accordance with the requirements of AASHTO Method T26. Water known to be of potable quality may be used without testing.

2.05 CURING MATERIALS SHALL CONFORM TO ONE OF THE FOLLOWING SPECIFICATIONS:

1. "Sheet Materials for Curing Concrete" shall conform to AASHTO M171.
2. "Burlap Cloth Made from Jute or Kenat" shall conform to AASHTO M182, Class 3.
3. "Liquid Membrane - Forming Compounds for Curing Concrete" shall conform to AASHTO M148, Type 2 (all-resin base), or Federal Specification TT-C-800, Type 2. Liquid Membrane shall be delivered and stored in bulk. Bulk storage shall be equipped with an agitator. All membranes shall be pigmented to allow visible inspection of coverage.

2.06 POZZOLANIC ADMIXTURE

A. The use of fly ash as a partial replacement for cement in pavement mix designs, at the rate specified in this paragraph will be allowed at the Contractor's option. Pozzolanic admixtures

shall be fly ash meeting the requirements of ASTM C-618; Type C except loss on ignition shall not exceed three (3) percent. When fly ash is used as a partial replacement for cement, the minimum cement content may be met by considering portland cement plus fly ash as the total cementitious component. The replacement rate should not exceed 15 percent.

PART 3 - EXECUTION

3.01 EQUIPMENT

A. Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity, and mechanical condition. The equipment shall be at the job site before the start of construction operations for examination and approval.

B. Batching Plant and Equipment.
   1. General. The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and coarse aggregate. If bulk cement is used, a bin, hopper, and a separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation.
   2. Bins and Hopper. Bins with adequate separate compartments for fine aggregate and coarse aggregate shall be provided in the batching plant. Each compartment shall discharge efficiently and freely into the weighing hopper. Means of control shall be provided so that, as the quantity desired in the weighing hopper is approached, the material may be added slowly and shut off with precision. A port or other opening for removing an overload of any one of the several materials from the hopper shall be provided. Weighing hoppers shall be constructed to eliminate accumulations of materials and to discharge fully.
   3. Scales. The scales for weighing aggregates and cement shall be of either the beam or the springless dial type. They shall be accurate within 0.5 percent throughout their range of use. When beam-type scales are used, provisions such as a "telltale" dial shall be made for indicating to the operator that the required load in the weighing hopper is being approached. A device on the weighing beams shall clearly indicate critical position. Poises shall be designed to be locked in any position and to prevent unauthorized change. The weight beam and "telltale" device shall be in full view of the operator while charging the hopper, and the operator shall have convenient access to all controls.
   4. Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy. The Contractor shall have on hand not less than ten 50-pound (23 kg) weights for testing of all scales when directed by the Engineer.

C. Mixers.
   1. General. Concrete may be mixed at a central plant, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.
      a. A device accurate within 3 percent and satisfactory to the Engineer shall be provided at the mixer for determining the amount of air-entraining agent or other admixture to be added to each batch requiring such admixtures.
      b. Mixers shall be examined daily for the accumulation of hard concrete or mortar and the wear of blades.
   2. Central Plant Mixer. Mixing shall be in an approved mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging the mixture without segregation. Central plant mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. The water system for a central mixer shall be either a calibrated measuring tank or a meter and shall not necessarily be an integral part of the mixer.
      a. The mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be

replaced when they have worn down 3/4-inch (19 mm) or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

3. Truck Mixers and Truck Agitators. Truck mixers used for mixing and hauling concrete and truck agitators used for hauling central-mixed concrete shall conform to the requirements of ASTM C94.

D. Finishing Equipment.

1. Finishing Machine. The finishing machine shall be equipped with one or more oscillating-type transverse screeds.
2. Vibrators. For side-form construction, vibrators may be either the surface pan type for pavements less than 8 inches (20 cm) thick or the internal type with either immersed tube or multiple spuds, for the full width of the concrete slab. They may be attached to the spreader or the finishing machine, or they may be mounted on a separate carriage. They shall not come in contact with the joint, load-transfer devices, subgrade, or side forms. The frequency of the surface vibrators shall not be less than 3,500 vibrations per minute, and the frequency of the internal type shall not be less than 7,000 vibrations per minute for spud vibrators. When spud-type internal vibrators are used adjacent to the side forms, they shall have a frequency of not less than 3,500 vibrations per minute. Hand vibrators should be used to consolidate the concrete along forms and other isolated areas.
3. For slip-form construction, the paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Vibration shall be accomplished by internal vibrators with a frequency range variable between 7,000 and 12,000 vibrations per minute. The amplitude of vibration shall be between 0.025 (0.6 mm) and 0.06 (1.5 mm) inches.
4. The number, spacing, frequency, and eccentric weights shall be provided as necessary to achieve an acceptable concrete density and finishing quality. Adequate power to operate all vibrators at the weight and frequency required for a satisfactory finish shall be available on the paver. The internal vibrators may be supplemented by vibrating screeds operating on the surface of the concrete. The frequency of surface vibrators shall not be less than 3,500 vibrations per minute. The Contractor shall furnish a tachometer or other suitable device for measuring the frequency of the vibrators. The vibrators and tamping elements shall be automatically controlled so that they shall be stopped as forward motion ceases. Any override switch shall be of the springloaded, momentary contact type.
5. For hand placed pavement the contractor shall consolidate concrete with the use of a hand held vibrator regardless of the type of strike off machinery used. Vibration shall be done to sufficiently remove air voids and consolidate concrete around reinforcing steel and side forms. VIBRATORS SHALL NOT BE USED TO DISTRIBUTE CONCRETE. The contractor shall limit disturbances of consolidated concrete during strike-off and finishing by using adequately sized floats and straight edges as approved by the Engineer. Vibrators, floats, and finishing tools to be on job site at all times during concrete placement.
6. Concrete Saw. When sawing of joints is specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. The Contractor shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be on the job both before and at all times during concrete placement.
7. Forms. Straight side forms shall be made of steel having a thickness of not less than 7/32 inch (6 mm) and shall be furnished in sections not less than 10 feet (3 m) in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete without horizontal joint, and a base width equal to the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of 100-foot (31 m) radius or less. Flexible or curved forms shall be of a design acceptable to the Engineer. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and

finishing equipment. Flange braces shall extend outward on the base not less than two-thirds the height of the form. Forms with battered top surfaces and bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used until inspected and approved. Built-up forms shall not be used, except as approved by the Engineer. The top face of the form shall not vary from a true plane more than 1/8 inch (3 mm) in 10 feet (3 m), and the upstanding leg shall not vary more than 1/4-inch (6 mm). The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting.

8. Slip-form Pavers. The paver shall be fully energized, self-propelled, and designed for the specific purpose of placing, consolidating, and finishing the concrete pavement, true to grade, tolerances, and cross section. It shall be of sufficient weight and power to construct the maximum specified concrete paving lane width as shown in the plans, at adequate forward speed, without transverse, longitudinal or vertical instability or without displacement. The paver shall be equipped with electronic or hydraulic horizontal and vertical control devices.

3.02 FORM SETTING

A. Forms shall be set sufficiently in advance of the concrete placement to insure continuous paving operation. After the forms have been set to correct grade, the grade shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than 3 pins for each 10-foot (3 m) section. A pin shall be placed at each side of every joint.

B. Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/4-inch (6 mm) at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of concrete.

C. The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

3.03 CONDITIONING OF UNDERLYING COURSE AND REINFORCING

A. The prepared grade shall be well moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from the concrete. Ruts or depressions in the subgrade or subbase caused by hauling or usage of other equipment shall be filled as they develop with suitable material (not with concrete or concrete aggregates) and thoroughly compacted by rolling. If damage occurs to a stabilized subbase, it shall be corrected full depth by the Contractor, or the damaged areas filled with concrete integral with the pavement. All excess material shall be removed. Low areas may be filled and compacted to a condition similar to that of the surrounding grade, or filled with concrete integral with the pavement. In cold weather, the underlying subbase shall be protected so that it will be entirely free from frost when the concrete is placed. The use of chemicals to eliminate frost in the underlying material will not be permitted. The work described under the foregoing paragraphs does not constitute a regular subgrading operation, but rather a final accurate check of the underlying course.

B. Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale, or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements and provided the rust or scale is not loose. Reinforcing bars shall be securely wired together at all intersections and splices and shall be securely wired to each dowel and load transmission unit intersected. All bars shall be installed in their required position as shown on the plans.

3.04 MIXING CONCRETE

A. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are emptied into the drum. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements of ASTM C94, except that the minimum required revolutions of the mixing speed for transit mixed concrete may be reduced to not less than that recommended by the mixer manufacturer. The number of revolutions recommended by the mixer manufacturer shall be indicated on the manufacturer's serial plate attached to the mixer.

B. When mixed at the work site or in a central mixing plant, the mixing time shall not be less than 50 seconds nor more than 90 seconds. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

C. The mixer shall be operated at the drum speed as shown on the manufacturer's nameplate on the approved mixer. Any concrete mixed less than the specified time shall be discarded at the Contractor's expense. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet (cubic meters), as shown on the manufacturer's standard rating plate on the mixer. An overload up to 10 percent above the mixer's nominal capacity may be permitted provided concrete test data for segregation and uniform consistency are satisfactory, and provided no spillage of concrete takes place. The batch shall be charged into the drum so that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform, and all water shall be in the drum by the end of the first 15 seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

D. Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or nonagitating trucks. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in nonagitating trucks, nor 60 minutes when the concrete is hauled in truck mixers or truck agitators. Retempering concrete by adding water or by other means will not be permitted, except when concrete is delivered in transit mixers. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, if permitted by the Engineer. All these operations must be performed within 45 minutes after the initial mixing operations and the water-cement ratio must not be exceeded. Admixtures for increasing the workability or for accelerating the set will be permitted only when specified for in the contract.

3.05 LIMITATIONS OF MIXING

A. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

B. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40 degrees F (4 degrees C) and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F (2 degrees C).

C. When concreting is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials. Unless otherwise authorized, the temperature of the mixed concrete shall not be less than 50 degrees F (10 degrees C) at the time of placement in the forms.

D. If the air temperature is 35 degrees F (2 degrees C) or less at the time of placing concrete, the Engineer may require the water and/or the aggregates to be heated to not less than 70 degrees F (21 degrees C) nor more than 150 degrees F (66 degrees C). Concrete shall not be placed on frozen subgrade nor shall frozen aggregates be used in the concrete.

E. During periods of warm weather when the maximum daily air temperature exceeds 85 degrees F (30 degrees C), the following precautions should be taken. The forms and/or the underlying

material shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90 degrees F (32 degrees C). The aggregate and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

3.06 PLACING CONCRETE

A. Side-form Method:

B. For the side-form method, the concrete shall be deposited on the moistened grade to require as little rehandling as possible. Unless truck mixers, truck agitators, or nonagitating hauling equipment are equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade to prevent segregation of the materials. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels -- NOT RAKES. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

1. Concrete for side-form construction shall be placed on cement treated base. No concrete shall be placed before the cement treated base has obtained a compressive strength specified at 7 days.
2. When concrete is to be placed adjoining a previously constructed lane of pavement and when mechanical equipment will be operated upon the existing lane of pavement, the concrete shall be at least 7 days old and at a flexural strength approved by the Engineer. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after 3 days, if approved by the Engineer.
3. Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 15 seconds in any one location, nor shall the vibrators be used to move the concrete. Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.
4. Should any concrete materials fall on or be worked into the surface of a completed slab, they shall be removed immediately by approved methods.

C. Slip Form Method.

1. For the slip-form method, the concrete shall be placed with an approved crawler-mounted, slip-form paver designed to spread, consolidate, and shape the freshly placed concrete in one
2. Complete pass of the machine so that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement in conformance with requirements of the plans and specifications. The concrete should be placed directly on top of the joint assemblies to prevent them from moving when the paver moves over them. Side forms and finishing screeds shall be adjustable to the extent required to produce the specified pavement edge and surface tolerance. The side forms shall be of dimensions, shape, and strength to support the concrete laterally for a sufficient length of time so that no appreciable edge slumping will occur. Final finishing shall be accomplished while the concrete is still in the plastic state.
3. Concrete for slip form construction shall be placed on cement treated base or lime stabilized subgrade. No concrete shall be placed before the cement treated base has obtained the compressive strength specified at 7 days. The Contractor shall set grade stakes and stringline for each lane placement. The stringline shall be supported at intervals of not more than 25 feet. Additional supports shall be installed to prevent sag of the stringline. The horizontal alignment of the stringline shall be within plus or minus 1/4-inch in 10 feet of true alignment. The Contractor shall provide a suitable method of

securing the stringline to maintain proper grade where vertical curves are to be constructed.

D. Hand Placement Method.

1. When the hand method of striking off and consolidating is permitted, the concrete, as soon as placed, shall be approximately leveled and then truck off and screeded to such elevation above grade that, when consolidated and finished, the surface of the pavement shall be at the grade elevation shown on the plans. The entire surface shall then be tamped and the concrete consolidated so as to insure maximum compaction and a minimum of voids. For the strike off and consolidation, both a strike template and tamping template shall be provided on the work. In operation the strike template shall be moved forward with a combined longitudinal and transverse motion and so manipulated that neither end of the template is raised from the forms during the striking-off process. A slight excess of material shall be kept in front of the cutting edge at all times. The straightedging, surfacing and joint finishing shall be as described herein.

3.07 STRIKE-OFF OF CONCRETE:

A. Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. All reinforcement shall be positioned in advance of concrete placement. All reinforcing bars and bar mats shall be installed in the slab at the required depth below the finished surface and supported by chairs installed on 4-foot centers. After the reinforcing steel is securely installed above the subgrade, as specifically required by plans and as herein prescribed, there shall be no loading imposed upon (or walking upon) the bar mats or individual bars that will cause deformation of reinforcing before or during the placing or finishing of the concrete.

3.08 JOINTS.

A. General:

1. Longitudinal and Transverse Joints. Longitudinal and transverse joints shall be constructed as indicated on the plans and in accordance with these requirements. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. Joints shall not vary more than 1/2-inch (13 mm) from a true line or from their designated position. The vertical surface of the pavement adjacent to all expansion joints shall be finished to a true plane and edged to a radius of 1/4-inch (6 mm) or as shown on the plans. The surface across the joints shall be tested with a 10-foot (3 m) straightedge as the joints are finished and any irregularities in excess of 1/4-inch (6 mm) shall be corrected before the concrete has hardened. Longitudinal construction joints that do not meet these requirements or which show significant cracking or planes of weakness shall be sawed-off full depth at the Contractor's expense using the minimum practical width at locations designated by the Engineer. When required, keyways shall be accurately formed with a template of metal or wood. The gauge or thickness of the material in the template shall be such that the full keyway, as specified, is formed and is in the correct location. Transverse joints shall be right
2. Angles to the centerline of the pavement and shall extend the full width of the slab. All joints shall be so prepared, finished, or cut to provide a groove of the width and depth shown on the plans.

B. Tie Bars: Tie bars shall consist of deformed bars installed principally in longitudinal joints as shown on the plans or the bars shall be extensions of the distributed reinforcing steel across the joints. Tie bars shall be placed at right angles to the centerline of the concrete slab. They shall be held in position parallel to the surface and midway between the surfaces of the slab. These bars shall not be painted, greased, or enclosed in sleeves. At all locations where tie bars are specified and where pavement is in place, the tie bars shall be inserted by drilling and grouting with approved epoxy material. Tie bars in longitudinal construction joints may be installed by bending the bars flush with a keyed joint.

C. Dowel Bars: If used, dowel bars or other load-transfer units of an approved type shall be placed across transverse or other joints in the manner as specified on the plans. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. A metal, or other type, dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on the plans. The caps or sleeves shall fit the dowel bar tightly and the closed end shall be watertight.

D. Installation: Joints in concrete pavements shall be cut as shown on the plans. Equipment shall be as described in Paragraph 3.1. The circular cutter shall be capable of cutting a groove in a straight line and shall produce a slot at least 1/8-inch (3 mm) wide and to the depth shown on the plans. When shown on the plans or required by the specifications, the top portion of the slot or groove shall be widened by means of a second shallower cut or by suitable and approved beveling to provide adequate space for joint sealers. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. Sawing shall be carried on both during the day and night as required. The joints shall be sawed at the required spacing consecutively in sequence of the concrete placement, unless otherwise approved by the Engineer.

E. Longitudinal Joints.

1. Construction. Longitudinal construction joints shall be formed against suitable side forms (usually made of steel) with or without keyways. Wooden forms may be used under special conditions, when approved by the Engineer. Where butt-type joints with dowels are designated, the dowels for this type shall be painted and greased. The edges of the joint shall be finished with a grooving tool or edging tool, and a space or slot shall be formed along the joint of the dimensions, as indicated, to receive the joint sealing material. Longitudinal construction joints shall be sawed to provide a groove at the top conforming to the details and dimensions indicated on the plans. Provisions shall be made for the installation of tie bars as noted on the plans.
2. Contraction or Weakened-plane type. The longitudinal groove sawed in the top of the slab shall be installed where indicated on the drawings. The groove shall be sawed with approved equipment in the hardened concrete to the dimensions required. The sawed groove shall be straight and of uniform width and depth. The groove shall be clean cut so that spalling will be avoided at intersections with transverse joints. Tie bars or distributed reinforcing steel shall be installed across these joints were indicated on the plans.
3. Expansion. Longitudinal expansion joints shall be installed as indicated on the plans. The premolded filler, of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space over the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic.

F. Transverse Joints.

1. Expansion. Transverse expansion joints shall be installed at the locations and spacing as shown on the plans. The joints shall be installed at right angles to the centerline and perpendicular to the surface of the pavement. The joints shall be installed and finished to insure complete separation of the slabs. Expansion joints shall be of a premolded type conforming to these specifications and with the plans and shall be the full width of the pavement strip.
2. All concrete shall be cleaned from the top of the joint material. Before the pavement is opened to traffic, this space shall be swept clean and filled with approved joint sealing material.

3. All devices used for the installation of expansion joints shall be approved by the Engineer. They shall be easily removable without disturbing the concrete and held in proper transverse and vertical alignment. Immediately after forms are removed, any concrete bridging the joint space at the ends shall be removed for the full width and depth of the joint.
4. When specified, expansion joints shall be equipped with dowels of the dimensions and at the spacing and location indicated on the plans. The dowels shall be firmly supported in place and accurately aligned parallel to the subgrade and the centerline of the pavement by means of a dowel assembly which will remain in the pavement and will ensure that the dowels are not displaced during construction.
5. Other types of load-transfer devices may be used, when approved by the Engineer.

G. Contraction. Transverse contraction joints, weakened-plane joints, or both, shall be installed at the locations and spacing as shown on the plans. These joints will be installed by sawing a groove into the concrete surface after the concrete has hardened in the same manner as specified in Paragraph 3.8(c)(2). Dowel bar assemblies shall be installed, when required, as shown on the plans.

H. Construction. Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. When the installation of the joint can be planned in advance, it shall be located at a contraction or expansion joint. The joint shall not be allowed within 8 feet (2.4 m) of a regular spaced transverse joint. If the pouring of the concrete has been stopped, causing a joint to fall within this limit, it shall not be installed, and the fresh placed concrete shall be removed back to the 8 foot (2.4 m) limit.

3.09 FINAL STRIKE-OFF, CONSOLIDATION, AND FINISHING:

A. Sequence. The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straightedging, and final surface finish. The addition of superficial water to the surface of the concrete to assist in finishing operations generally will not be permitted. If the application of water to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment.

B. Finishing at Joints. The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material; it shall be firmly placed without voids or segregation under and around all load-transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated. After the concrete has been placed and vibrated adjacent to the joints, the finishing machine shall be operated in a manner to avoid damage or misalignment of joints. If uninterrupted operations of the finishing machine, to, over, and beyond the joints, cause segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the screed is approximately 8 inches (20 cm) from the joint. Segregated concrete shall be removed from the front of and off the joint; the screed shall be lifted and set directly on top of the joint, and the forward motion of the finishing machine shall be resumed. Thereafter, the finishing machine may run over the joint without lifting the screed, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

C. Machine Finishing. The concrete shall be spread as soon as it is placed, and it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area as many times and at such intervals as necessary to give the proper consolidation and to leave a surface of uniform texture. Excessive operation over a given area shall be avoided. When side forms are used, the tops of the forms shall be kept clean by an effective device attached to the machine, and the travel of the machine on the forms shall be maintained true without lift, wobbling, or other variation tending to affect the precision finish. During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed for its entire length. When in operation, the screed shall be moved forward with a combined

longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing, and so manipulated that neither end is raised from the side forms during the striking-off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.

D. Hand Finishing. Hand finishing methods will not be permitted, except under the following conditions: In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade; in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used.
   1. The screed for the surface shall be at least 2 feet (0.6 m) longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or of other suitable material covered with metal. Wood will not be permitted. Consolidation shall be attained by the use of a suitable vibrator.

E. Floating. After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, using one of the following methods:
   1. Hand Method. The hand-operated longitudinal float shall not be less than 12 feet (3.6 m) in length and 6 inches (15 cm) in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion, while held in a floating position parallel to the slab centerline and passing gradually from one side of the slab to the other. Forward movement along the centerline of the slab shall be in successive advances of not more than one-half the length of the float. Any excess water or soup material shall be wasted over the slab edge on each pass.
   2. Mechanical Method. The Contractor may use a machine composed of a cutting and smoothing float(s), suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on, and constantly in contact with, the side forms or pavement subgrade. If necessary, long-handled floats having blades not less than 5 feet (1.5 m) in length and 6 inches (1.5 cm) in width may be used to smooth and fill in open-textured areas in the slab. Long-handled floats shall not be used to float the entire surface of the slab in lieu of mechanical methods. After floating, any excess water and laitance shall be removed from the surface of the slab by a straightedge 10 feet (3 m) or more in length. Successive drags shall be lapped one-half the length of the blade.

F. Straight-edge Testing and Surface Correction. After the pavement has been struck off and consolidated and while the concrete is still plastic, it shall be tested for trueness with a 16-foot (4.8 m) straightedge. For this purpose the Contractor shall furnish and use an accurate 16-foot (4.8 m) straightedge swung from handles 3 feet (0.4 m) longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance shall be removed from the surface of the pavement. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

3.10 SURFACE TEXTURE

A. A light broom drag shall be used for slab concrete pavements. The direction of the texture device shall be as directed by the Engineer. Contractor to match existing pavement finishes.

3.11 SURFACE TEST

A. As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 16-foot (5 m) straightedge or other specified device to determine its compliance with design grades. Where the departure from correct cross section exceeds ½ inch (13 mm), the pavement shall be ground down with a approved grinding machine to within 1/4 inch of tolerance or removed and replaced at the expense of the Contractor when so directed by the Engineer. Cracked or damaged slabs shall be removed and replaced at the expense of the Contractor when so directed by the Engineer.

B. Any area or section so removed shall not be less than 20 feet (6 m) in length nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, and remaining portion of a slab adjacent to the joints that is less than 10 feet (3 m) in length shall also be removed and replaced.

3.12 CURING

A. Immediately after the finishing operations have been completed and marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured in accordance with one of the methods below. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period. The following are alternate approved methods for curing concrete pavements.

B. Impervious Membrane Method. The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of 1 gallon (4 liters) to not more than 150 square feet (14 square meters). The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but approved means shall be used to insure proper curing for 72 hours. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of the side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface. For the Impervious Membrane Method, the Contractor is encouraged to include Polyethylene Film dispensing equipment in the Paving Train to provide protection to the finished work in case of rainfall.

C. Polyethylene Films. The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units shall be lapped at least 18 inches (457 mm). The sheeting shall be placed and weighted to cause it to remain in contact with the surface covered. The sheeting shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the pavement. Unless otherwise specified, the sheeting shall be maintained in place for 72 hours after the concrete has been placed.

D. Waterproof Paper. The top surface and sides of the pavement shall be entirely covered with waterproofed paper. The units shall be lapped at least 18 inches (457 mm). The paper shall be placed and weighted to cause it to remain in contact with the surface covered. The paper shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the slab. The surface of the pavement shall be thoroughly wetted prior to placing of the paper. Unless otherwise specified, the paper shall be maintained in place for 72 hours after the concrete has been placed.

E. White Burlap-Polyethylene Sheets. The surface of the pavement shall be entirely covered with sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the

thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully wetted and in position for 72 hours after the concrete has been placed.

F. Curing in Cold Weather. When the average daily temperature is below 40 degrees F (4 degrees C), curing shall consist of covering the newly laid pavement with not less than 12 inches (30 cm) of loose, dry hay or straw, or equivalent protective curing authorized by the Engineer, which shall be retained in place for 10 days. The hay or straw shall be secured to avoid being blown away. Admixture for curing or temperature control may be used only when authorized by the Engineer.

G. When concrete is being placed and the air temperature may be expected to drop below 35 degrees F (2 degrees C), a sufficient supply of straw, hay, grass, or other suitable blanketing material such as burlap or polyethylene shall be provided along the work. Any time the temperature may be expected to reach the freezing point during the day or night, the material so provided shall be spread over the pavement to a sufficient depth to prevent freezing of the concrete. The period of time such protection shall be maintained shall not be less than 10 days. A minimum of 3 days is required when high, early strength concrete is used. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete injured by frost action shall be removed and replaced at the Contractor's expense.

3.13 REMOVING FORMS

A. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has set for at least 12 hours, except where auxiliary forms are used temporarily in widened areas. Forms shall be removed carefully to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated in Paragraph 3.17. Major honeycombed areas shall be considered as defective work and shall be removed and replaced. Any area or section so removed shall not be less than 20 feet (6 m) in length nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet (3 m) in length shall also be removed and replaced.

3.14 SEALING JOINTS:

A. The joints in the pavement shall be prepared and sealed in strict accordance with the sealant manufacturer's printed recommendations.

3.15 PROTECTION OF PAVEMENT:

A. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, or crossovers, etc. The plans or special provisions will indicate the location and type of device or facility required to protect the work and provide adequately for traffic. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense. In order that the concrete be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor is encouraged to have available at all times materials for the protection of edges and surface of the unhardened concrete. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils (0.1 mm) thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel should begin covering the surface of the unhardened concrete with the protective covering.

3.16 OPENING TO TRAFFIC:

A. The Engineer shall decide when the pavement shall be opened to traffic. The pavement will not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have

attained a flexural strength of 550 pounds per square inch (3792 kPa) when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening to traffic, the pavement shall be thoroughly cleaned.

3.17 SURFACE AND THICKNESS TOLERANCES:

A. Extreme care must be exercised in all phases of the operation to assure the pavement will pass the specified tolerances. The following tolerances are applicable:
   1. Lateral deviation from established alignment of the pavement edge shall not exceed plus or minus 0.10 foot (30 mm) in any lane.
   2. Vertical deviation from established grade shall not exceed plus or minus 0.04 foot (12 mm) at any point.
   3. Surface smoothness deviations shall not exceed 3/8 inch (6 mm) from a 16-foot (5 m) straightedge placed in any direction, including placement along and spanning any pavement joint or edge.

B. No additional payment over the contract unit price shall be made for any pavement of a thickness exceeding that required by plans.

3.18 INTEGRAL CURBS:

A. Where shown on the drawings, integral curbs shall be installed to the dimension shown using identical concrete to the paving mix. Expansion and contraction joints shall extend through curb section. Reinforcing for integral curb, when shown on the plans, shall be supported from the ground with driven stakes or as directed by the Engineer. Once the forms are removed, all voided areas shall be rubbed and filled with non-shrink grout within 24 hours. If the forms are removed within 2 days of placement, the curb shall be treated with a specified curing membrane.

3.19 CONCRETE CURB AND GUTTER:

A. Concrete curb and gutter shall be constructed using concrete of the type and strength specified in the plans. The placement, strike-off consolidation and finishing shall be made using applicable portions of this specification as determined by the Engineer. Contraction joints shall be placed at 20-foot centers with the use of a 1/2" deep grooving tool. Expansion joints shall be placed at a maximum spacing of 400 feet and at all radius points, curb returns and junctions with structures. For curves of 100 feet radius or less, contraction joints shall be tooled at 10-foot centers and expansion joints constructed at 50-foot centers. Expansion joints shall contain a minimum of two smooth dowels a minimum of one bar size larger than the longitudinal reinforcing and 3/4-inch thick expansion joint material of the type specified in the plans. Expansion joints shall be sealed in accordance with the plan details.

3.20 SIDEWALKS AND SLOPE PAVING

A. Concrete sidewalks and slope paving shall be constructed to use concrete of the type and strength specified in the plans. The placement, strike-off, consolidation and finishing shall be made using applicable portions of this specification as determined by the Engineer. Contraction joints shall be tooled at a depth of 1/2" at a spacing equal to the width of the sidewalk not to exceed six feet. For walks wider than six feet, longitudinal joints shall be tooled at equal spacing, not less than three feet. Edges shall be tooled with a 1/4-inch radius and finish slightly higher than adjacent curbs to ensure proper drainage if some settlement occurs. Expansion joints shall be placed at 100-foot intervals or at intersecting walk locations. Expansion joints shall be 3/4-inch in thickness and contain smooth dowels at not less than 12" spacing. The size of the dowels will be equal to the thickness of the sidewalk in inches. Scoring and tooling for barrier free ramps shall be made in accordance with governing City standards or as directed by the Engineer.

3.21 FIELD TEST SPECIMENS

A. Concrete samples shall be furnished by the Contractor and shall be taken in the field to determine the consistency, air content, and strength of the concrete. Compressive test cylinders shall be made each day that the concrete is placed. However, at the start of paving

operations and when the aggregate source, aggregate characteristics, or mix design is changed, additional groups of test cylinders may be required until the Engineer is satisfied that the concrete mixture being used complies with the strength requirements of these specifications. Test ages will be 7 days and 28 days.

B. Test cylinders for compressive strength tests shall be taken and cured in accordance with ASTM C-31 and tested in accordance with ASTM C-39. At least four cylinders (a set) shall be made for each 1,000 cubic yards or fraction thereof placed and tested at 7 days and 28 days. No extra compensation will be allowed for materials and work involved in fulfilling these requirements. Concrete will be accepted on the basis of tests conducted on a "lot" of concrete. A lot will consist of 160 cubic yards and will be divided into four equal sublots. One set of tests will be made for each sublot. Random samples will be taken from the plastic concrete at the site in accordance with accepted statistical procedures.

C. The concrete shall be sampled in accordance with ASTM C172.

D. The lot will be accepted without adjustment in payment if the average 28 day compressive strength, based on four acceptance tests, indicates a strength deficiency of not less than 100 psi. The pay factor for 28-day compressive strengths showing a deficiency greater than 100 psi are listed in the table below.

1. PAY FACTOR SCHEDULE FOR COMPRESSIVE STRENGTH
   a. AT THE SPECIFIED INTERVAL

Strength Deficiency (Based on an Average of 4 Cylinders) psi	Pay Factor (Percent of Contract Unit Price) psi
0 - 100	100
100 - 150	85
151 - 200	75
201 - 250	70
251 - 300	60
301 - 375	55
375 - 500	50
>500	Reject

END OF SECTION

SECTION 321320
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 32 13 13, Concrete Pavement.

1.02 QUALITY ASSURANCE

A. Reference Standards:
   1. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.

B. ASTM A615, Specification for Deformed Billet Steel Bars for concrete.
   1. ASTM A185, Specifications for Welded Steel Wire Fabric for Concrete Reinforcement.
   2. Concrete Reinforcing Steel Institute, Manual of Standard Practice.

C. Allowable Tolerances:
   1. Fabricating: (per ACI 117-90)
      a. Saw cut length to: Plus or minus 1". (Remove all burrs).
      b. Stirrups and ties: Plus or minus 1/2".
      c. All other bends: Plus or minus 1".
   2. Placing:
   3. Concrete cover to formed surfaces: Plus or minus 1/4".
      a. Minimum spacing between bars: Plus or minus 1/4".
      b. Top bars in slabs and beams:
         1) Members 8" deep or less: Plus or minus 1/4".
         2) Members more than 8" but not over 2'-0" deep: Plus or minus 1/2".
         3) Members more than 2'-0" deep: Plus or minus 1".
         4) Crosswise of members: Space evenly within 2" of stated separation.
         5) Lengthwise of members: Plus or minus 2".
   4. Maximum bar relocation to avoid interference with other reinforcing steel, conduits, or other embedded item: 1 bar diameter.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with tags indicating bar size, length and mark.

B. Unload reinforcing carefully to prevent damage. Store above ground in dry, well drained area; protect from mud, dirt and corrosion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: ASTM A615, deformed billet steel bars, domestic manufacture, Grades 40 and/or 60 as indicated on structural drawings.

B. Welded Wire Fabric Reinforcing: ASTM A185, steel wire spot welded at intersections and of size indicated.

C. Metal Accessories: Include spacers, chairs, bolsters, ties and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place, conforming to requirements to CRSI "Manual of Standard practice for Detailing Reinforced Concrete Structures." Metal accessories shall be galvanized or plastic coated where legs will be exposed in finished concrete surfaces.

D. Tie Wire: FS QQ-W-461, black annealed steel, 16 ga. min.

2.02 FABRICATION:

A. In accordance with CRSI "Manual of Standard Practice."

PART 3 - EXECUTION

3.01 PREPARATION

A. Cleaning: Before placing in work, thoroughly clean reinforcement of loose rust, mill, scale, dirt, oil, and other coating which might tend to reduce bonding. Reinspect reinforcing left protruding for future bonding, or following delay in work, and reclean if necessary.

3.02 INSTALLATION

A. Bar Placement: In accordance with CRSI "Recommended Practice for Placing Reinforcing Bars" and "Recommended Practice for Placing Bar Supports."

B. Bending: Bend bars cold; do not heat reinforcing or bend by make-shift methods. Discard bent, kinked or otherwise damaged bars.
   1. Splices: In accordance with ACI 315.
   2. Placing: Accurately position reinforcement; securely saddle tie at intersections.
   3. Supports: In accordance with ACI 315 for number, type, spacing and placing.

END OF SECTION

SECTION 321373
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and asphalt pavement.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
   3. When joint substrates are wet or covered with frost.
   4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: to match concrete color.

2.03 COLD-APPLIED JOINT SEALANTS

A. Multi-component Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:
   1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
   2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.
   3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

B. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

C. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

D. Multi-component Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint-sealant manufacturer, based on pre-construction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability. Do not leave gaps between ends of backer materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Use tooling

agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 321623
SIDEWALKS

PART 2 PRODUCTS

END OF SECTION

SECTION 323000
CAST-IN-PLACE CONCRETE SITE WORK

PART 1 GENERAL

1.01 GENERAL DESCRIPTION OF WORK COVERED

A. Mixing, placing, finishing and providing all related services necessary to construct all cast-in-place concrete work indicated on plans.

1.02 QUALITY ASSURANCE

A. Comply with the latest published edition of the American Concrete Institute (ACI) and American Society of Testing and Materials (ASTM) standards and codes:
   1. ACI 315 – Manual of Standard practice for Detailing.
   2. ACI 318 – Building Code Requirements for Reinforced Concrete.
   3. ACI 347R – Recommended Practice for Concrete Formwork.
   4. ASTM A36/A36M – Structural Steel.
   5. ASTM C33/C33M – Concrete Aggregates.
   6. ASTM C39/C39M – Concrete Strength of Molded Concrete Cylinders.
   7. ASTM C94/C94M – Ready-Mixed Concrete.
   8. ASTM C143/C143M – Slump of Portland Cement Concrete.
   9. ASTM C150/C150M– Portland Cement.
   10. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.
   11. ACI 304R - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
   12. ACI 301 – Specification for Structural Concrete for Building.

B. Submit compliance submittals as specified in Division 1, including but not limited to the following: bar schedule, bar details, shop drawings including size and location of openings, waterstops, joint systems and curing method.

C. Submit proposed concrete mix proportions to Engineer prior to placing concrete.

1.03 SUBMITTALS

A. Conform to requirements of Section 013300.

B. Manufacturer's Literature: Manufacturer's descriptive literature and recommended method of installation.

C. Certificates: Manufacturer's certification that products meet specification requirements.

PART 2 - PRODUCTS

2.01 PORTLAND CEMENT

A. Type I, Type II or Type III conforming to ASTM C150/C150M as modified by Texas State Department of Highways and Public Transportation, Most Recent Edition Standard Specifications.

B. Type I or II cement may be used unless Type II is specified.

C. Except when Type II specified, Type III may be used when the anticipated air temperature for the succeeding 12 hours will not exceed 60˚F.

D. Type III may be used in all pre-cast pre-stressed concrete except in piling when Type II cement is required for substructure concrete.

E. All cement used in a monolithic placement shall be of the same type.

F. May be either bagged or bulk. Partially set or caked cement will be rejected.

2.02 WATER:

A. Clear, fresh, free from injurious amounts of oil, alkaline, acid or organic matter or other deleterious substances and shall not contain more than 1000 parts per million of chlorides as C1 nor more than 1000 parts per million of sulfates as SO_4.

B. The sand, or mixture of sand, comprising a single fine aggregate, shall consist of clean, hard, durable, uncoated grains and shall be essentially free from clay lumps, salt or alkali, and other foreign material.

C. Water shall have a Ph of not less than 4.5 or more than 8.5.

2.03 FINE AGGREGATE

A. ACI 301 - Specifications for Concrete Construction 2020.

B. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

C. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).

D. ACI 347R - Guide to Formwork for Concrete 2014, with Errata (2017).

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

G. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

H. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2021b.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

J. ASTM C150/C150M - Standard Specification for Portland Cement 2021.

K. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.

L. Natural sand, manufactured sand or a combination of the two, with or without mineral filler.

M. The sand, or mixture of sand, comprising a single fine aggregate, shall consist of clean, hard, durable, uncoated grains and shall be essentially free from clay lumps, salt or alkali, and other foreign material.

N. The maximum permissible percentage, by weight of deleterious substances shall not exceed the following: Material removed by decantation 3.0%. Other deleterious substances such as coal, shale, coated grains and soft flaky particles 3.0%. An additional loss of 2% by decantation may be allowed, provided this new additional loss is material of the same quality as specified for fine aggregate or mineral filler.

O. Gradation, percent of weight retained:

Sieve Size	Percent Retained
3/8 inch	0
No. 4	0 - 5
No. 8	0 - 20
No. 16	15 - 50
No. 30	35 - 75
No. 50	65 - 90
No. 100	90 - 100
No. 200	97 - 100

P. Fineness Modulus:
   1. For Grade 1 only – 2.3 minimum, 3.1 maximum.

Q. Mineral Filler:
   1. May be added upon written authorization of Engineer
   2. Shall be stone dust or clean crushed sand, or other approved inert material.
   3. Shall not exceed 5% of the fine aggregate.
   4. Shall meet the following requirements:
      a. Passing No. 30 sieve 95 to 100%
      b. Passing No. 100 sieve 70 to 100%

2.04 COARSE AGGREGATE

A. Crushed stone, gravel, crushed gravel, crushed blast furnace slag or a combination of these.

B. Gravel and crushed gravel shall consist of clean, hard durable particles, free from adherent coating, thin or elongated pieces, soft or disintegrated particles, dirt, organic or deleterious substances, salt or alkali, and other foreign material.

C. Crushed stone shall consist of the clean, dust free product resulting from crushing of stone. There shall be no adherent coatings, clay, loam organic or deleterious substances, salt or alkali, and other foreign material.

D. The maximum permissible percentage, by weight, of deleterious substances shall not exceed the following:

Material removed by decantation	1.00%
Shale, Slate or other similar material	1.00%
Clay lumps	0.25%
Soft fragments	3.00%
Other deleterious substances, including friable, thin, elongated or laminated pieces	3.00%
The sum of all deleterious susbstances exclusive of material removed by decantation, shall not exceed by weight	5.00%

E. Coarse aggregates shall have a percent wear of not more than 45 when tested in accordance with Test Method Tex-410-A.

F. Gradation, percent of weight retained on

1. Grade No. 1 – Maximum Nominal Size 2 1/2-inches (63 mm)

Sieve	Percentage Retained
2 1/2-inches	0%
2-inches	0 - 20%
1 1/2-inches	15 - 50%
3/4-inches	60 - 80%
No.4	95 - 100%

2. Grade No.2 - Maximum Nominal Size 1 1/2-inches (37.5 mm)

Sieve	Percentage Retained
2-inches	0%
1 1/2-inches	0 - 5%
3/4-inches	30 – 65%
3/8-inches	70 – 90%
No. 4	95 - 100%

3. Grade No. 3 – Maximum Nominal Size 1-inch (25 mm)

Sieve	Percentage Retained
1 1/2-inches	0 – 5%
3/4-inches	10 – 40%
1/2-inches	40 – 75%
No. 4	95 – 100%

4. Grade No. 4 – Maximum Nominal Size 3/8-inch (9.5 mm)

Sieve	Percentage Retained
1/2-inches	0 – 5%
3/8-inches	5 – 30%
No. 4	75 – 100%

G. Gradation Requirements – maximum size of aggregate for structural concrete shall not exceed three inches, and shall be reduced in size to meet the following conditions:
   1. One-sixth (1/6) of the least dimension between forms of that part of the structure in which concrete is to be placed.
   2. Three-fourths (3/4) of the clear space between reinforcement.
   3. The maximum size aggregate is defined as the clear space between the sides of the smallest square openings through which 95 percent of the weight of the aggregate can be passed.
   4. Unless otherwise noted or restricted by above Grade No. 2, gradation shall be used.

2.05 PIT-RUN AGGREGATE

A. Pit-run aggregate is the natural gravel and sand obtained from pits without the addition of other fine or coarse aggregates, and shall consist of hard, durable, uncoated pebbles or stone particles mixed with sand.

B. Pit-run aggregate shall be free from lumps of clay and injurious amounts of dust, shale, soft or flaky particles, salt and alkali.

C. Pit-run aggregate shall be well graded from coarse to fine when tested by standard laboratory methods and shall meet the following minimum requirements for percentages by weight.
   1. Retained on 1/4 in sieve 55 to 60%

D. Pit-run aggregate shall not be used for high-strength concrete of 3000 psi and above.

E. Pit-run aggregate may be used only for concrete cushion, cradle and protection for pipe.

2.06 ADMIXTURES:

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

G. 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.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Catexol 1000CL; Axim Concrete Technologies.
      b. MCI 2000 or MCI 2005; Cortec Corporation.
      c. DCI or DCI-S; W. R. Grace & Co., Construction Products Div.
      d. Rheocrete 222+; Master Builders, Inc.
      e. FerroGard-901; Sika Corporation.

2.07 REINFORCING STEEL

A. Reinforcing steel shall comply with plans and geotechincal report.

2.08 CURING MATERIALS

A. Liquid Membrane: white pigmented chlorinated rubber, ASTI C309.

B. Liquid Membrane: resin base, clear compound, permitting application of paint, Serviced Products Corporation – Code 2802 or equal.

C. Plastic Film: White pigmented, 0.00085-inches (minimum) thick.

D. Burlap: jute fabric, lean, free of impurities.

E. Surface Hardener: gray crystal, acidic fluosilicate base, slightly hygroscopic chemical surface hardener, SIKA Hardener, SIKA Chemical Corporation, or equal.

2.09 JOINT MATERIALS

A. Joint Sealer: hot poured, non-extruding, elastic, ASTI 01190.

B. Preformed Expansion Joint Filler: non-extruding, bituminous fiber, ASTI D1751.

2.10 WATERSTOP

A. Polyvinyl chloride or rubber, centerbulb.

B. Size to suit joinings, minimum 6-inches.

2.11 FORM MATERIALS

A. Use plywood, metal, metal framed plywood faced or other acceptable panel-type material.

B. Coat forms with non-bonding, non-staining commercial compounds.

2.12 MOISTURE BARRIER

A. Polyethylene sheet, minimum 8-mil., ASTI E154.

2.13 CONCRETE MIX DESIGN AND CONTROL

A. Submit not less than 10 days prior to the start of concreting operations to the Engineer:
   1. Mix design, using a coarse aggregate factor acceptable to the Engineer.
   2. Sufficient samples of all materials to be incorporated into the mix for testing.
   3. Full description of the source of supply of each material component.

B. Coarse aggregate factor:
   1. Not more than 0.82 when voids less than 48%.
   2. Not more than 0.85 when voids exceed 48%.
   3. Not less than 0.68.

C. No changes or deviations from proportions or sources of supply without approval of Engineer.

D. No concrete may be placed on the job site until the mix design has been approved by Engineer in writing to the Contractor.

2.14 CONCRETE QUALITY:

A. Consistency:
   1. Mortar shall cling to the coarse aggregate.
   2. The aggregate shall not segregate during transport.
   3. The concrete and mortar shall show no free water when removed from the mixer.

B. The consistency should allow the completion of all finishing operations with the addition of water to the surface.

C. The concrete shall be uniform, workable, cohesive, possess satisfactory finishing qualities and be of the stiffest consistency that can be placed and vibrated into a homogeneous mass.

D. Excessive bleeding shall be avoided.

E. Slump requirements shall be as follows:

Structural Concrete	Average Slump	Maximum Slump
1. Case Drilled Shafts and Thin walled Sections (9-inches or less)	4	5
2. Slabs, Caps, Columns, Piers, wall sections over 9-inches etc.	3	4
3. Slip Form Paving	1/2	2
4. Underwater or Seal Concrete	5	6

5. Rip-rap, Curb, Gutter and other Misc. Surfaces — As Specified By Owner — As Specified By Owner

NOTE: No concrete shall be permitted with slump in excess of the maximums shown. Any concrete mix failing to meet the above consistency requirements, although meeting the slump requirements shall be considered unsatisfactory; and the mix shall be changed to correct such unsatisfactory conditions.

F. The concrete shall comply with Table 1 below:

TABLE 1 - CLASSES OF CONCRETE

Classof Concrete	Minimum MaximumSX Cement Per CY	Maximum Comprehensive Strength 28-day psi	Minimum Beam Strength 7-day psi****	Maximum Water Cement Item 2.1.1I(4)	Coarse Aggregate Number
A	5.0	3000	500	6.5	2-3-4
B	4.0	2000	330	8.0	2-3-4
C	6.0	3600	600	6.0	1-2-3**
D	3.0	1500	250	11.0	2-3-4
E	6.0	3000	500	7.0	2-3
F	6.5	4200	700	5.5	2-3
H***	6.5-8.0	As Spec'd On plans	N/A	5.5	3

*Entrained Air.

**No. 1 coarse aggregate may be used in foundations only (Except cased drilled shafts).

***Prestressed Concrete.

****ASTI C293 (Center Point).

2.15 GROUT:

A. Non-Shrink:
   1. Use premixed non-shrink, Embeco Pre-Mixed Grout or Embeco Pre-Mixed Mortar by Master Builders Company or equal.
   2. Keep water to a minimum for placing by the dry packing method.

PART 3 - EXECUTION

3.01 SUBGRADE

A. Insure subgrade is true to line and grade and compacted as specified.

B. Fill and recompact any ruts or depressions.

C. Check cross section with a template.

D. Place moisture barrier or motion subgrade prior to placing of concrete. Method to be approved by Engineer.

3.02 FORMS

A. Provide forms for all concrete work including footings and base slabs.

B. Construct forms so that completed concrete will conform to shapes, lines, grades and dimensions indicated and required.

C. Forms shall be true, plumb and level with reasonably tight joints. Adequately support and brace forms.

D. Place anchors, inserts, blots, sleeves and other devices indicated or required for the various portions of all the work.

E. Oil temporary forms with non-staining form oil before reinforcing steel is placed.

F. Rough form finish as defined by ACI 301 permitted for concealed concrete.

G. Smooth form finish as defined by ACI 301 permitted for concealed concrete.

H. Provide 3/4 inch chamfer on exposed corners and edges, and 1-foot below ground level.

3.03 REMOVAL OF FORMS

A. Do not remove forms or supports until concrete has acquired sufficient strength to safely support its own weight and the superimposed loads.

B. Remove formwork for columns, walls, beam sides and other parts not supporting the weight of the concrete as soon as the concrete has hardened sufficiently to resist damage from removal operations.

C. Formwork for slabs, beam soffits and other parts supporting the weight of the concrete shall remain in place until the concrete has reached its specified 28-day strength.

D. Protect concrete from damage prior to acceptance.

E. Prohibit traffic until concrete is at least 10 days old.

F. Cure areas previously covered by forms.

3.04 MIXING CONCRETE

A. Maintain all equipment, tools, and machinery used for hauling materials and performing any part of the work to insure completion of the work underway without excessive delays for repairs or replacement.

B. Mixing shall be done in a mixer of adequate size and type to produce uniform distribution of the material throughout the mass.

C. The mixer shall have a plate affixed showing the manufacturer's recommended operating data and it shall be operated within the speed and capacity limits stated thereon.

D. The absolute volume of the concrete batch shall not exceed the rated capacity of the mixer.

E. The entire contents of the drum shall be discharged before any materials are placed.

F. Improperly mixed concrete will not be placed.

G. The mixing time shall be in accordance with the recommendations of the mixer manufacturer.

H. Transit Mix Concrete:
   1. Sufficient transit mix equipment shall be assigned exclusively to the project as required for continuous operation.
   2. Satisfactory evidence shall be furnished so that the delivery of concrete shall be continuous at regular and uniform intervals, without stoppage or interruption.
   3. Concrete shall not be placed on the job after a period of 1 hour after the cement has been placed in the mixer, with mixer turning; 30 minutes without turning.

I. Continuous Volumetric Mix Concrete:
   1. A mobile, continuous, volumetric mixer of the rotating puddle type may be used for when approved by Engineer.
   2. Mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging.
   3. The mixers shall have adequate water supply and metering devices.
   4. Calibration of these mixers will be required.

3.05 PLACING CONCRETE

A. The minimum temperature of all concrete at the time of placement shall not be less than 50°F.

B. Clean transporting equipment, reinforcing and embedded items before placing concrete.

C. Batch trucks or paving equipment not permitted on prepared subgrade unless authorized by the Engineer based on actual job conditions.

D. Place no concrete until after inspection of forms by Engineer.

E. The maximum time interval between the addition of cement to the batch, and the placing of concrete in the forms shall not exceed the following:

Air of Concrete Temperature	Non Agitated Concrete	Maximum Time
80ºF or Above	26.6ºC	15 minutes
35ºF to 79ºF	1.6ºC to 26.1ºC	30 minutes
Air of Concrete Temperature	Agitated Concrete	Maximum Time
90ºF and Above	32.2ºC	45 minutes
75ºF to 89ºF	23.9ºC to 31.6ºC	60 minutes
35ºF to 74ºF	1.6ºC to 23.3ºC	90 minutes

F. Prevent segregation during placing.

G. Consolidate flat work with one pass of a mechanical vibrator moving parallel to the centerline. Unusual sections and widths may be hand puddled and finished.

H. Place concrete continuously so that each pour unit will be monolithic in construction and will terminate at an expansion, contraction or construction joint. Permit no more that 30 minutes between depositing adjacent batches.

I. Place slab concrete over membrane waterproofing before waterproofing has become damaged or dirty.

J. Concrete placement will not be permitted when impending weather conditions will impair the quality of the work.

K. Slope horizontal surfaces of exterior concrete for drainage.

L. Deposit concrete in forms in horizontal layers not deeper than 24 inches. . Avoid inclined construction joints. Place each layer while preceding layer is still plastic to avoid cold joints.

M. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

N. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to penetrate placed layer of concrete and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. Limit vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

3.06 PLACING CONCRETE IN WATER

A. Concrete shall be deposited in water only when specified on the plans or with written permission of the Engineer.

B. The forms or cofferdams shall be sufficiently tight to prevent any water current passing through the space in which the concrete is deposited.

C. Water pumping will not be permitted during the concrete placing, nor until it has set for at least 36 hours.

D. The concrete shall be placed with a tremie, closed bottom-dump bucket or other approved method.

E. The concrete shall not be allowed to fall freely through the water nor shall it be disturbed after it has been placed. Its surface shall be kept approximately level during placement.

F. The tremie shall consist of a water-tight tube 14-inches or less in diameter. It shall be constructed so that the bottom can be sealed and opened after it is in place and fully charged with concrete. It shall be supported so that it can be easily moved horizontally to cover all the

work area and vertically to control the concrete flow. The lower end of the tremie shall be submerged in the concrete at all times.

G. Bottom-dump buckets used for underwater placing shall have a capacity of not less than one-half cubic yard. It shall be lowered gradually and carefully until it rests upon the concrete already placed and raised very slowly during the upward travel; the intent being to maintain still water at the point of discharge and to avoid agitating the mixture.

H. The placing operations shall be continuous until the work is complete.

I. Unless otherwise specified, all concrete placed under water, except seal concrete, shall contain an additional sack of cement per cubic yard.

3.07 JOINTS

A.
1. Extend entirely across flat slabs at locations shown.
2. Location where not shown; maximum spacing is:
   a. Driveways: 10-feet.
   b. Sidewalks: 4-feet.
   c. Other flat slabs: 20 times slab thickness.
3. Saw depth not less than 1/4 slab thickness.

B. Expansion Joints:
1. Install where shown on the plans.
2. Locations where not shown: all structures and features which project through, into or against slab.
3. Install according to manufacturer's recommendations, set material securely before placing concrete.
4. Install 1-inch width unless shown otherwise.

C. Filling Joints:
1. Fill not later than 14 days after sawing.
2. Fill immediately following cleaning.
3. Fill to 1/8-inch of surface.
4. Remove excess while material is still pliable.
5. Refill low areas where necessary.
6. Omit filling sidewalk joints.

3.08 FINISHING EXTERIOR FLAT WORK

A. Strike off and float as required.

B. Check surface with ten foot straight edge, maximum variance allowed -1.8-inch.

C. Drag concrete surface longitudinally with double thickness burlap drag after completion of straight edging unless noted otherwise.

D. Use edger on edges of slab.

E. Use hand finishing only when approved by Engineer.

3.09 FINISHING OTHER CONCRETE

A. Interior floors: smooth, steel-troweled finish; use edger on exposed edges. Grind smooth defects which would telegraph through applied finish flooring.

B. Exterior walks and steps lightly broomed finish transverse to traffic flow; use edger on exposed edges.

C. Other surfaces:
1. Remove fins, projections and loose material.
2. Clean surfaces of form oil.
3. Patch honeycomb, aggregate pockets, voids and holes as follows:
   a. Chip out until sound concrete is exposed to minimum depth of 1-inch.

b. Prepare patching mortar with approximately two parts of normal Portland Cement, one part white cement, nine parts fine aggregate; vary proportions of aggregate as necessary to match color of adjacent concrete.

4. Fill holes left by form ties to within 1-inch of surface with non-shrink grout. Fill remainder with patching mortar specified hereinbefore.
5. Apply grout-cleaned finish to all exposed vertical surfaces. Wet surface and rub grout on surfaces with rubber or cork float. Scrape off excess grout and finish with brick rubbing or as approved by Engineer.

D. Coordinate required finish with Engineer.

3.10 CURING

A. Contractor shall inform the Engineer fully of the methods and procedures proposed for curing; shall provide proper equipment and in adequate amounts; and shall have approval of the proposed method, equipment and materials prior to placing concrete.

B. All concrete shall be cured for a period of 4 curing days except as noted herein.
1. Exceptions to 4-day Curing.
a. Upper surfaces of Bridge Roadway, Median and Sidewalk Slabs and Top Slabs of Direct Traffic Culverts require 8 curing days.
b. A curing day is defined as a calendar day when the ambient temperature, taken in the shade away from artificial heat, is above 50° Fahrenheit (10°C) for at least 19 hours, or the ambient temperature is 50° or less; and if satisfactory provisions are made to maintain the temperature at all surfaces of the concrete above 40° Fahrenheit (4.4°C) for the entire 24 hours.

C. Form Curing:
1. When forms are left in contact with the concrete, other curing methods shall not be required except for cold-weather protection.

D. Water Curing:
1. All exposed surfaces of the concrete shall be kept wet continuously for the required curing time. The water used for curing shall meet requirements for concrete mixing water.
a. Wet Mat:
1) Cotton mats shall be used for this curing method. The mats shall not be placed in contact with the concrete until such time that damage shall not occur to the surfaces.
2) Damp burlap blankets made from 9-ounce stock may be placed upon the damp concrete surface for temporary protection prior to the application of the cotton mats.
3) The mats may be placed by and wetted down after placement.
4) Mat curing, except for continuous placements, shall commence not later than three hours after finishing of the roadway slab.
5) The mats shall be weighted down adequately to provide continuous contact with all concrete surfaces where possible.
6) The surfaces of the concrete shall be kept wet for the required curing time.
7) Surfaces which cannot be cured by contact shall be enclosed with mats, anchored positively to the forms, or to the ground, so that outside air cannot enter the enclosure. Sufficient moisture shall be provided inside the enclosure to keep all surfaces of the concrete wet.
b. Water spray:
1) This method shall be accomplished by overlapping sprays or sprinklers, so that all unformed surfaces are kept continuously wet.
c. Ponding:
1) This method requires the covering of the surface with a minimum of two inches (5 cm) of clean granular material, kept wet at all times; or water to a minimum

depth of one inch (2.5 cm). Satisfactory provisions shall be made to provide a dam to retain the granular material or water.

E. Membrane Curing

1. Unless otherwise shown on the plans, Type 2 membrane curing compound may be used where permitted.
2. Membrane shall be applied in a single, uniform coating at the rate of coverage recommended by the manufacturer and as approved by the Engineer, but not less than nine gallons per 210 feet (.0038M^3 63M) of area. Tests for acceptance shall be at this specified rate.
3. Membrane curing shall not be applied to dry surfaces; but shall be applied to horizontal surfaces just before free moisture has disappeared.
4. Formed surfaces and surfaces which have been given a first rub shall be dampened and shall be moist at the time of application of the membrane.
5. When a membrane is used for complete curing, the film shall remain unbroken for the minimum curing period specified. A membrane which is damaged shall be corrected immediately by reapplication of membrane.

REQUIRED			PERMITTED	
	Water for Complete Curing	Membrane for Interim Curing	Water for Complete Curing	Membrane for Interim Curing
A. Upper surfaces of Bridge Roadway, Median and Sidewalk Slabs, Top Slabs of Direct Traffic Culverts	X	X (Resin Base)		
B. Top Surface of any Concrete Unit upon which Concrete is to be placed and bonded at a later interval (Stub Walls, Risers, etc.) Other Super structure Concrete (Curbs, Wingwalls, Parapets walls, etc.)	X			
C. Top surface of precast and/or prestressed piling	X	X		
D. All substructure Concrete, Culverts, Box Sewers, Inlets, Manholes, Retaining walls, Riprap.X			X	X

* Polyethylene sheeting or burlap polyethylene mats fastened to prevent outside air from entering shall be considered equivalent to water or membrane curing per this item.

3.11 TESTING

A. Furnish at least three cylinders or beams from each 40 cubic yard, or portion thereof for test purposes unless otherwise directed by Engineer. Test one cylinder at 7 days, test second cylinder at 28 days and test third cylinder only if needed for confirmation of compression strength.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-in: fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Use non-shrink grout as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Equipment bases and foundations: provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment. Use non-shrink grout as shown on plans.

C. Steel pan stairs: provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screen, tamp and finish concrete surfaces as scheduled.

D. Reinforced masonry; provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

END OF SECTION

SECTION 32 31 19
AMERISTAR FENCE PRODUCTS®
ECHELON II® -
Heavy Industrial Aluminum Ornamental Fence System – Internally Secured
Construction Specification –

PART 1 - GENERAL
1.01 WORK INCLUDED
The contractor shall provide all labor, materials and appurtenances necessary for installation of the industrial ornamental aluminum fence system defined herein at Lot 98 of Pharr Kelly Subdivision Pharr, Texas 78577.

1.02 RELATED WORK
Section _ _ _ - Earthwork
Section _ _ _ - Concrete

1.03 SYSTEM DESCRIPTION
The manufacturer shall supply a total industrial ornamental aluminum fence system of the Ameristar® Echelon II® (Majestic™) design. The system shall include all components (i.e., pickets, rails, posts, gates and hardware) required.

1.04 QUALITY ASSURANCE
The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 REFERENCES
- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- ASTM D523 - Test Method for Specular Gloss.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

1.06 SUBMITTAL
The manufacturer's submittal package shall be provided prior to installation.

1.07 PRODUCT HANDLING AND STORAGE
Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 - MATERIALS
2.01 MANUFACTURER
The industrial ornamental aluminum fence system shall conform to Ameristar Echelon II, (Majestic) (4-Rail) style manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma.

2.02 MATERIAL
A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T52.

B. The manufactured framework shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be (Black). The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

C. Material for fence pickets shall be 1" square x 0.062" thick (.125” wall for Invincible) extruded tubing. The cross-sectional shape of the rails shall conform to the manufacturer's ForeRunner™ design with outside cross-section dimensions of 1.75" square. The top wall and internal web of the rail shall be 0.070" thick; the sidewalls shall be 0.070" thick for superior vertical load strength. Picket holes in the ForeRunner rail shall be spaced 4.715” o.c., except for Invincible style 6’ long, which shall be, spaced 4.98” o.c. Picket retaining rods shall be 0.125” diameter galvanized steel. Fence posts and gate posts shall meet the minimum size requirements of Table 1. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections.

D. Bracket to rail attachments shall be made using specially designed one-way tamperproof security nuts with carriage bolt. Bracket to post connections shall be made using self-drilling hex-head screws.

E. Aluminum castings shall be used for all rings, post caps, finials, and miscellaneous adornments.

2.03 FABRICATION
A. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner rails shall be pre-punched to accept pickets.

B. The rail inner slide shall be fully inserted into the rail outer channel to form the raceway for the internal retaining rod. Grommets shall be inserted into the pre-punched holes in the rails, and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal raceway of the two-part ForeRunner rails. (Note: This can best be accomplished by using an alignment template). Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.

C. Completed panels shall be capable of supporting a 300 lb. load (applied at midspan) without permanent deformation. Panels shall be biasable to a 25% change in grade.

D. Gates shall be fabricated using 1.75” sq. reinforced ForeRunner rail material, 2” sq. x .250” gate ends, and 1” sq. x .125” pickets. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall be joined by welding.

PART 3 - EXECUTION
3.01 PREPARATION
All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION
Fence post shall be spaced according to Table 3, plus or minus ½”. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36” (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The “Earthwork” and “Concrete” sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE
When cutting/drilling rails or posts adhere to the following steps to seal the exposed surfaces; 1) Remove all metal shavings from cut area. 2) Apply custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1& 2 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 GATE INSTALLATION
Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING
The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 – Minimum Sizes for Echelon II Posts

Fence Posts	Panel Height
2-1/2” x 2-1/2” x .080” Alum. w/ reinforced web	Up to & Including 6’ Height
3” x 3” x .120” Alum.	Over 6’ Up to & Including 8’ Height
4” x 4” x .250” Alum.	Over 8’ Height Up to 10’

Gate Leaf	Gate Height			
	Up to & Including 4’	Over 4’ Up to & Including 6’	Over 6’ Up to & Including 8’	Over 8’ Up to & Including 10’
Up to 4’	3” x 3” x .120” Alum.	4” x 4” x .250 Alum. or 3” x 12 Ga. steel	4” x 11 Ga. steel	4” x 11 Ga. steel
4’1” to 6’	4” x 4” x .250 Alum. or 3” x 12Ga. steel	3” x 12 Ga. steel	4” x 11 Ga. steel	4” x 11 Ga. steel
6’1” to 8’	4” x 11 Ga. steel	4” x 11 Ga. steel	4” x 11 Ga. steel	6” x 3/16” steel
8’1” to 10’	4” x 11 Ga. steel	4” x 11 Ga. steel	6” x 3/16” steel	6” x 3/16” steel
10’1” to 12’	4” x 11 Ga. steel	6” x 3/16” steel	6” x 3/16” steel	6” x 3/16” steel
12’1” to 14’	6” x 3/16” steel	6” x 3/16” steel	6” x 3/16” steel	6” x 3/16” steel

Table 2 – Coating Performance Requirements

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117 & D1654	Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8” coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625” ball).
Weathering Resistance	D822 D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Echelon II – Post Spacing By Bracket Type

Span	For INVINCIBLE® 8’ Nominal (91.25” Rail)		For CLASSIC, GENESIS, & MAJESTIC 8’ Nominal (92.625” Rail)					
Post Size	2-1/2”	3”	2-1/2”	3”	2-1/2”	3”	2-1/2”	3”
Bracket Type	Industrial Flat Mount (BB301)		Industrial Universal (BB302)	Industrial Universal (BB303)	Industrial Flat Mount (BB301)		Industrial Swivel (BB304)*	
Post Settings ± ½” O.C.	94-1/2”	95”	96”	96.5”	96”	96-1/2”	*97.5”	*98”
Span	For INVINCIBLE® 6’ Nominal (71.375” Rail)		For CLASSIC, GENESIS, & MAJESTIC 6’ Nominal (67.75” Rail)					
Post Size	2-1/2”	3”	2-1/2”	3”	2-1/2”	3”	2-1/2”	3”
Bracket Type	Industrial Flat Mount (BB301)		Industrial Universal (BB302)	Industrial Universal (BB303)	Industrial Flat Mount (BB301)		Industrial Swivel (BB304)*	
Post Settings ± ½” O.C.	75”	75.5”	71.5”	72”	71.5””	72”	*73”	*73.5”

Note: When using BB304 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.

SECTION 331110
WATER TRANSMISSION LINES AND/OR PRESSURE WASTEWATER LINES

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

A. Trench Excavation, Backfill, and Compaction: Section 312200.

B. Water Valves: Section 331120.

1.02 SUBMITTALS:

A. Conform to requirements of Section 013300. Manufacturer's Literature: Manufacturer's descriptive literature and recommended method of installation.

B. Certificates: Manufacturer's certification that products meet specification requirements. 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 City Engineer is at Contractor's risk.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials on manufacturer's original skids or in original unopened protective packaging. OWNER reserves the right to reject material left from another job.

B. Store materials to prevent physical damage.

C. Protect materials during transportation and installation to avoid physical damage.

1.04 GENERAL DESCRIPTION OF WORK COVERED:

A. Furnish and install all pipe, fittings, structures and accessories required for water transmission line and/or pressure wastewater lines.

1.05 QUALITY ASSURANCE:

A. Comply with the latest published edition of American Water Works Association (AWWA) Standards:
   1. AWWA C110/A21.10 & C110a - Gray Iron and Ductile-Iron Fittings, 2 inch through 48 inch for water and other liquids.
   2. AWWA C111/A21.11 - Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.
   3. AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe.
   4. AWWA C151/A21.51 - Ductile-Iron Pipe, centrifugally cast in metal mold or sand lined molds, for water or other liquids.
   5. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe 4 inch through 12 inch for water.
   6. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe 14 inch through 48 inch for water.
   7. other liquids.

B. Comply with the latest published editions of the American Society for Testing and Materials (ASTM) Standards:
   1. ASTM D2241 - Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
   2. ASTM D3139 - Joints for PVC Pressure Pipes using Flexible Elastomeric Seals.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. Pipe furnished may be either Polyvinyl Chloride (PVC), Steel Cylinder (SCP) or Ductile Iron (DI) as specified herein for water mains unless shown otherwise on the plans or bid documents.

B. Use PVC pipe for all pressure wastewater lines unless shown otherwise on the plans. Pressure wastewater lines shall be color coded green.

C. All pipe shall be marked in accordance with the applicable standard specification under which the pipe is manufactured unless otherwise specified and shall be National Sanitation Foundation (NSF) approved stamped.

D. Steel cylinder pipe manufactured shall have had a successful experience record in the design and manufacture of steel cylinder pipe with substantial footage in successful operation for at least five years.

E. The quality of materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the Engineer at the pipe manufacturing plant and at the project site prior to and during installation. All water distribution pipe and fittings shall be listed in the Fire Protection Equipment Directory published by the Underwriter's Laboratories, Inc. or shall be Factory Mutual approved for fire service.

2.02 POLYVINYL CHLORIDE PIPE (PVC):

A. Waterlines 12" and less may be constructed of PVC water pipe, pressure pipe, in accordance with AWWA C900 (latest version) for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inches through 12-inches, for Water Distribution. All pipe should be designed and installed with a minimum of four-foot cover.

B. Waterlines 14 inches through 48 inches may be constructed of PVC water pipe, pressure pipe, in accordance with AWWA standard C905 (latest version) for PVC Water Transmission Pipe and Fabricated Fittings. All pipe should be designed and installed with a minimum of four-foot cover.

C. Provide push-on joints with bell integrally cast into pipe or with coupling of same material as pipe.

D. Use elastomeric gaskets, as provided in AWWA C900 or ASTM D3139.

E. Provide either cast-iron or PVC 1120 fittings as indicated or required. Use long radius fittings where possible.

F. Provide fittings with materials and pressure class equal to or greater than that specified for pipe.

G. Provide sleeve type or anchored coupling where indicated or required to join pipe or provide restraint to offset internal or hydrostatic test pressures.

H. Provide pipe marked to indicate the following:
   1. Nominal Pipe Size.
   2. Material Code Designation.
   3. Standard Dimension Ratio.
   4. Pressure Rating.
   5. Manufacturer's name or trademark.
   6. National Sanitation Foundation Seal.
   7. Appropriate ASTM designation number.

2.03 STEEL CYLINDER PIPE (SCP):

A. Provide pipe with a minimum working pressure of 200 psi or as shown on the plans or in the specifications.

2.04 DUCTILE IRON PIPE (DIP):

A. Pipelines ranging in size from 12 inches through 36 inches in diameter shall comply with the latest published edition of AWWA as modified herein:
   1. AWWA C104/A21.4 - ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
   2. AWWA C105/A21.5 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
   3. AWWA C110/A21.10 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3-inches through 48-inches (76 mm through 1,219 mm), for Water and Other Liquids
   4. AWWA C111/A21.11 - ANSI Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
   5. AWWA C115/A21.15 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

6. AWWA C150/A21.50 - ANSI Standard Thickness Design of Ductile-Iron Pipe
7. AWWA C151/A21.51 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
8. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
9. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.
10. ASTM G 62 - Test Methods for Holiday Detection in Pipeline Coatings.
11. AWWA C600 - Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.
12. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.
13. Ductile-iron push-on and mechanical joint pipe shall meet all requirements of standard AWWA C151/A21.51 .

B. Joint Types include ANSI A21.11 push-on; ANSI A21.11 mechanical joint; or ANSI A21.15 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 C111/A21.11. Threaded- or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

C. 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 A21.51.

D. Provide certifications that all pipe joints have been tested and meet requirements of ANSI A21.11.

E. Ductile-iron flanged pipe shall meet all requirements of standard AWWA C115/A21.15 . Barrels shall have a nominal thickness required by Table 1 of AWWA C115/A21.15 , which thickness corresponds to Special Class 53 in sizes through 54-inch, and Class 350 in 60- and 64-inch sizes. Flanges shall be ductile-iron (gray-iron is not acceptable) they shall be Class 125 flanges as shown in ANSI/ASME B16.1; and shall conform to dimensions shown in Table 2 and Figure 1 ofAWWA C115/A21.15. Flanges shall be fabricated and attached to the pipe barrels by U.S. fabricators using flanges and pipe barrels of U.S. manufacture. If fabrication is to be by other than the pipe barrel manufacturer, a complete product submittal and approval by the Water and Wastewater Utility will be required. Additionally, such fabricator shall furnish certification that each fabricated joint has been satisfactorily tested hydrostatically at a minimum pressure of 300 psi.

F. 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. Do not use polyethylene wrap with a cathodic protection system.

G. 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.
   4. Provide for restrained joints designed to meet test pressures required under Part 3.04 of this section.

H. Linings and Coating: Interior surfaces of all ductile-iron water pipe shall be cement-mortar lined and seal coated as required by AWWA C104/A21.4 . Pipe exteriors shall be coated as required by the applicable pipe specification. The type and brand of interior lining shall be clearly marked on the outside of the pipe and fittings. Except as authorized by the E/A, only one type and brand of pipe lining shall be used on a given project.

I. 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. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer as resistant to the contaminants identified.

J. Except as described above for flanged pipe (Thickness Class 53) and where not otherwise indicated, ductile-iron pipe shall be minimum Pressure Class 250 as defined by AWWA C150/A21.50; all ductile-iron pipe and flanges shall meet the following minimum physical requirements:
   1. Grade 60-42-10:
   2. Minimum tensile strength: 60,000 psi (414 MPa)
   3. Minimum yield strength: 42,000 psi (290 MPa)
   4. Minimum elongation: 10 percent

K. The flanges for AWWA C115/A21.15 pipe may also be made from:
   1. Grade 70-50-05:
   2. Minimum tensile strength: 70,000 psi (483 MPa)

L. Minimum yield strength: 50,000 psi (345 MPa)
   1. Minimum elongation: 5 percent

M. Joint Materials:
   1. Gaskets for mechanical joints shall conform to ANSI/AWWA A21.11/C-111.
   2. 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.
   3. 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

   4. Joining of slip joint iron pipe shall, without exception, be accomplished with the natural or synthetic rubber gaskets of the manufacturer of that particular pipe being used. A joint lubricant shall be used, and applicable recommendations of the manufacturer shall be followed.
   5. Gaskets for flanged joints shall be continuous full-face gaskets, of 1/8-inch minimum thickness of natural or synthetic rubber, cloth reinforced rubber or neoprene material, preferably of deformed cross section deign and shall meet all applicable requirements of ANSI/AWWA A21.11/C-111 for gaskets. They shall be manufactured by, or satisfy all recommendations of, the manufacturer of the pipe/fittings being used and be fabricated for use with Class 125 ANSI B16.1 flange.
   6. Tee-head bolts, nuts, and washers for mechanical joints shall be high strength, low alloy, corrosion resistant steel stock equal to "COR-TEN A" having UNC Class 2 rolled threads or alloyed ductile-iron conforming to ASTM A 536; either shall be fabricated in accordance with ASTM B18.2 with UNC Class 2 rolled threads.
   7. Hex-head bolts and nuts shall satisfy the chemical and mechanical requirements of ASTM A449
   8. SAE Grade 5 plain and shall be fabricated in accordance with ASTM B 18.2 with UNC Class 2 rolled threads.
   9. Either Tee-head or Hex-head bolts, nuts, and washers as required, shall be protected with bonded fluoropolymer corrosion resistant coating where specifically required by the E/A.
   10. All threaded fasteners shall be marked with a readily visible symbol cast, forged or stamped on each nut and bolt, which will identify the fastener material and grade. The producer and the supplier shall provide adequate literature to facilitate such identification; painted markings are not acceptable and the number of degrees for bends. Painted markings are not acceptable.
   11. 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.

12. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.
13. 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.
14. Mechanical Joint Fittings: ANSI A 21.11 (AWWA C110/A21.10); pressure rated at 250 psi.

2.05 DUCTILE IRON PIPE FITTINGS:

A. Fittings shall be push-on, flanged, or mechanical joint as indicated or approved, with pressure rating of not less than that specified for adjacent pipe and shall meet all requirements of standards as follows:
   1. Sizes 4-inch and larger: AWWA C110/A21.10
   2. Shall be compatible with joint type of adjacent pipe.
   3. All specials, taps, plugs, flanges and wall fittings shall be as required.
   4. Interior surfaces of all iron water pipe fittings shall be lined with cement-mortar and seal coated as required by AWWA C104/A21.4 . Interior surfaces of all iron wastewater and force main fittings shall be coated with a non-corrosive lining material acceptable to Owner.
   5. Fitting exteriors shall be coated as required by the applicable pipe specifications.

2.06 VALVES, HYDRANTS, METERS AND APPURTENANCES:

A. Valve Boxes:
   1. Provide for all buried valves.
   2. Use nominal 6-inch cast-iron sliding type pipe shaft with cover and base casting.
   3. Set box top at finished grade.
   4. Furnish drop cover appropriately marked "WATER".

B. Corporation Stops:
   1. Conform with AWWA C800.
   2. Use 3/4 inch unless indicated otherwise.

C. Hydrants:
   1. Design: latest edition of AWWA C502, traffic model with break flange.
      a. Mueller Centrurion - A423
   2. American-Darling - B-84-B
      a. Kennedy Guardian - K-81A
      b. U.S. Pipe - Metropolitan
      c. Others as approved by OWNER in writing
   3. Provide 6-inch inlet, 2 - 2> inch hose nozzles, 1 - 4> inch pumper.
   4. Provide compression type main valve, minimum size 5< inches.
   5. Pentagon operating nut.
   6. Design to open counterclockwise.
   7. Provide mechanical joint bell on foot piece.
   8. Furnish depth as noted on plans.
   9. Furnish National (American) Standard Fire Hose Coupling Screw Thread (NH).

D. Polyethylene Wrapping:
   1. Material: AWWA C105/A21.5 .
   2. Thickness: 8 mils.

E. Polyethylene Plastic Pipe (PE):
   1. Material: ASTM D2737.
   2. Fittings: ASTM D2683.
   3. Size: 3/4 inch unless shown otherwise on plans.

F. Copper Pipe (CU):
   1. Material: seamless, Type K, ATM B88.

2. Fittings: wrought copper solder joint or flared.
3. Size: 3/4 inch unless shown otherwise on plans.

PART 3 – EXECUTION

3.01 GENERAL:

A. Provide all labor, equipment and materials and install all pipe fittings, special and appurtenances as indicated or specified.

3.02 PIPE INSTALLATION:

A. Handling:
   1. Handle in a manner to insure installation in sound and undamaged condition.
   2. Do not drop or bump.
   3. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.
   4. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.
   5. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation:
   1. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.
   2. Do not lay on blocks unless pipe is to receive total concrete encasement.

C. Accomplish horizontal and vertical curve alignments of ductile iron pipe with bends, bevels or deflection joints.
   1. Limit joint deflection with ductile iron pipe to conform with AWWA C600.

D. Use short specials preceding curves as required.
   1. Obtain approval of ENGINEER of method proposed or transfer of line and grade from control to the work.
   2. Install pipe of size, material, strength class, and joint type with embedment as shown on plans or specified herein.
   3. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
      a. Close open ends of pipe with snug fitting closures.
      b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
      c. Remove water, sand, mud and usher undesirable materials from trench before removal of end cap.
   4. Pipe shall be inspected prior to installation to determine if any pipe defects are present.
   5. Brace or anchor as required to prevent displacement after establishing final position.
   6. Perform only when weather and trench conditions are suitable.
      a. Do not lay in water.
   7. Observe extra precaution when hazardous atmospheres might be encountered.
   8. Sanitary wastewater relation to water mains:
      a. Maintain 9 feet horizontal separation whenever possible.
      b. When conditions prevent a lateral separation of 9 feet, wastewater may be installed closer to a water main if:
         1) wastewater constructed of PVC pipe meeting AWWA Specifications and having a minimum working pressure rating of 150 psi or greater and equipped with pressure type joints, and
         2) the wastewater line and water main are separated by a minimum vertical distance of 2 feet and a minimum horizontal distance of 4 feet, measured between the nearest outside diameters of the pipes.

c. When a sanitary wastewater crosses a water line and that portion of the wastewater is constructed as described in this section, the wastewater may be placed no closer than 12 inches from the water line. The separation distance must be measured between the nearest outside pipe diameters. The wastewater line shall be located at a lower elevation than the water line whenever possible and one length of the wastewater pipe must be centered on the water line.

9. Separation of water mains from wastewater manholes:
   a. No water pipe shall pass through or come in contract with any part of a wastewater manhole.
   b. A minimum horizontal separation of 9 feet shall be maintained.
10. Construct service lines where shown on plans in accordance with Standard Detail Drawing. Use pipe material specified on plans or in contract documents.
11. Wrap pipe, fittings and tie rods with polyethylene where shown on plans in accordance with AWWA C105/A21.5 .

E. Jointing:
   1. General requirements:
      a. Locate joint to provide for differential movement at changes in type of pipe embedment, at changes from rock to soil trench bottom, and structures.
         1) Not more than 18 inches from structure wall, or
         2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.
      b. Perform in accordance with manufacturer's recommendations.
      c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.
      d. Utilize methods and equipment capable of fully homing or making up joints without damage.
      e. Check joint opening and deflection for specification limits.
   2. Special provisions for jointing cast-iron and ductile iron:
      a. Conform to AWWA C600.
      b. Visually examine while suspended and before lowering into trench.
         1) Paint bell, spigot, or other suspected portions with turpentine and dust with cement to check for cracks invisible to the eye.
         2) Remove turpentine and cement by washing when test is satisfactorily completed.
         3) Reject all defective pipe.
   3. Special provisions for jointing and laying PVC pipe:
      a. Conform to AWWA C600 and ASTM D2321
      b. Allow pipe to reach trench soil temperature prior to installation in ditch.
   4. Special provisions for jointing steel cylinder pipe:
      a. Before laying each joint, the bell and spigot rings shall be cleaned by wire brush and wiped clean and dry.
      b. Inside cement mortar joint:
         1) the inside joint recess shall be filled immediately prior to placing the pipe together by buttering the bell end with mortar.
         2) the joint mortar of pipe 18 inch diameter and smaller shall be smoothed and cleaned with a swab.
         3) the joint mortar of pipe diameters larger than 18 inches shall be finished off smooth by hand trowel.
      c. Outside cement mortar joint:
         1) encircle joint with wrapper after joint found satisfactory.
         2) leave enough space between wrapper ends to allow cement mortar to be poured.
         3) the entire joint shall be poured with cement mortar and consolidated and rodded or agitated to eliminate voids.

F. Cutting:
   1. Cut in neat workmanlike manner without damage to pipe.
   2. Cut cast-iron with Carborumdum saw or other approved method.
      a. Smooth cut by power grinding to remove burrs and sharp edges.
      b. Repair lining as required and approved by ENGINEER.

G. Closure Pieces:
   1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
   2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.
   3. May be accomplished with sleeve coupling for water pipe:
      a. Of length such that gaskets are not less than 3 inches from pipe ends.
      b. Include spacer ring identical to pipe end such that clear space does not exceed 1/4 inch.

H. Temporary Plugs:
   1. Install whenever installed pipe is left unattended.
   2. Use water-tight plug.

I. Cutting and Plugging Water Mains:
   1. Where the plans call for abandoning water mains, adhere to the following general procedure:
      a. After constructing, disinfecting, testing, and placing the replacement main in service, and services are transferred to the replacement main, locate the main to be abandoned, trace it back to the feeder main, and at this point cut and plug it at the tee. Normally, installing a plug, clamp, and a concrete thrust block does this. In cases of 1-1/2 in. or 2 in. corporation cock or tapping sleeve and valve (TS&V) connections, remove the valve and install a cap or plug at the tee. Ensure the line to be abandoned is not valves off at the nearest valve, nor cut and plugged other than at the supply main.
      b. Adequately plug the ends or openings in abandoned mains or cap them in an approved manner and replace excavation, backfill, and any street surfaces, to the Engineer's satisfaction. Perform this work in accordance with Excavations and Backfilling sections.
      c. Remove surface identification, i.e., valve boxes and fire hydrants. Where valve boxes are in improved streets (other than shell), pouring valve boxes full of concrete with the cap permanently removed is permitted.
      d. Do not remove plugs during the months of peak water demands, June, July, and August, unless otherwise approved.

J. Wet Connections:
   1. Make the wet connections, as directed, in such a manner and at such hours to minimize inconvenience to the public. When the existing mains have been cut or a plug removed for a connection, pursue the work of making the connection without interruption until complete.
   2. If the Contractor proceeds with a wet connection without a complete shut-off, there will be no extra compensation for damages or extra work resulting from the incomplete shut-off.
   3. The Utility Owner will operate gate valves in the existing system and in sections of completed mains that have been placed in service. Notify the Utility Owner at least 48 hr. in advance of making connections.
   4. Wet connections that are 2 in. or smaller are sometimes referred to on the plans as 2 in. standard connections or gooseneck connections.
   5. Items that may be necessary to complete these types of wet connections include corporation cock, saddle, copper tubing, brass fittings, and 2 in. valves. Do not use these connections on or consider them as part of a 2 in. service line.

6. The Utility Owner will handle, at no cost to the Contractor, operations involving opening and closing valves for wet connections.

K. Installing Service Lines:
1. For curb and gutter streets, lay copper service lines with a minimum 30 in. of cover from top of curb to the top of the service line. For crowned streets with open ditches, lay copper service lines with a minimum 30 in. of cover at the crown and with a minimum 18 in. of cover from the flow line of the ditch to the top of the service line. Ensure service line locations are clear of proposed paving and underground work.
2. Exercise caution to keep the lines free of dirt and foreign matter at all times. Assemble copper lines in an entirely slack position and free of kinks. Use service lines consisting of one continuous run of copper tubing where possible. Do not use bends greater than that originally found in the coil of tubing as packaged.
3. For 1-1/2 in. and 2 in. copper tubing shipped in straight lengths, use the following bend criteria:
   a. For 2 in. copper tubing, a maximum of one 45° bend may be accomplished in a 4 ft. section; for 1-1/2 in. copper tubing, a maximum of one 45° bend in a 3 ft. section. No kinks, dents, flats, or crimps will be permitted.
   b. Locate meters, in general, 1 ft. into the street right of way. Where this is not applicable, locate meters approximately 1 ft. from the sidewalk on the curb side. If the present meter location conflicts with proposed driveway turnouts or other proposed street improvements, shift the meter to miss the obstruction and reconnect it to the customer's service line. Reset meters at positions such that the top of the meter is 4 in. to 6 in. below the finished grade.
   c. Where the plans call for salvaging and relocating the meter, meter box, and curb stop, remove these materials with care, thoroughly clean them, and submit them for inspection by the Engineer, before installing them in the new location. If the plans call for relocating the meter (other than at some point along the existing service line), a new service line will be required.
   d. Where it is necessary to cross a paved street, push the service line under the paving through a pre-drilled and prepared opening. Use only full lengths of copper tubing, taking care not to damage the tubing when pulling it through the prepared hole.
   e. A compression type union is only permitted when a full 40 ft. (60 ft. for 3/4 in. to 1 in.) length of tubing cannot completely span underneath the pavement. Do not use compression type unions under the paved street.

L. Adjusting Existing Surface Structures:
1. Valve Boxes
   a. Salvage and reuse the valve box. Remove and replace the 6 in. ductile-iron riser pipe with a suitable length for the depth of cover required to establish the adjusted elevation to accommodate the actual finished grade.
   b. Reinstall the valve box and riser piping plumbed in a vertical position. Provide a minimum of 6 in. telescoping freeboard space between the riser pipe top butt end and the interior contact flange of the valve box, for vertical movement damping.
   c. After setting, aligning, and adjusting the valve box so that the top lid is level with the final grade, place a 24in. by 24 in. by 8 in. thick concrete block around the valve box. Center the valve box horizontally within the concrete box.
2. Meter Boxes
   a. Salvage and reuse meter boxes when possible. Reinstall them in conformance with the manufacturer's recommendations. Repair any damage sustained by the meter box during relocation or service transfer, at no expense to the Department.
   b. If the existing meter box requires replacement, the Contractor may obtain a new box from the Utility Owner by providing adequate documentation of the existing and proposed locations.
3. Meter Vaults

a. Adjust meter vaults in conformance with the details shown on the plans. Salvage and reuse access covers.

M. Removing and Salvaging Fire Hydrants and Water Meters:
1. Deliver removed and salvaged fire hydrants and water meters to the Utility Owner at the location shown on the plans, or as directed.

N. Removing Water Mains and Removing Water Mains with Casing:
1. Remove water mains and water mains with casing in accordance with Item 100, or as shown on the plans. This includes removing and disposing of pipe and appurtenances as shown on the plans or as directed. Perform related excavation and backfilling, as required, at no additional cost the Department.

O. Thrust Blocks:
1. Provide for all horizontal or vertical turns utilizing fittings.
2. Use on all dead-end and tee fittings.
3. Install as indicated on Standard Detail Drawing
4. Construct to undisturbed edge of trench for bearing.
5. Provide minimum bearing area in S.F. as follows based on 150 psi test pressure and 2000 psf soil bearing:

Pipe Size	Tee / Deadends	11<0 Bend	22>0 Bend	45° Bend	90° Bend
4"	1.0	0.5	0.5	0.8	1.3
6"	2.2	0.5	0.9	1.6	3.0
8"	3.8	0.8	1.5	2.9	5.3
10"	6.0	1.2	2.3	4.5	8.4
12"	8.5	1.7	3.3	6.5	12.1
14"	11.6	2.3	4.5	8.9	16.4
16"	15.2	3.0	5.9	11.6	21.4

6. Shall apply to all pipe materials specified.

3.03 VALVE AND APPURTENANCE INSTALLATION:

A. Valves:
1. Install with stems vertical when installation is horizontal.
2. Set valves on concrete thrust block having four (4) square feet of bearing area on undisturbed earth.

B. Valve Boxes:
1. Center on valves.
2. Carefully tamp earth around each valve box to a distance of 4 feet on all sides of box or to undisturbed trench face, if less than 4 feet.

C. Hydrants:
1. Set hydrants where shown on plans in accordance with Standard Detail Drawing.
2. Install gravel, blocks and anchors in accordance with Standard Detail Drawing.
3. Set reference elevation 3 inches above existing grade or to elevation established by ENGINEER (not to exceed 6 inches).
4. Break-a-way flange to be either ground level where applicable or between 3 inches and 6 inches above curb as established by ENGINEER.

3.04 ACCEPTANCE TESTS FOR PRESSURE MAINS

A. All testing must meet or exceed Texas Commission on Environmental Quality's current requirements.

B. Perform hydrostatic pressure and leakage test.
   1. Conform to AWWA C600 procedures.
      a. As modified herein.
      b. Shall apply to all pipe materials specified
   2. Perform after backfilling.

C. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.
   1. CONTRACTOR to furnish and install test plugs, including all anchors, braces and other temporary or permanent devices to withstand hydrostatic pressure on plugs, at no additional cost to the OWNER.
   2. CONTRACTOR responsible for any damage to public or private property caused by failure of plugs.

D. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 1 fps.

E. OWNER will make water for testing available to contractor at nearest source. Valves of existing system will at all times be operated by City personnel only.

F. Pressure test:
   1. Conduct at pressure at least 1.5 times than normal working pressure (not less than 150 psi test pressure).
   2. Maintain pressure for a minimum of two (2) hours.
   3. Test pressure shall not vary by more than +5 psi

G. Leakage Test:
   1. Conduct concurrently with the pressure test.
   2. Maintain pressure for a minimum of two (2) hours.
   3. Acceptable when leakage does not exceed that determined by the following formula:
      a. L = Maximum permissible leakage in gallons per hour.
      b. N = Number of pipe joints in segment under test.
      c. O = Nominal internal diameter of pipe being tested in inches.
      d. P = Average actual leakage test pressure, psig.
   4. Repeat leakage test as necessary.
      a. After location of leaks and repair or replacement of defective joints, pipe or fittings. Until satisfactory performance of test is at no increase in cost to the OWNER.

H. Refit and replace all pipe not meeting the leakage or pressure requirements. Repair clamp is not permitted.

I. Repair all visible leaks regardless of the amount of leakage.

J. OWNER or ENGINEER will observe all tests.

3.05 DISINFECTION OF PIPELINES FOR CONVEYING POTABLE WATER

A. CONTRACTOR provide all equipment and materials and perform in accordance with AWWA C601.
   1. As modified herein.
   2. Include chlorination and final flushing.

B. Add chlorine to attain an initial concentration of 50 mg/l chlorine with 10 mg/l remaining after 24 hours.

C. Flush main until concentration is 2 mg/l or less prior to placing main in service.

D. Obtain approval of materials and methods proposed for use.

E. May be conducted in conjunction with acceptance tests.

F. Dispose of flushing water without damage to public or private property.

G. Repeat disinfection procedure should initial treatment fail to yield satisfactory results.
   1. At no additional cost to the OWNER.
   2. OWNER will provide water under terms specified for acceptance tests.

H. Do not exceed 500 gpm rate in flushing.

I. Provide safe bacterial sample results before placing main into service.

PART 4 - MEASUREMENT

4.01 WATER MAIN PIPE AND STEEL CASING.

A. Measured by the foot, of the various sizes and types specified. Water mains and casing will be measured along the axis of the pipe and no deductions will be made for valves or fittings. Reducers will be classed as pipe of the size of the larger end.

4.02 SPLIT STEEL CASING.

A. Measured by the foot, of the various sizes shown on the plans.

4.03 FIBERGLASS REINFORCED PLASTIC (FRP) PIPE FOR CASING.

A. Measured by the foot, of the various sizes shown on the plans.

4.04 JACKING, TUNNELING, BORING, OR AUGERING.

A. Jacking, Tunneling, Boring, or Augering for water mains and steel casing will be measured by the foot, of the sizes, types, and wall thickness (applicable only for casing) specified.

4.05 NEW COPPER SERVICE LINES.

A. Measured by each service line installed.

B. Short Side service line refers to service connections made to meters located on the same side of the street as the supply main is located. Long Side service line refers to service connections made to meters located on the opposite side of the street from the supply main, or from the center of the street, where the supply main is located in the center of the street.

4.06 GATE VALVES, TAPPING SLEEVES AND VALVES, AND BUTTERFLY VALVES.

A. Measured by each assembly installed, of the various sizes specified.

4.07 FIRE HYDRANTS.

A. Measured by each assembly installed, including a 6-in. gate valve and box, regardless of depth. It is the Contractor's responsibility to install the fire hydrant assembly such that it meets the standard installation requirements of this specification and the manufacturer's specifications.

B. Fire Hydrant Branches (Leads) are subsidiary to fire hydrant assembly.

4.08 METERS AND VAULTS.

A. Measured by each assembly constructed.

4.09 AIR RELEASE AND VACUUM RELIEF VALVES.

A. Measured by each assembly, of the various sizes, with the valve box installed.

4.10 PRESSURE REDUCING STATIONS.

A. Measured by the lump sum unit constructed.

4.11 BLOW OFF VALVES.

A. Measured by each assembly, of the various sizes and types, with the corporation stop, spool, spool piece, branch lead, and gate valve box installed.

4.12 REMOVING FIRE HYDRANTS.

A. Measured by each assembly removed and disposed of properly.

4.13 REMOVING WATER VALVES AND BOXES.

A. Measured by each assembly removed and disposed of properly.

4.14 REMOVING AND RELOCATING METERS AND BOXES.

A. Measured by each assembly removed, cleaned, and installed at the new location.

4.15 REMOVING METERS AND VAULTS.

A. Measured by each assembly removed and disposed of properly.

4.16 REMOVING AND SALVAGING WATER METERS.

A. Measured by each assembly removed and salvaged.

4.17 REMOVING AND SALVAGING FIRE HYDRANTS.

A. Measured by each assembly removed and salvaged.

4.18 REMOVING AND RELOCATING WATER METERS AND METER VAULTS.

A. Measured by each assembly removed and relocated.

4.19 ADJUSTING METER VAULTS.

A. Measured by each assembly adjusted.

4.20 ADJUSTING METER BOXES.

A. Measured by each assembly adjusted.

4.21 ADJUST OR RELOCATE WATER METER.

A. Measured by each assembly adjusted or relocated.

4.22 LOWERING WATER MAINS.

A. Measured by the foot, of the sizes and types of pipe lowered.

4.23 CUTTING AND PLUGGING WATER MAINS.

A. Measured by each location a water main is cut and plugged, of the sizes indicated.

4.24 REMOVING PRESSURE REDUCING STATIONS.

A. Measured by each complete pressure reducing station removed.

4.25 WET CONNECTIONS.

A. Measured by each connection, of the sizes specified.

4.26 EXTRA HAND EXCAVATION OR EXTRA MACHINE EXCAVATION.

A. Measured by the cubic yard in its original position. Excavation performed by manual labor at the locations specifically designated by the Engineer, and which is not included under or subsidiary to other bid items contained in this specification, is considered Extra Hand Excavation or Extra Machine Excavation.

4.27 ADJUSTING MANHOLES.

A. Adjusted manholes will be measured as each manhole adjusted.

B. Measured by the foot.

4.28 CUTTING AND CAPPING WATERLINE.

A. Measured by each waterline cut and capped of the sizes specified.

PART 5 - PAYMENT

5.01 WORK

A. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit prices bid for the items of work described below. These prices are full compensation for excavation and backfill required for excavation protection; furnishing, placing, and removing shoring, sheeting or bracing; de-watering or diversion of water; jacking and jack removal, hauling, placing, and installing the materials; for inspecting and testing; and for other materials, labor, equipment, tools, and incidentals.

5.02 NEW

5.03 WATER MAIN PIPE AND STEEL CASING.

1. Payment for water main pipe, and steel casing will be made at the unit prices bid for "Water Main Pipe (Cast-Iron)," "Water Main Pipe (Steel)," "Water Main Pipe (Ductile Iron)," "Water Main Pipe (Copper)," "Water Main Pipe (Polyvinyl Chloride)(PVC)," and "Casing (Steel)," of the various sizes and types specified, installed by the open-cut method.
2. Unless otherwise shown on the plans or specifications, fittings, excavating, disposing of unsuitable excavated material, backfilling, and the material for backfill, for the complete installation of the water main system, are subsidiary to this bid Item.

B. **Split Steel Casing.**

1. Payment for split steel casing will be made at the unit price bid for "Split Steel Casing," of the various sizes specified, installed by the open cut method.

C. **Fiberglass Reinforced Plastic (FRP) Pipe for Casing.**

1. Payment for Fiberglass Reinforced Plastic (FRP) Pipe for Casing will be made at the unit price bit for "Fiberglass Reinforced Plastic (FRP) Pipe for Casing" of the various sizes specified.

D. **Jacking, Tunneling, Boring, or Augering.**

1. Payment for jacking, tunneling, boring, or augering water main will be made at the unit price bid for "Jacking, Tunneling, Boring, or Augering (Water Main)," of the sizes and types specified. This price includes furnishing the pipe.
2. Payment for jacking, tunneling, boring, or augering steel casing will be made at the unit price bid for "Jacking, Tunneling, Boring, or Augering Casing (Steel)," of the sizes, types, and wall thickness specified. This price includes the casing, casing spacers, labor, equipment, tools, and incidentals, and other materials required to place the watermain in and through the casing. Water mains placed in the casing will be paid for by the appropriate bid item.
3. Excavating, backfilling, backfill material, and disposing of unsuitable excavated material for jacking, tunneling, boring, or augering pits are subsidiary to these bid items.

E. **New Copper Service Lines.**

1. Payment for copper service lines will be made at the unit price bid for "Service Line (Short Side 5/8 in. to 1 in.)," "Service Line (Long Side 5/8 in. to 1 in.)," "Service Line (Short Side 1-1/2 in. to 2 in.)" and "Service Line (Long Side 1-1/2 in. to 2 in.)," installed. This price is full compensation for labor, materials, excavation, and backfill required to install the facility, including connection to the customer's service line.

F. **Gate Valves, Tapping Sleeves and Valves, and Butterfly Valves.**

1. Payment for gate valves, tapping sleeves and valves, and butterfly valves will be made at the unit price bid for "Gate Valve," "Tapping Sleeve and Valve," and "Butterfly Valve," of the various sizes specified, with the valve box installed.

G. **Fire Hydrants.**

1. Payment for fire hydrants will be made at the unit price bid for "Fire Hydrant Assembly," including 6 in. gate valve and box, installed regardless of barrel depth.
2. Fire hydrant branches (leads) are subsidiary to "Fire Hydrant Assembly" installed by the open-cut method.
3. Any adjustment required either in the flow line of the water main or to the barrel length of the fire hydrant is subsidiary to this bid Item.

H. **Meters and Vaults.**

1. Payment for meters and vaults will be made at the unit price bid for "Meter and Vault" constructed.

I. **Air Release and Vacuum Relief Valves.**

1. Payment for air release and vacuum relief valves will be made at the unit price bid for "Air Release and Vacuum Relief Valve," of the various sizes specified, with the valve box installed.

J. **Pressure Reducing Stations.**

1. Payment for pressure reducing stations will be made at the unit price bid for “Pressure Reducing Station.” This price is full compensation for performing the necessary excavation, backfill, finish grading, constructing the concrete structure, and furnishing and installing station appurtenances addressed under Article 2, “Materials,” of this specification.

K. **Blow Off Valves.**

1. Payment for blow off valves with boxes will be made at the unit price bid for “Blow Off Valve” of the various sizes and types specified, with corporation stop, spool, piece , branch lead, gate and gate valve box installed are subsidiary to this bid item.

L. **Removing Fire Hydrants.**

1. Payment for removing fire hydrants will be made at the unit price bid for “Removing Fire Hydrant.” This price includes removing valves from the existing location, disposing of the valves, and plugging at the tee. Excavation and backfill required for removing fire hydrants are subsidiary to this bid Item.

M. **Removing Water Valves and Boxes.**

1. Payment for removing water valves and boxes will be made at the unit price bid for “Removing Water Valve and Box.” Excavation and backfill required for removing water valves and boxes are subsidiary to this bid Item.

N. **Removing and Relocating Meters and Boxes.**

1. Payment for removing and relocating meters and boxes will be made at the unit price bid for “Removing and Relocating Meter and Box.”

O. **Removing Meters and Vaults.**

1. Payment for removing meters and vaults will be made at the unit price bid for “Removing Meter and Vault.” This includes salvaging the meter strainers and valves and delivering them to their owner at the location shown on the plans or as directed.

P. **Removing and Salvaging Water Meters.**

1. Payment for removing and salvaging water meters will be made at the unit price bid for “Removing and Salvaging Water Meter.” This price includes removing salvaged water meters from the existing locations and delivering them to the owner. Excavation, backfill, and finish grading required for removing the water meters are subsidiary to this bid Item.

Q. **Removing and Salvaging Fire Hydrants.**

1. Payment for removing and salvaging fire hydrants will be made at the unit price bid for “Removing and Salvaging Fire Hydrant.” The salvaging of fire hydrants will be a cash reimbursement to the owner by the Contractor where the fire hydrants will become the property of the Contractor or the Contractor will deliver the fire hydrants to the Utility Owner at the location shown on the plans. Excavation, backfill, and finish grading required for removing fire hydrants are subsidiary to this bid Item.

R. **Removing and Relocating Water Meters and Meter Vaults.** Payment for removing and relocating water meters and meter vaults will be made at the unit price for “Removing and Relocating Water Meter and Meter Vault.”

1. Payment for removing and relocating water meters and meter vaults will be made at the unit price for “Removing and Relocating Water Meter and Meter Vault.”

S. **Adjusting Meter Vaults.** Payment for adjusting meter vaults will be made at the unit price bid for “Adjusting Meter Vault.” This price is full compensation for furnishing the required materials, including backfill as required, excavation, tools, labor, equipment, and incidentals.

1. Payment for adjusting meter vaults will be made at the unit price bid for “Adjusting Meter Vault.” This price is full compensation for furnishing the required materials, including backfill as required, excavation, tools, labor, equipment, and incidentals.

T. **Adjusting Meter Boxes.**

1. Payment for adjusting meter boxes will be made at the unit price for “Adjusting Meter Box.”

U. **Adjust or Relocate Water Meter.**

1. Payment for adjusting or relocating water meters will be made at the unit price for “Adjusting or Relocating Water Meters.” This price is full compensation for adjusting or relocating water meters. Miscellaneous fittings required to complete the work will not be paid for directly, but will be subsidiary to this Item unless otherwise shown on the plans. Water line sterilization and testing of the completed water main system is considered subsidiary to this Item.

V. **Lowering Water Mains.**

1. Payment for lowering water mains will be made at the unit price bid for “Lowering Water Mains,” of the sizes and types of pipe lowered. This price is full compensation for lowering and adjusting pipes, as well as any connected valves, boxes, and service lines. Excavation and backfill required for lowering water mains are subsidiary to this bid Item.

W. **Cutting and Plugging Water Mains.**

1. Payment for cutting and plugging water mains will be made at the unit price bid for “Cut and Plug Water Main,” of the sizes indicated. This price is full compensation for performing excavation, backfill, finish grading, and other incidental items required to abandon or cut and plug the water main as set forth this specification. Where grout is required, as shown on the plans, it is subsidiary to this bid Item.

X. **Removing Pressure Reducing Stations.**

1. Payment for removing pressure reducing stations will be made at the unit price bid for “Removing Pressure Reducing Station.” This price is full compensation for performing the necessary excavation, backfill, finish grading, pipe removal, structure removal, and for tools, equipment, and incidentals.

Y. **Wet Connections.**

1. Payment for wet connections will be made at the unit price bid for “Wet Connections,” of the sizes specified. This price is full compensation for demolition, hauling, fittings, disposal, removal of appurtenances, excavation and backfill, equipment, labor, tools and incidentals.

Z. **Extra Hand Excavation or Extra Machine Excavation.**

1. Payment for extra hand excavation or extra machine excavation will be made at the unit price bid for “Extra Hand Excavation” or “Extra Machine Excavation.” This price is full compensation for labor, hand tools, machines, dewatering, and handling and properly disposing of any excess excavated material not suitable for bedding or backfill for this project.

AA. **Adjusting Manholes.**

1. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Water Main (Adj Exist Manhole).” This price is full compensation for replacement of Air Release / Vacuum Release Valve and installation of the Standard Bollards as shown on the plans; for materials including backfill as required, and for excavation, tools, equipment, labor, and incidentals.
2. Trench excavation protection or temporary special shoring for trenches greater than 5 ft. in depth, or sloping the sides of these trenches to preclude collapse, will be measured and paid for as required by Item 402, “Trench Excavation Protection,” or Item 403, “Temporary Special Shoring.”
3. Furnishing and placing bedding material is subsidiary to the various bid items.
4. Providing fittings, including necessary concrete thrust blocking, pipe clamps, nipples, pipe coatings, and lubricants, etc. is subsidiary to the water mains in which they are installed.
5. In addition, providing fittings required due to plan changes or alterations in line and grade, is subsidiary to the water mains in which they are installed.

6. Furnishing and installing taps, risers, jumpers, blind flanges, cast-iron sleeves, plugs, reducers etc., as required to disinfect and pressure test the new mains is subsidiary to the various bid items. In addition, necessary excavation and backfill, site grading, and maintenance until completion of pressure testing are subsidiary to the various bid items.
7. Unless otherwise shown on the plans, the work performed and materials furnished to support the pipes or conduits of public utilities are subsidiary to the various bid items.
8. Furnishing and installing the nonmetallic pipe detection system, as well as the labor and materials necessary for the system, is subsidiary to the various bid items. In addition, ensure that the detection system is complete, operational, and satisfactory to the Utility Owner.
9. Adjusting valve boxes is subsidiary to the various bid items.

BB. **Removal of Asbestos Cement Pipes.**

1. The work performed in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for the Removal of Asbestos Cement Pipe. This price is full compensation for demolition plan preparation, loading, hauling, disposal, stockpiling, removal of appurtenances, excavation and backfill, equipment, labor, tools, and incidentals. All removed material is to be disposed of properly, in accordance with Federal, State, and local regulations.

CC. **Cutting and Capping Waterline.**

1. Payment for Cutting and Capping waterlines will be made at the unit prices bid for “cutting and capping waterline” of the various sizes specified. This price is full compensation for demolition plan preparation, loading, hauling, disposal, stockpiling, removal of appurtenances, excavation and backfill, equipment, fittings, thrust blocks, tools, and incidentals.

END OF SECTION

SECTION 331120
WATER VALVES

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This work shall consist of furnishing and installing valves as indicted on the plans or as directed by the ENGINEER in accordance with these specifications.

B. Unless otherwise noted, all valves 4 inches and larger shall be AWWA-type valves of suitable design and fully equipped for service buried in the earth, without need for further modification and shall be wrapped with 8 mail polyethylene film with all edges and laps securely taped to provide a continuous wrap.

C. Valve ends on Valves 4 inches and larger shall be flanged or mechanical joint. All mechanical joints shall conform to AWWA Specification C111. Flanges shall be dimensioned, faced, and drilled to the 125 pound "American Standard".

D. Valves shall be carefully installed in their respective positions, accessible for operation and repair. Unless shown on the plans otherwise, valves shall be of the same sizes as the pipelines in which they are installed. Stems shall be installed pointing straight upward. The operating nuts of all valves or valve stem extensions shall be no deeper than 18 inches below the top of the valve box cover. Valves shall be left in satisfactory operating condition, free from all distortion and strain.

E. All valve operators shall turn in a counterclockwise direction to open the valve.

1.02 SUBMITTALS:

A. Conform to requirements of Section 013300.

B. Manufacturer's Literature: Manufacturer's descriptive literature and recommended method of installation.

C. Certificates: Manufacturer's certification that products meet specification requirements.

PART 2 - PRODUCTS

2.01 VALVE TYPES

A. Gate Valves

1. Gate valves shall only be used for pipe sizes of 12 inches and smaller, unless otherwise noted on the plans.
2. Resilient seat gate valve shall be used and shall conform to AWWA C509. The gate valve shall be a non-rising stem type with inside screw and "O" ring seals. The valve shall have a standard hub equipped with a square operating nut. The body-to-bonnet and bonnet-to-bonnet cover shall use "O' rings as seals.
3. The resilient seat shall be mechanically retained or bonded on the valve gate (wedge disc).
4. The gate valve shall have protective coating inside and outside of fusion bonded epoxy approved for potable water.
5. The valve stem shall comply with AWWA C509. The material for the valve stem shall be brass or bronze, and shall have minimum yield strength of 20,000 psi and minimum tensile strength of 60,000 psi. The valve stem shall be compatible and interchangeable with the equivalent sized double disc gate valve models.
6. Gate valves shall have a 2 inch square operating hub nut.
7. The number of turns to open the valve shall be the same or less than the equivalent sized double disc gate valve models. Maximum input torque to open and/or close the valve shall be 200 foot pounds for a 4 inch valve and 300 foot pound for a 6 inch under a working pressure of 200 psi.
8. Gate valves shall be American Darling, Metroseal by U.S. Pipe, Mueller, or approved equal.

9. Gate Valves 14 Inches and Larger in Diameter. AWWA C500; parallel seat double disc, or AWWA C515 ; reduced-wall, resilient-seated gate valves; flanged ends and nut-operated unless otherwise specified. Provide reduced-wall resilient-seated valves with 250 psig pressure rating and manufactured by American Flow Control Series 2500, or approved equal. Provide double disc valves with 150 psig pressure rating and manufactured by American Darling 52, Clow F-6102, or approved equal. Comply with following requirements unless otherwise shown on the plans.

B. Rubber seated Butterfly Valves
   1. Butterfly valves will be used in lieu of gate valves for sizes of 14 inches and larger, the butterfly valve shall be of the rubber-seated tight closing type conforming to AWWA C504 .
   2. The valve body shall be cast iron having integral hubs for the housing shaft bearings and seals. The body ends shall be flanged per AWWA C504 with the flanges designed for installation between Class 125 cast iron flanges or mechanical joint meeting the requirements of AWWA C111/A21.11.
   3. The butterfly valve disc shall be cast iron.
   4. The seat shall be resilient new natural or synthetic rubber and shall be mechanically retained on the disc edge by means of 18-8 stainless steel bolts. Seat must also be capable of being replaced in the field without chipping, grinding, or burning out of the old seat or retaining substance. The body seat mating surface shall be 18-8 stainless steel, type 304 mechanically retained.
   5. Valve shafts shall be 18-8 stainless steel, type 304 and shall be securely attached to the disc by means of bolts, dowel pins, or taper pins.
   6. All butterfly valves shall be side operated. Valve actuator shall be integrally mounted on the valve mounting flange and shall be of the self locking traveling nut type in complete accordance with AWWA C504 requirements. Actuators shall be furnished with a standard 2 inch operating nut and must be designed to permit the adjustment of the valve disc seating without the removal of the housing cover.
   7. All butterfly valves shall be tested per AWWA C504

C. Valve Stem Extensions
   1. Extension stems shall be provided as necessary to situate the operating nut no greater than 18 inches below the valve cover.
   2. Extension stems shall be equipped with stem guides affixed to the valve box at intervals not to exceed ten feet.
   3. Stem guides shall be considered a part of the extension. Extension stems and stem guides shall be manufactured items or approved equal.

D. Air and Vacuum Valves
   1. Air and vacuum valves shall be of the type that automatically exhaust large quantities of air during the filling of a pipeline and allow air to re-enter enduring draining or when a negative pressure occurs.
   2. The inlet and outlet of the valve shall have the same cross-sectional area. The floats shall be guided by a stainless steel guide shaft and seat against a synthetic seat.
   3. Valves shall have NPT inlets and outlets.
   4. All air and vacuum valves shall be constructed of cast iron with stainless steel trim and buna-n seating. Valves shall be as manufactured by Val-Matic Valve & Mfg. Corp., Series 100.

E. Fire Hydrants
   1. Fire hydrants and their extensions shall be in accordance withAWWA C502 , traffic type. The hydrants provided shall be from the same manufacturer throughout the project. The hydrants currently approved are as follows:
      a. Mueller Company Super Centurion 250 5-1/4 in. A423
      b. American Darling Model B-84-B
   2. Fire hydrants shall have one 5 1/4 inch diameter valve opening; 6 inch mechanical joint of slip on inlet connection; two 2 1/2 inch hose nozzle connections; and one 4 1/2 inch

steamer nozzle with National Standard Fire Hose Coupling Screw Threads or as specified by the OWNER.

3. Fire hydrants shall have a bronze or cast iron, pentagon, operating nut, be designed for 150 psi., working pressure service, and have a normal bury of 4 to 4 1/2 feet unless field conditions require a deeper bury, in which case extensions will be used so as to bring the bottom of the break-off flange 2 to 8 inches above the top of finish grade.
4. The pipe fittings and fire hydrants starting at the street main and ending at the fire hydrant itself shall be lying in a line perpendicular to the street's centerline or radially on a curvilinear installation.
5. Fire hydrants shall be installed in as near a vertical position as possible and shall have no more than 1/2 inch variation from a vertical line between the breakaway flange and the top of the fire hydrant.
6. Hydrants shall be dry barrel, post-type with compression main valve closing with pressure. They shall have a field lubrication capability, be tamper resistant, and of collision-safety construction design. Hydrants shall have a bronze seat ring threaded into a bronze drain ring or bronze or cast iron bushing.
7. Hydrant interior and exterior below the ground line shall be coated with asphalt varnish, and the exterior painted from the top to a point one foot below the ground level flange, consisting of one coat rust inhibitive primer.
8. The bottom plate of the main valve shall be epoxy coated. The shoe of the fire hydrant shall have a 6-inch mechanical joint connection. The inside shall be epoxy coated to prevent corrosion.
9. The nozzle shall be threaded in place and retained by stainless steel locks.
10. Hydrant body shall be threaded to receive the threaded nozzle. Nozzle shall be secured by a stainless steel locking device.
11. Fire hydrant shall contain two drain outlets. The drain outlets shall be constructed of bronze. Hydrant shall be provided with a pentagon operating nut to open counter clockwise and shall have an anti-friction washer between the hold-down nut and the operating nut.
12. Fire hydrant shall be installed at locations as shown on construction plans and in accordance with Standard Detail Drawings.
13. No project will be accepted by the OWNER until all hydrants are operational, and accessible.
14. Hydrants shall be limited the following unless prior written approval is provided by the ENGINEER:
    a. Mueller Centurion A-423
    b. American Darling B-84-B
    c. Kennedy Guardian K-81A
    d. U.S. Pipe Metropolitan 250

F. Valve Boxes
1. Valve boxes, rings and covers shall be the type, size and materials shown in Standard Detail drawings.
2. No valve box shall be paved over without the permission of the ENGINEER. Paving material shall not remain on valve box covers overnight.
3. Valve boxes shall be fabricated using 6 inch cast-iron sliding type pipe shaft with cover and base casting.
4. Drop covers for vale boxes shall be marked "water" using lettering casted in the cover by the manufacturer.
5. Top of valve box shall be set at finished grade unless otherwise noted.

G. Water Valve Data Card shall be prepared for all types of valves (Gate Valves, Butterfly Valves, Air Release Valves, etc) according to the following instructions:

END OF SECTION

SECTION 333100
WETWELL AND MANHOLE STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Wastewater wetwells, manholes and appurtenances
   2. Valve vaults

1.02 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M198, Standard Specification for Asbestos-Cement Underdrain Pipe.
      b. H20, Axial Loading.
   2. American Society for Testing and Materials (ASTM):
      a. A48, Gray Iron Castings (Class 35 Minimum).
      b. C478, Precast Reinforced Concrete Manhole Sections.
      c. C581, Practice for Determining Chemical Resistance of Chemical Thermosetting Resins Used in Glass-Fiber Reinforced Structures Intended for Liquid Service.
      d. C582, Plastic Laminate.
      e. C923, Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
      f. C950, Glass-Fiber Reinforced Thermosetting Resin Pressure Pipe.
      g. D695, Test Method for Compressive Properties of Rigid Plastics.
      h. D790, Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
      i. D2412, Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading.
      j. D2583, Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impresser.
      k. D2584, Test Method for Ignition Loss of Cured Reinforced Resins.
      l. D3753, Standard Specification for Glass-Fiber Reinforced Polyester Manholes.
   3. Occupational, Health and Safety Administration (OSHA).

1.03 SUBMITTALS

A. Product technical data including:
   1. Acknowledgment that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.
   3. Operation and maintenance manuals.

B. Fabrication and/or layout drawings:
   1. Include detailed diagrams of wetwells/manholes and valve vaults showing typical components and dimensions.
   2. Itemize, on separate schedule, sectional breakdown of each wetwell/manhole or valve vault structure with all components and refer to drawing identification number or notation.
   3. Indicate knockout elevations for all piping entering each wetwell/manhole.

C. Certifications.

D. Design calculations.

E. Concrete pad foundation design and drawings.

F. Test reports.

G. Warranty information.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. Wetwell/manhole rings, covers and frames:
      a. Halliday.
      b. Bilco.
      c. Bass & Hays Foundry.
      d. Neenah Foundry.
      e. Deeter Foundry.
   2. Black mastic joint compound:
      a. Kalktite 340.
      b. Tufflex.
      c. Plastico.
   3. Premolded joint compound:
      a. Ram Nec.
      b. Kent Seal.
   4. Fibered asphalt compound:
      a. Sonneborn Hydrocide 700B Semi-Mastic.
   5. Fiberglass Wetwells/Manholes:
      a. Containment Solutions, Inc.
      b. L.F. Manufacturing, Inc.
      c. Flowtite Products.
      d. Belco.
   6. One-piece Fiberglass Tee Base manhole System
      a. HOBAS
   7. Precast Concrete Wetwells/Manholes:
      a. Hanson.
      b. Oldcastle Precast.
      c. American.
      d. Park Engineering.
   8. Interior Protective Epoxy Coating for Concrete Wetwells/Manholes:
      a. Raven 405

2.02 WETWELLS

A. Wetwell/Manhole Interior Dimensions:

B. Diameter: 96 inches (wetwell). 48 inches & 60 inches (receiving manhole).
   1. Depth: See plans.
   2. The dimensions provided herein are approximate. The Contractor shall refer to the Drawings for exact dimensions.

SECTION 333113
WASTEWATER COLLECTION SYSTEM

PART 1 - GENERAL

1.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials on manufacturer's original skids or in original unopened protective packaging. Owner reserves the right to reject material left from another job.

B. Store materials to prevent physical damage.

C. Protect materials during transportation and installation to avoid physical damage.

1.02 GENERAL DESCRIPTION OF WORK COVERED

A. Furnish and install all wastewater pipe, fittings and structures, and accessories required for sanitary wastewater construction as indicated.

1.03 QUALITY ASSURANCE

A. Comply with latest published editions of American Society of Testing and Materials (ASTM) Standards:

1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
2. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
3. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
4. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
5. ASTM F794 - Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
6. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings (SDR35).
7. ASTM F949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
8. ANSI A21.11 - Rubber Gasket Joints for Cast Iron and Ductile- Iron Pressure Pipe and Fittings.
9. ASTM D3753 - Standard Specification for Glass Fiber Reinforced Polyester Manholes.
10. ASTM C923/C923M - Standard Specification for Resilient Manhole Connectors.
11. ASTM C478/C478M - Specification for Pre-cast Reinforced Concrete Manhole Sections.
12. ASTM C443 - Specification for Joints for Circular Concrete Sewer and Culvert pipe using Rubber Gaskets.
13. ASTM C-1244 - Specification for Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
14. AWWA C151/A21.51 - Specification for Ductile Iron Pipe and Fittings.
15. ASTM D-1248 - Standard specification for Polyethylene Plastics Molding and Extrusion Materials.
16. AWWA C150/A21.50 - Polyethylene Encasement for Gray and Ductile Cast -Iron Piping for Water and Other Liquids.
17. AWWA C110/A21.10 - Gray Iron And Ductile Iron Fittings 3-inch through 48-inch, for Water and Other Liquids.
18. ASTM D3350 - Specification for Polyethylene Plastic Pipe and Fittings Materials.
19. ASTM F714 - Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3-inch IPS and larger).
20. ASTM D3261 - Specification for Butt Heat Fusion Polyethyle (PE) Plastic Fittings for Polyethylene (PE) Pipe and Tubing.
21. ASTM D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds, and Chlorinated Poly (Vinyl Chloride) (CPVC) Compound.

22. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 12-inch for water distribution.
23. AWWA C905 - Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameter 14-inch through 36-inch.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Pipe furnished may be any one of materials specified herein for sanitary wastewater construction unless shown otherwise on plans or bid forms.

B. All pipe shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.

2.02 POLYETHYLENE PIPE AND FITTINGS (PE)

A. Comply with ASTM D3350 and ASTM F-714 for polyethylene (PE) solid wall pipe and fittings for use in pressure sanitary wastewaters. Wall thickness shall be as shown on the plans.

B. Fittings shall comply with the performance requirements of ASTM D2683 or ASTM D3261 for molded or fabricated fittings of the size and pressure class as required.

C. Provide pipe and fittings with minimum performance requirements of ASTM D 1248, Type III Class C, Category 5, Grade P34 and ASTM D3350 as indicated in this specification and as shown in the plans and details.

2.03 POLYVINYL CHLORIDE PLASTIC PIPE (PVC)

A. Comply with ASTM D3033, D3034, ASTM F679, CT-1 walls, or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fittings.
   1. Sewers 6-inches to 10-inches shall conform to ASTM D3034.
   2. Sewers 12-inches to 30-inches shall conform to ASTM D3034, ASTM F-679 (T-1 wall), or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fitting.
   3. Sewers 36-inches and larger shall conform to ASTM F-949, ASTM D3034, ASTM F-679 or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fitting.

B. Use single elastomeric gasket push-on joints complying with ASTM D3212.

C. Provide pipe and fittings with minimum performance capabilities of SDR-35 dimension ratio for gravity wastewaters of less than 10-feet in depth or cover. Where directed by the Engineer and as indicated on the plans, wastewaters greater than 10-feet in depth shall meet SDR26 or AWWA C900 or C905 requirements.

D. Lubricant to be in accordance with the requirements of ASTM D3212. Lubricant to be suitable for lubricating the parts of the joints in the assembly. The lubricant to not have any deteriorating effects on the gasket and pipe materials.

E. Schedule 40 shall be used for service laterals.

F. Mark all pipe and fittings.

2.04 DUCTILE IRON PIPE AND FITTINGS

A. Comply with the latest published edition of American Water Works Association (AWWA) Standards:
   1. AWWA C110 & C110a - Gray Iron and Ductile-Iron Fittings, 2-inch through 48-inch for water and other liquids.
   2. AWWA C111 - Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.
   3. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
   4. AWWA C151 - Ductile-Iron Pipe, centrifugally cast in metal mold or sand lined molds, for water or other liquids.
   5. AWWA C153 - Ductile-Iron Compact fittings, 3-inch through 12-inch for water and other liquids.
   6. ASSA C900 - Polyvinyl Chloride (PVC) Pressure Pipe 4-inches through 12-inches for water.

7. Polyethylene encasement for the protection of ductile and cast iron pipes, fittings valves, and appurtenances shall be furnished and installed in accordance with the requirements of AWWA C-105.
8. Lining and Coating- Ductile and cast iron pipes, fittings valves, and appurtenances for sanitary wastewater service shall be furnished with corrosion resistant interior lining furnished by the manufacturer:
    a. Polyethylene "polybond"
    b. Polyurethane "Corropipe II TX 5"
    c. Ceramic-Epoxy "Protecto 401"
    d. Engineer Approved Equal
9. Exterior Coating - Ductile and cast iron pipes, fittings valves, and appurtenances for sanitary wastewater service shall be furnished with outside surfaces coated with a bituminous coating 1 mil thick in accordance with ANSI A21.6 or ANSI A21.51.

2.05 MANHOLES, STRUCTURES AND PIPE ACCESSORIES

A. Fittings
    1. Fittings allowed only on service laterals.
    2. Fittings shall equal or exceed quality of pipe. Fittings shall be full-bodied gasket fittings or inserted gasketed compression fittings on line size greater than 15-inches as shown in the plans and details.

B. Cast-in-Place Manholes
    1. Concrete and reinforcing steel shall comply with Specifications.
    2. Construction details as shown on plans.
    3. Minimum wall thickness will be 5-inches.
    4. Provide cast-in-place rubber gasket for connection of required wastewater line or watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923.

C. Fiberglass Manholes
    1. Fiberglass manholes shall be in accordance with ASTM D3753 "Glass Fiber Reinforced Polyester Manholes, latest revision. The minimum wall thickness for all manholes up to 20-feet depth shall be .50-inches. The inside diameter of the manhole barrel shall be either 48-inches or 1.5 times the nominal pipe diameter of the largest pipe, which ever is larger, or as indicated on the plan sheets. A concentric reducer over the barrel of the have an inside diameter of 32-inches.
    2. Pipe Connectors - Watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923 or shall be InsertaTee as shown in the plans and specification details. Joints for wastewater pipe for line and drop connections in sizes 4-inches - 15-inches shall be made by means of gasketed inserted watertight compression connection or approved equal as shown in the plans and details. Install in accordance with the manufacturer's written instructions. Connections for pipe larger than 15-inches shall be made using a pre-approved connection. Install in accordance with the manufacturer's written instructions.

D. Manhole Accessories
    1. Manhole lid and cover:
        a. Gray cast iron, with minimum clear opening 30- inches.
        b. Use Western Iron Works A770R or approved equal with vent holes.
        c. Provide anchor bolt holes for exposed manhole tops.
    2. Manhole Rings:
        a. Provide minimum of three throat rings between cone and manhole lid and cover, adjustment rings shall be High Density Polyethylene grade rings (LADTECH or approved equal).

3. Coating - Coating and lining of the interior vertical surfaces, if required, shall be as noted in the plans and details. Materials shall be installed and applied in accordance with the written instructions and specifications of the manufacturer at the thickness and quality as noted in the plans and details as approved by Engineer.
4. Manhole Inserts -Provide manhole insert to fit the manhole frame rim upon which the manhole cover rests.
    a. Insert body shall be made of high density polyethylene copolymer material that meets ASTM D 1248, Class A, Category 5, Type III. Minimum thickness 1/8-inch.
    b. Gasket shall be of closed cell neoprene and have pressure sensitive adhesive on one side and be placed under the weight-bearing surface of the insert by the manufacturer.
    c. Lift strap of 1-inch woven polyethylene (seared on all cut ends to prevent unraveling. Strap shall be attached to the rising edge of the bowl off the insert by means of stainless steel rivet and washer.
    d. Vent shall have 1/8-inch hole located on the side wall of the insert 3/4-inch below the lip.
    e. Load capacity insert shall have certified test data verifying minimum collapse load of 1500 lbs. minimum applied to a 5.50-inch square area in the center of the insert.

PART 3 - EXECUTION

3.01 GENERAL:

A. Provide all labor, equipment and materials and install all pipe, fittings, specials and appurtenances as indicated or specified.

3.02 PIPE INSTALLATION

A. Handling
1. Handle in a manner to insure installation in sound and undamaged condition.
    a. Do not drop or bump.
    b. Use slings, lifting lugs, hooks and usher devices designed to protect pipe, joint elements, and coatings.
2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.
3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation
1. Installation, jointing and testing of pipe, fittings, and accessories shall be in accordance with the provisions of the applicable reference standard and in accordance with the requirements of this specification and related specifications referenced or contained in the contract documents for pressure or gravity wastewaters.
2. Lay pipe to slope gradient noted on the drawings.
3. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.
    a. Do not lay on blocks unless pipe is to receive total concrete encasement.
    b. Use laser or minimum of 3 batter boards for control of line and grade.
4. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.
5. Insofar as possible, commence laying of pipe at downstream end of line, and, install pipe with bell ends in direction of pipe laying. Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations there from.
6. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
    a. Close open ends of pipe with snug fitting closures.
    b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.

c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

7. Inspect pipe prior to installation to determine if any pipe defects are present.
8. Brace or anchor as required to prevent displacement after establishing final position.
9. Perform only when weather and trench conditions are suitable.
10. Observe extra precaution when hazardous atmospheres might be encountered.
11. Sanitary wastewater relation to water mains:
    a. Maintain 9-feet horizontal separation whenever possible.
    b. When conditions prevent a lateral separation of 9- feet, wastewater may be installed closer to a water main if:
        1) wastewater constructed of PVC pipe meeting AWWA Specifications and having a minimum working pressure rating of 150 psi or greater and equipped with pressure type joints, and;
        2) the wastewater line and water main are separated by a minimum vertical distance of 2-feet and a minimum horizontal distance of 4-feet, measured between the nearest outside diameters of the pipes.
    c. When a sanitary wastewater crosses a water line and that portion of the wastewater is constructed as described in 3.02 B.11.b.(1), the wastewater may be placed no closer than 6 inches from the water line. The separation distance must be measured between the nearest outside pipe diameters. The wastewater line shall be located at a lower elevation than the water line whenever possible and one length of the wastewater pipe must be centered on the water line.
12. Auger or jack casing pipe in place where shown on plans.

C. Jointing
1. General requirements:
    a. Locate joint to provide for differential movement at changes in type of pipe embedment, at changes from rock to soil trench bottom, and structures.
        1) Not more than 18 inches from structure wall, or
        2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.
    b. Perform in accordance with manufacturer's recommendations.
    c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.
    d. Utilize methods and equipment capable of fully homing or making up joints without damage.
    e. Check joint opening and deflection for specification limits.

D. Closure Pieces
1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.

E. Temporary Plugs
1. Furnish and install temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.
2. Remove from pipe laid under adjacent contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.
3. Plugs
    a. Use test plugs as manufactured by pipe supplier, or
    b. Fabricate by Contractor of substantial construction.
    c. Must be watertight against heads up to 20 feet of water.
    d. Secure in place in a manner to facilitate removal when required to connect pipe.

3.03 MANHOLE INSTALLATION

A. Foundations to be poured in place or to be pre-cast concrete base sections in accordance with the requirements of ASTM C-478.

B. Construct manhole foundation and channel inverts integrally for cast in place manhole foundations.

C. Pre-cast manhole sections of ruse with cast in place manhole bases may be installed after foundation concrete has attained 75% of design strength.

D. Forms for cast-in-place manhole may be installed after foundation concrete has attained 75% of design strength.

E. Manhole foundation and manhole may be installed simultaneously if manhole section is supported on concrete blocks and foundation concrete placed under and around bottom section.

F. Install manhole sections and joints in accordance with the requirements of the specification.

G. Heat materials for casting in place in freezing weather and protect work from cold; maintain temperature of work at 40° F. for at least 24 hours after placing.

H. Invert Channels: Inverts: The bottom of the manhole shall be provided with a "U" shaped channel that is as much as possible a smooth continuation of the inlet and outlet pipes.
   1. For manholes connected to pipes less than 15-inches in diameter the channel depth shall be at least half the largest pipe diameter.
   2. For manholes connected to pipes 15 to 24-inches in diameter the channel depth shall be at least three fourths the largest pipe diameter.
   3. For manholes connected to pipes greater than 24-inches in diameter the channel depth shall be at least equal to the largest pipe diameter.
   4. In manholes with pipes of different sizes, the tops of the pipes shall be placed at the same elevation and flow channels in the invert sloped on an even slope from pipe to pipe. The bench provided above the channel shall be sloped at a minimum of 0.5-inch per foot.
   5. Where wastewater lines enter the manhole higher than 24- inches above the manhole invert, the invert shall be filleted to prevent solids deposition.
   6. Drop Manholes: A drop manhole as shown in the details shall be provided for a wastewater entering a manhole more than 30-inches above the insert. A drop pipe of the same pipe material and size shall be provided for a wastewater pipe entering a manhole more than 24-inches above the invert. The drop pipe shall be constructed on the outside of the manhole utilizing Wyes and Ells to provide a smooth drop and a clean out leg as shown on the details. The drop pipe shall be encased with concrete unless otherwise directed by the Engineer. Concrete shall extend from the bottom of the manhole base up to the bottom of the incoming wastewater pipe, concrete shall also extend from the outside wall of the manhole out past the Wye on the Wye branch with a minimum of six inches (6") on each side.

I. Pipe Connection
   1. Make watertight.
   2. Use rubber gasket or size on size resilient connectors allowing for differential settlement conforming to ASTM C-9232.
   3. All connections shall be at flowline of manhole.

J. Exterior Pipe Support (Rigid Pipe)
   1. Support vitrified clay pipe on concrete cradle from manhole connection to first joint on each side of manhole as indicated.
   2. Provide pipe joint within 18 inches of manhole wall.

K. Castings, frames, and fittings
   1. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed.
   2. The unit shall be protected until mortar or concrete is set.

L. Coatings if required in the specifications and details shall be applied after Engineer's approval of structure.

3.04 ACCEPTANCE TESTS FOR SEWER PIPELINES

A. Infiltration Testing
   1. General
      a. All testing must meet or exceed the Texas Commission on Environmental Quality current requirements.
      b. Maximum infiltration for each section of wastewater pipe shall not exceed 50 gal/mile/day/inch of pipe diameter.
      c. Infiltration, exfiltration or air test may be used to prove compliance with infiltration requirement.
      d. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.
      e. After backfilling and removing debris from each section of wastewater line, conduct a line acceptance test under observation of the Engineer. Copies of all test results shall be made available to the Engineer upon request. Test the sanitary wastewater lines in strict accordance with the following leakage test using low pressure air. If the test results indicate an unacceptable installation, locate the source of leakage, correct the defect, and retest until the installation is proven satisfactory.
      f. Tests should conform to the following requirements:
         1) Infiltration or Exfiltration Tests. The total exfiltration as determined by a hydrostatic head test shall not exceed 50 gallons per inch diameter, per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole.
         2) When pipes are installed below the groundwater level an infiltration test shall be used in lieu of the exfiltration test. The total infiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole, or at least two feet above existing groundwater level, whichever is greater.
         3) For construction within the 25 year flood plan, the infiltration or exfiltration shall not exceed 10 gallons per inch diameter per mile of pipe per 24 hours at the same minimum test head.
         4) If the quantity of infiltration or exfiltration exceeds the maximum quantity specified, remedial action shall be undertaken in order to reduce the infiltration or exfiltration to an amount within the limits specified.
   2. Air Test
      a. Furnish all facilities required including: (1) Necessary piping connections. (2) Test pumping equipment. (3) Pressure gauges or manometers. (4) Bulkheads. (5) All miscellaneous items required.
      b. Obtain approval from Engineer of equipment and methods proposed for use.
      c. Test pipe in sections determined by Contractor and approved by Engineer.
      d. Plug ends of line and cap or plug all connections to with-stand internal test pressures.
      e. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe. (Add 0.43 psi for each vertical foot of ground water over the top of pipe.)
      f. Allow two minutes for air pressure to stabilize.
      g. Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

B. Deflection Testing
   1. Perform on flexible pipe.

2. Use a mandrel to test for a maximum 5 percent deflection unless otherwise specified in the contract document.
3. The mandrel shall be sized and constructed as required by the Texas Commission on Environmental Quality.
4. Conduct no sooner than thirty (30) days after final backfill.
5. Use no mechanical pulling devices.
6. Uncover all irregularity or pipe deformation exceeding 5%. Replace all damaged pipe reround non-damaged pipe and tamp the embedment and initial backfill.
7. Any pipe removed shall be replaced by use of gasketed repair couplings.
8. Conduct deflection test in the presence of the Owner's or Engineer's representative.
9. Manhole Testing: Successful passage of a vacuum or hydrostatic test shall be required for acceptance of all sanitary wastewater manholes and sanitary wastewater structures. If a manhole fails a leakage test the manhole must be made watertight and retested. Hydrostatic testing shall be conducted by plugging with Engineer approved plugs all influent and effluent pipes in the manhole and filling the manhole with water to the top of the manhole cone with water. Additional water may be added over a twenty-four (24) hour period to compensate for absorption and evaporate losses. At the conclusion of the twenty-four (24) hour saturation period the manhole shall be filled to the top of the manhole cone and observed. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour. Any loss within a thirty (3O) minute period shall be considered an unsuccessful test. Vacuum testing shall be performed in accordance with the requirements of ASTM C-1244, Specification for Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

3.05 SERVICE CONNECTIONS:

A. Install service connections at each dwelling or business place, or as directed by Engineer.

B. Services wyes: install wyes, 4-inch branch diameter unless shown otherwise on plans. See standard detail.

C. Risers: use in lieu of wyes for service connections where invert of wastewater is 15 feet or more below ground surface or where shown on plans. See standard detail.

D. Place suitable stopper in end of connection, cement stopper in place with cold bituminous joint compound.

E. Backfill trench only after recording exact location of service connection. Place engineer approved maker tape above service piping in excavation within 3-feet of the surface.

F. Make no connections to house wastewaters or extend service connections beyond this contract without written permission of Engineer.

G. Backfill trench only after entire service line and Wye connection has been inspected and approved by Engineer. Compact as specified in Section 02221, "Trenching, Backfilling and Compacting".

H. Street crossings shall have a minimum of 3 feet of cover to sub-grade unless approved by Engineer.

I. No payment for service lines will be made until all specified requirements have been met.

3.06 CONNECTIONS TO EXISTING DRAINS AND SEWER SYSTEM

A. Connect existing sanitary service drains which cross new wastewater line through equal sized Wye.

B. Connect no storm drains to new wastewaters.

C. Connections to existing manholes:
   1. Cut hole in existing manhole at required elevation.
   2. Insert new wastewater pipe flush with inside of manhole.
   3. Grout new pipe in place.

4. Reconstruct manhole bottom to suit new connection.

D. Connections to existing wastewater:
   1. Build new manhole around existing wastewater.
   2. Break out existing wastewater inside of manhole and construct bottom to suit new connection.

END OF SECTION

SECTION 334000
STORMWATER COLLECTION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Material and installation of storm sewer culverts and appurtenances, including headwalls.

1.02 REFERENCES

A. ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

C. ASTM A377- Ductile Iron Pipe

D. ASTM F2736 and F2881 – Annular Corrugated Profile Wall Polypropylene Compound pipe and fittings for land drainage applications

E. Texas Department of Transportation (TxDOT) most current edition Standard Specifications for Construction of Highways, Streets and Bridges.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 013300

PART 2 - PRODUCTS

2.01 STORM SEWER PIPE

A. Reinforced Concrete Pipe: Provide reinforced concrete pipe which conforms with ASTM C76, class as shown on the Drawings.

B. Schedule 40 PVC and Schedule 80 PVC Pipe Culverts: Provide Schedule 40 PVC or Schedule 80 PVC pipe fabricated in conformance withASTM D1784

C. HDPE Pipe: Provide high-density polyethylene pipe which conforms with ASTM D3350, ASTM F2619 or ASTM F2306.

D. Pipe Requirements
   1. 12- through 30-inch (300 to 750 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330
   2. 36- through 60-inch (900 to 1500 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330
   3. Manning's "n" value for use in design shall be 0.012

2.02 CONCRETE PIPE JOINT MATERIAL

A. Cold Compound Joints: For concrete pipe sections carrying rainfall runoff, furnish pipe joint material (Talcote No. 0.52, Gulf States No. GS 702, or Ram-Nek flexible plastic gasket manufactured by the K. T. Snyder Company, Inc.) meeting the requirements of the (Standard Specification for Construction and Maintenance of Highways, Streets, and Bridges). Apply a primer of the type recommended by the manufacturer of the compound used.

2.03 POLYPROPYLENE JOINT MATERIAL

A. Joint Performance
   1. Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.
   2. 12- through 60-inch (300 to 1500 mm) shall be watertight according to the requirements of ASTM D3212.Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
   3. 12- through 60-inch (300 to 1500 mm) diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.

B. Fittings
   1. Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

C. Field Pipe and Joint Performance
   1. To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F1417 or ASTM F2487. Appropriate safety precautions must be used when field-testing any pipe material. Contact the manufacturer for recommended leakage rates.

2.04 HIGH DENSITY POLYETHYLENE PIPE

A. Pipe Requirement 4 through 10-inch pipe shall meet AASHTO M252, Type S
   1. 4 through 10-inch pipe shall meet AASHTO M252, Type S
   2. 12 through 60 pipe shall meet AASHTO M294, Type S or ASTM F2306

B. Joint Performance
   1. Pipe shall be joined using a bell & spigot joint meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. 12- through 60-inch diameters shall have an exterior bell wrap installed by the manufacturer.

C. Fittings
   1. Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294, or ASTM F2306

D. Field Pipe and Joint Performance
   1. To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field-testing any pipe material. Contact the manufacturer for recommended leakage rates.

2.05 HP STORM MANHOLE

A. General
   1. This specification describes the 48" HP manhole for use in underground stormwater applications as indicated on the contract drawings and reference within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer.

B. Materials
   1. The 48" HP manhole bodies shall be made from an impact modified copolymer polypropylene meeting the material requirements of ASTM F2764. The eccentric cone reducer shall be manufactured from polyethylene material meeting ASTM D3350 cell class 213320C. The joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals used for the polyethylene cone and pipe connections to the structure shall conform to ASTM F477.
   2. The covers, grates, and frames furnished for all surface drainage inlets shall be ductile iron. Ductile iron castings used shall conform to ASTM A536 grade 70-50-05 for ductile iron and shall be painted black.

PART 3 - EXECUTION

3.01 EXCAVATION, BACKFILLING AND COMPACTION

A. Excavation, backfill, and compaction of the trench shall be in accordance with Section 312200.

3.02 PIPE INSTALLATION

A. Pipe Sewers and Culverts: Do not place pipe until the excavation has been completed, the bottom of the trench shaped, proper bedding material placed, and the line and grade have been obtained. Lay pipe accurately to line and grade in a straight line with spigot or tongue end of the pipe pointing in the direction of flow. Fit pipes together and match them so that when laid, the pipe will form a sewer or culvert with a smooth and uniform invert except where there is a pipe size change, in which case, the crowns of the larger and smaller pipes shall be at the same elevation and a concrete collar used to make the connection unless otherwise shown.

B. PVC culvert pipe joints shall be solvent welded with appropriate solvent weld compound as recommended by the PVC pipe manufacturer.

C. Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in traffic areas for 12- through 48-inch diameters shall be one foot. and for 60-inch diameters, the minimum cover shall be 2 ft. in single run applications. Backfill for minimum cover situations shall consist of Class 1, Class 2 (minimum 90% SPD) or Class 3 (minimum 95%) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.04.

3.03 HIGH DENSITY POLYETHYLENE PIPE INSTALLATION'

A. Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch diameters shall be one foot. and for 60-inch diameter the minimum cover shall be 2 ft in single run applications. Backfill for minimum cover situations shall consist of Class 1 (compacted), Class 2 (minimum 90% SPD) or Class 3 (minimum 95%) material.

3.04 CONCRETE PIPE CULVERT JOINT INSTALLATION

A. Cold Compound Joints:

1. Tongue and Groove Pipe. Completely coat both ends of the pipe with primer on all surfaces that will be in contact. Coat pipe only when the pipe is clean and dry. Allow the primer to dry before the pipe is laid. Pipe 24 inches and larger must be primed at the factory. After pipe has been set to proper line and grade in the trench, trowel or otherwise apply to the groove end of the pipe a 1/2-inch-thick layer of compound. Cover two-thirds of the joint face around the entire circumference. Next, shove home the tongue end of the next pipe with sufficient pressure to make a tight joint. Take care to avoid leaving ridges of compound projecting into the pipe. Make necessary adjustments in the quality and consistency of the compound, as directed by the Owner.
2. Positioning. Joints made with cold compound may be pulled home by means of a suitable winch or other suitable power equipment or a come-along. Do not use a bar stuck into the ground for positioning joints on pipe larger than 10 inches. A bar may be used to push home the joints in pipe 10 inches and smaller, provided the joints are pushed all the way home. Positioning joints multiplied by the laying length per joint must equal the actual length of sewer in any given section. Pull pipe home in a straight line with all parts of the pipe on line and grade. Do not permit horizontal or vertical movement of the pipe during or after the pulling operation. Pull or push home rubber gasket joints by any suitable means that will provide adequate pressure to ensure proper assembly of the joint. Use special care to ensure that the joints are positioned in accordance with the published instructions of the manufacturer. Do not mortar the outside of joints. Do not use backhoe to drive pipe to make-up pipe joints.

3.05 HEADWALL, MANHOLE AND INLET INSTALLATION

A. Construct all headwalls to line and grade and at locations shown. Construct in accordance with Texas Standard Specifications most current edition. Neatly cut off all pipe leads at the appropriate face of the headwall, manhole or inlet wall and finish with mortar.

3.06 HP STORM MANHOLE INSTALLATION

A. Excavate HP manhole location to the depth required and provide a stone base. The stone base shall be a minimum of 6", however a thicker base may be required. Set HP Manhole in place

and level the structure. Connect storm pipe into HP manhole. Re-check HP manhole depth, level, and position, The specified 48" HP Manhole shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 1 material as defined in ASTM D 2321. Bedding and backfill for the HP Manholes shall be well placed and compacted uniformly in accordance with ASTM D2321. No brick, stone, or concrete block will be required to set the grate to final grade height. For load-rated installations, a concrete slav shall be poured under and around the grate and frame. The frame and grate/cover must be fully supported by the concrete slab. The collar must bear on the surrounding stone and soil backfill and not on the structure. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations, such as migration of fines, groundwater, and soft foundations refer to ASTM D2321 guidelines.

END OF SECTION

SECTION 334213
STORMWATER CULVERTS

PART 2 PRODUCTS

1.01 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 312316.13.

B. Cover: As specified in Section 312316.13.

END OF SECTION

SECTION 334230
STORMWATER DRAINS

PART 2 PRODUCTS

END OF SECTION