Sunset Heights Urgent Care

Harris Health

Houston, Texas

Project Manual

Issued For
Contract Documents

O'CONNELL ROBERTSON

Project Number: 2321.06
12.19.25

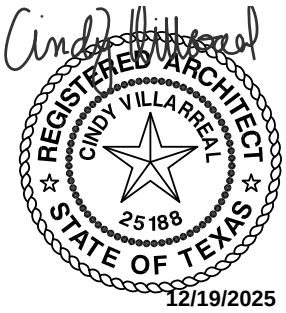
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SECTION 00 01 07

SEALS PAGE

ARCHITECT OF RECORD

O'Connell Robertson
811 Barton Springs Road, Suite 900
Austin, Texas 78704



12/19/2025

Architect of Record Date

MECHANICAL ENGINEER OF RECORD

O'Connell Robertson
811 Barton Springs Road, Suite 900
Austin, Texas 78704
TBPE Registered Firm No. F-2708



12/18/2025

Mechanical Engineer of Record Date

ELECTRICAL ENGINEER OF RECORD

O'Connell Robertson
811 Barton Springs Road, Suite 900
Austin, Texas 78704
TBPE Registered Firm No. F-2708

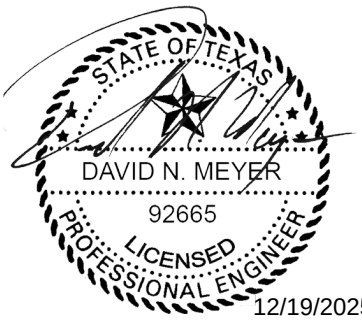


12/18/2025

Electrical Engineer of Record Date

PLUMBING ENGINEER OF RECORD

O'Connell Robertson
811 Barton Springs Road, Suite 900
Austin, Texas 78704
TBPE Registered Firm No. F-2708

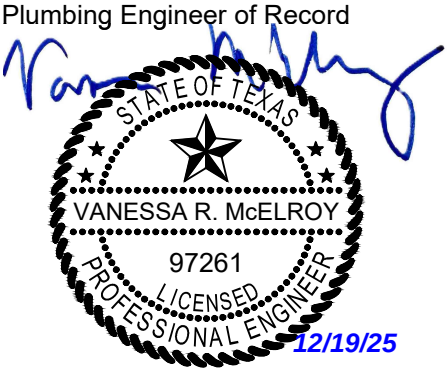


12/19/2025

Plumbing Engineer of Record — Date

CIVIL ENGINEER OF RECORD

Martinez-Moore Engineers
401 S. 1st Street, Suite 600
Austin, TX 78704

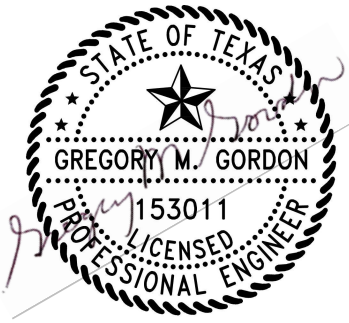


Martinez Moore Engineers LLC
TBPE No. F-16839

Civil Engineer of Record — Date

STRUCTURAL ENGINEER OF RECORD

H2B Engineering
1225 North Loop West, Suite 800
Houston, TX 77008



12/19/2025

Structural Engineer of Record — Date

DATACOM CONSULTANT OF RECORD

Combs Consulting
1022 River Road #2
Boerne, Texas 78006

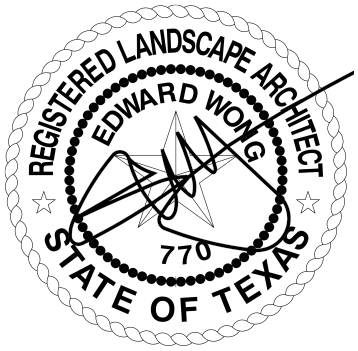


12/19/2025

Datacom Consultant of Record — Date

LANDSCAPE ARCHITECT OF RECORD

Wong & Associates, Inc
P.O Box 2028
Bellaire, Texas 77402



12/19/2025

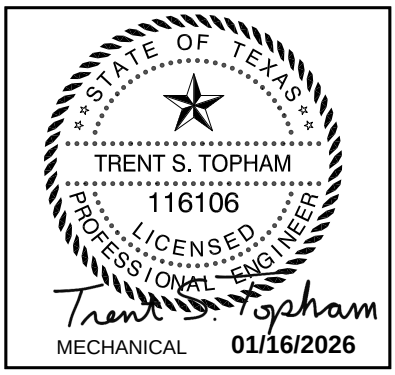
Landscape Architect of Record — Date

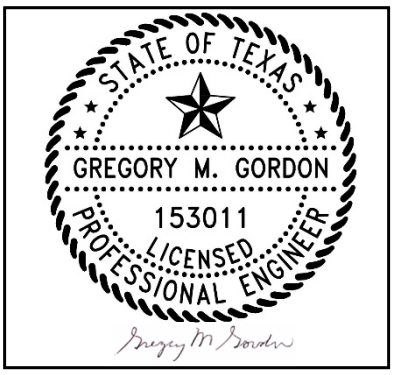
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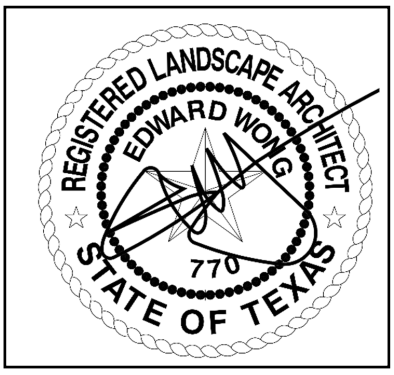
ADDENDUM

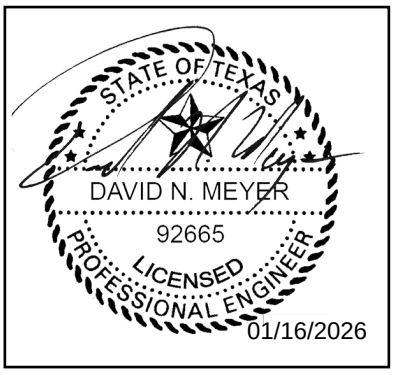
SCP ACS Sunset Heights Urgent Care
1615 N. Main Street
Houston, TX
O'Connell Robertson Project No. 2321.06
Harris Health Project No. 25-3SCP00178

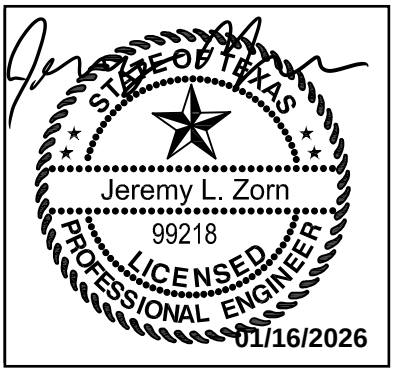














Addendum No. 01
Date: 01/16/26
SCP ACS Sunset Heights Urgent Care
1615 N. Main Street
Houston, Texas
O'Connell Robertson Project: 2321.06
Harris Health Project: 25-SCP00178

Notice To Bidders

A. This Addendum shall be considered part of the Construction Documents dated **December 19, 2025**, for the above-mentioned project, as though it had been issued at the same time and incorporated integrally therewith. Where provisions of the following supplementary data differ from those of the original Construction Documents, this Addendum shall govern and take precedence.

B. Bidders are hereby notified that they shall make necessary adjustments in their estimates on account of this Addendum. It will be construed that each bidder's proposal is submitted with full knowledge of all modifications and supplemental data specified herein. Please staple in the back of your specification book.

SPECIFICATIONS

Sections itemized below are attached to this Addendum.

Replace previously issued sections in entirety with those issued herewith.

*Indicates new specification section

ITEM 1 **Section 23 09 23 - Building Automation Systems for HVAC**

A. ADDED section.

DRAWINGS

LANDSCAPE:

ITEM L1 **Sheet L1.1 – LANDSCAPE PLAN**

A. Due to conflict with overhead powerlines poles, trees and site furnishing have shifted to stay out of easement.

ITEM L2 **Sheet L1.2 – ENLARGEMENT PLAN**

A. Due to conflict with overhead powerlines poles, trees and site furnishing have shifted to stay out of easement.

STRUCTURAL:

ITEM S1 **Sheet S6 – FOUNDATION SECTIONS AND DETAILS**

A. MODIFIED detail 9 for clarity.

B. ADDED detail 10 for typical light pole foundation.

C. ADDED detail 11 for typical charging station pedestal footing.

D. ADDED detail 12 for HEAL lettering foundation.

ARCHITECTURAL:

ITEM A1 **Sheet A1.2 – ARCHITECTURAL SITE PLAN – AREA A**

A. REVISED mobile unit charging pedestal.
B. MODIFIED keynote 175**.**

ITEM A2 **Sheet A1.5 – ARCHITECTURAL SITE DETAILS**

A. ADDED elevations, sections & detailing for charging pedestal.

ITEM A3 **Sheet A3.1 – FLOOR PLAN**

A. REVISED door swing for doors 1013 and 1002.
B. REVISED window tags.

ITEM A4 **Sheet A4.1 – EXTERIOR ELEVATIONS**

A. **REVISED a** curtain wall window at the North Exterior Elevation.

ITEM A5 **Sheet A6.1 – EXTERIOR DETAILS**

A. **REVISED** cement fiber panel soffit detail.
B. REVISED curtainwall at sill detail.

ITEM A6 **Sheet A6.2 – EXTERIOR DETAILS**

A. **REVISED** curtainwall details.
B. REVISED parapet plate detail.
C. REVISED light at soffit detail.

ITEM A7 **Sheet A6.3 – EXTERIOR DETAILS**

A. **REVISED** parapet EJ detail.
B. REVISED parapet detail at roof canopy.

ITEM A8 **Sheet A6.4 – EXTERIOR DETAILS**

A. **REVISED** existing canopy detail at corridor.

ITEM A9 **Sheet A6.5 – PLAN DETAILS**

A. **REVISED** detail 1.

ITEM A10 **Sheet A7.4 – EXTERIOR FRAME TYPES**

A. **REVISED** storefront frames to curtainwall.

ITEM A11 **Sheet A9.1 – REFLECTED CEILING PLAN**

A. **REVISED** ceiling grid and lighting in Cashier 1016.
B. **REVISED** ceiling grid and lighting in Ambulance Vestibule 1068.
C. **REVISED** RCP legend.

ITEM A12 **Sheet A9.2 – ENLARGED REFLECTED CEILING PLAN**

A. **ADDED** dimensions to Enlarged Ceiling Plan – Waiting.

ITEM A13 **Sheet A10.1 – ROOM FINISH PLAN**

A. **REVISED** Room Finish Tag for METERING ROOM 1002.
B. **ADDED** Keynote Legend to sheet.

FIRE PROTECTION:

ITEM FP1 **Sheet FP1.1 – FIRE PROTECTION NOTES, SYMBOLS AND ABBREVIATIONS**

A. REVISED notes.

PLUMBING:

ITEM P1 **Sheet P1.1 – PLUMBING NOTES, SYMBOLS AND ABBREVIATIONS**

A. REVISED notes.

ITEM P2 **Sheet P3.0 – PLUMBING UNDERFLOOR PLAN**

A. ADDED pipe tags.

ITEM P3 **Sheet P3.1 – PLUMBING PLAN**

A. ADDED keynotes.

ITEM P4 **Sheet P5.1 – PLUMBING RISER DIAGRAMS**

A. ADDED sheet.

MECHANICAL:

ITEM M1 **Sheet M3.1 – MECHANICAL DUCTWORK PLAN**

A. ADDED Keynotes 9-11.
B. REVISED ductwork in EVS 1062 and Staff Lounge 1043.
C. REVISED ductwork in south east corner.
D. REVISED V2-09 size.
E. REVISED V2-01 thermostat location.
F. REVISED static pressure sensor locations in ductwork.
G. REVISED ductwork near Ambulance Vestibule 1068.

ITEM M2 **Sheet M3.5 – MECHANICAL ROOF PLAN**

A. ADDED keynote #5.
B. ADDED outside air intake clearance boundaries.

ITEM M3 **Sheet M7.2 – MECHANICAL CONTROLS**

A. REMOVED detector from controls diagram.
B. ADDED VAV control serving vestibule notes.

ITEM M4 **Sheet M8.1 – MECHANICAL SCHEDULES**

- **A. ADDED 'pre/final' to rooftop AC schedule.**
- **B. REVISED values in the VAV terminal schedules.**
- **C. REVISED V2-09 unit size.**
- **D. REVISED notes on VAV terminal schedules.**
- **E. REVISED area served on electric unit heater.**

ELECTRICAL:

ITEM E1 **Sheet E1.3 – ELECTRICAL SITE PLAN**

- **A.** REVISED utility poles to be dimensional aligned with Centerpoint Energy drawings.
- **B.** CLARIFIED lighting and relay panel circuit.
- **C.** DELETED (2) light poles at south parking lot.
- **D.** REVISED light pole locations at north parking lot.
- **E.** ADDED power for monument sign.
- **F.** ADDED keyed notes 7-10.

ITEM E2 **Sheet E3.1 – ELECTRICAL POWER PLAN**

- **A.** Circuit numbers have been updated but not clouded for clarity.
- **B.** Elec Rm 1013: ADDED lighting inverter locations.
- **C.** Elec Rm 1030: ADDED 3rd panelboard section.

ITEM E3 **Sheet E3.2 – ELECTRICAL POWER PLAN - EQUIPMENT**

- **A.** Circuit numbers have been updated but not clouded for clarity.
- **B.** ADDED keyed note 10 for VAV controls circuit.

ITEM E4 **Sheet E4.1 – LIGHTING PLAN**

- **A.** X

ITEM E5 **Sheet E5.1 – SPECIAL SYSTEMS PLAN**

- **A.** Utility 1072: ADDED fire pull station.
- **B.** AIDR 1064 & IDR 1066: ADDED smoke detector and fire pull station. REVISED to AV device.

ITEM E6 **Sheet E7.1 – ELECTRICAL RISER DIAGRAM AND PANEL SCHEDULES**

- **A.** Detail 1: ADDED available fault current calculations. REVISED Panel 'HL1' multipoint meter to be external.
- **B.** Panel 'MDP2' and 'HL1': CLARIFIED 'MPM' description.
- **C.** Panel 'HQ1': ADDED available fault current calculations.

ITEM E7 **Sheet E8.1 – ELECTRICAL EQUIPMENT AND LIGHTING SCHEDULES**

- **A.** REVISED Light Fixture Schedule.

ITEM E8 **Sheet E9.1 – ELECTRICAL DETAILS**

A. DELETED detail 1.

TECHNOLOGY:

ITEM T1 **Sheet T2.1 – TECHNOLOGY OVERALL FLOOR PLAN**

A. **ADDED** overhead cable tray section through Consultation 1015 as requested by Harris Health IT.

ITEM T2 **Sheet T2.2 – TECHNOLOGY FLOOR PLAN**

A. **UPDATED** Keyed Note #19. Removed "DATA CABLE FOR PRIMAX SYSTEM" and changed verbiage to "NOT USED".

ITEM T3 **Sheet T3.0 – TECHNOLOGY ENLARGED VIEWS**

A. **REVISED** Details #1 and #2 - Moved equipment rack row 5 feet plan east closer to the entrance door and switched positions of Rack #1 and Rack #2 as requested by Harris Health IT.

END OF ADDENDUM NO. 01

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END OF DOCUMENT

SECTION 23 09 23 - BUILDING AUTOMATION SYSTEMS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to associated equipment specification sections as they apply to BMS interface requirements herein as they are shown in the controls sheets in the Drawings.

C. Division 01 - Submittal Procedures

D. Division 01 - Temporary Facilities and Controls

E. Division 01 - Execution and Closeout Requirements

F. Division 01 - Commissioning

G. Section 07 84 00 - Fire-stopping.

H. Section 23 05 53 - Identification for HVAC Piping and Equipment

I. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

J. Section 23 08 00 - Commissioning of HVAC

K. Section 26 00 01 - Basic Electrical Requirements.

L. Section 26 05 03 - Equipment Wiring Connections.

M. Section 26 05 19 - 600-Volt Building Wire and Cable.

N. Section 26 05 53 - Identification for Electrical Systems.

1.2 SYSTEM DESCRIPTION

A. General:

1. Building Automation Controls shall be designed, procured, installed, and commissioned by an experience Controls Installing Contractor (CIC) following these and other approved specifications.
2. The control system network of BACnet controllers, an Enterprise system server, enterprise network infrastructure, and web service user interfaces shall integrate seamlessly into the site IT infrastructure. Network shall be composed of the Multitier Model as described in this document.

B. Tier 1: Enterprise IP Network Tier. This tier includes devices directly connected to the Owner’s enterprise network, including the Enterprise server, graphical front end, data historian, SQL server, OPC Server, etc.; peripheral devices such as printers, Web-client computers, Master Operator Workstations (B-OWS), Wi-Fi enabled cellphones or tablets; network routers, and BAS controllers (B-BCs, B-CACs, B-ASCs,) and devices that have IP connectivity. Includes IEEE 802.3, 1000BASE-X, 1000BASE-SX, 1000BASE-T.

C. Tier 2: Building- or Facility-Level IP Device Network. This tier includes VLAN IP devices connected to the IP network tier via a switch dedicated to the BAS device network or to enterprise managed switches under Owner's IT department control. In general this may include Operator Workstations (B-OWS) for sub-divisions of a master network (e.g. separate buildings on a campus system) and BAS controllers (B-CACs, B-ASCs), gateways to non-BACnet protocol and other devices that have IP connectivity. This may include equipment containing IP NIC such as chillers, VFDs, boilers, lighting control, compressors, energy meters, etc. Includes IEEE 802.3, 10BASE-T, 100BASE-T. Tier 2 network cabling costs shall be obtained from the Owner's approved network cabling contractor for those portions of the work that require integration into the Owner's network infrastructure.

D. Tier 3: Non-IP-Based BAS Controller Network Tier or BAS Controller Tier. This tier includes devices and actuators that are not IP based. These devices should be networked using non-IP wired networks such as BACnet MS/TP, LON TP/FT-10, Modbus, or other approved proprietary media types. This tier also includes any sensors and actuators that are directly connected to a BAS controller or are required for a BAS device, such as a boiler or chiller, which in turn is networked into the non-IP-BAS controller network. Device planned in Tier 2 that are non-IP based will be assigned to Tier 3. Other Tier 3 devices may include terminal box actuator/controllers, room thermostats, occupancy sensors, networked remote I/O, networked sensors, etc. Preferred ISO 8802-2 Type 1, EIA-485 physical layer

E. Enterprise IT Integration Requirements. CIC shall coordinate their work with the Owner's IT department to provide a seamless integration into the Owner's enterprise network. Integration shall be coordinated with Owner's IT group regarding IT requirements for the following:

1. Network switches and hubs (coordinate scope of work with Owner)
2. Network routers (coordinate scope of work with Owner)
3. Gateways: In general gateways shall be avoided
4. Security firewalls
5. Network IP address allocation, VLAN and static IP blocks
6. Port blocking/unblocking/binding
7. Password/pass phrase requirements, strength, periodic changes
8. Use of antivirus, antispam, and adware blocking, and logon security
9. Server security requirements
10. Server backup and maintenance requirements
11. System gateway requirements

F. System Architecture - refer to Controls Drawings.

G. Remote accessing outside of the Owner's enterprise network shall be prohibited if security features do not meet the Owner's IT standards. CIC shall identify requirements for remote access in their proposal. Limited access via VPN or limited duration "guest access" may be provided. Owner may not approve the request and no additional compensation will be provided.

H. Significant design activities will be required by the CIC to establish detailed requirements for trending, alarming, operator notification and escalation, graphics screens, etc. CIC shall provide sufficient time and resources to meet with the Owner's team to collect necessary input to complete these design activities. CIC shall have sufficient resources to conduct on-site meetings with the Owner's team to establish minimum requirements, submittal review of Owner feedback, and publication of a Basis of Design document covering the various aspects of the project.

I. Performance Monitoring: The BAS will provide the specified performance monitoring functionality including required monitoring points and performance metrics, improved through system accuracy, data acquisition and data management capabilities, and required graphical and data displays.

J. System Performance:

1. The communication speed between the BACnet controllers, Network interface devices, Enterprise server, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. Contractor shall submit guaranteed response times with Shop Drawings including calculations to support the guarantee. In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein:

    a. 5 seconds between a Level 1 (critical) alarm occurrence and enunciation at operator workstation.
    b. 10 seconds between a Level 2 alarm occurrence and enunciation at operator workstation.
    c. 20 seconds between a Level 3/4 alarm occurrence and enunciation at operator workstation.
    d. 10 seconds between an operator command via the operator interface to change a setpoint and the subsequent change in the controller.
    e. 5 seconds between an operator command via the operator interface to start/stop a device and the subsequent command to be received at the controller.
    f. 10 seconds between a change of value or state of an input and it being updated on the operator interface.
    g. 10 seconds between an operator selection of a graphic and it completely painting the screen and updating at least ten (10) points.

2. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
3. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 1 under “Accuracy Required for Control.”

TABLE 1 Sensors, Meters, Calculated Values, and Required Accuracies

Sensor Type	Range	Min. Accuracy
Duct/AHU Temperature	40 - 130°F	± 0.5°F
Room Temperature	50 - 85°F	± 0.5°F
Outside Air Temperature	-20 - 120°F	± 0.5°F
Humidity	0 – 100%	± 3% RH
Duct Static Pressure	0 – 3.0” w.g.	± 1% full scale per 50°F
Space Static Pressure	-0.25” – 0.25” w.g.	± 1% full scale per 50°F
Current Sensor	Sized for application	± 1% full scale
Power (kWh)	Sized for application	± 2% full scale (at 1.0 PF)
Air Flow	700 – 4,000 fpm	± 2% full scale
CO_2 Sensors	0 – 2,000 PPM	± 3% full scale

1.3 CONTROL AND POWER WIRING

A. All electrical control wiring, conduit, raceway and cable systems shall be furnished and installed under this section.

1. Wiring of interlock systems includes, but is not limited to, all fan interlocks and motorized dampers. See schedule on the drawings for motorized dampers to be interlocked.
2. Wiring of control equipment includes, but in not limited to, all necessary relays, switches and other equipment specified or required to accomplish interlocks and control sequences specified.
3. Wiring shall conform to National Electrical Code and ANSI C2.

B. Low voltage wiring shall be run in EMT conduit in exposed areas, attic spaces, and in vertical risers. Low voltage wiring shall be run in Schedule 80 PVC conduit outside. Line voltage control wiring shall be run in EMT conduit.

C. All 120V power wiring required to make the control system completely functional, which is not shown on the electrical drawings shall be provided by the controls contractor in accordance with Division 26 specification requirements.

1.4 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

1. ASHRAE 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks (2019 edition, including all current addenda and annexes).
2. ASHRAE Guideline 13, Specifying Direct Digital Control Systems (2015 edition)
3. ASHRAE Guideline 36, High Performance Sequences of Operation for HVAC Systems (2018 edition)

E. Electronics Industries Alliance:

1. EIA-458: Standard Optical Fiber Material Classes and Preferred Sizes.
2. EIA-485: Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.
3. EIA-472: General and Sectional Specifications for Fiber Optic Cable.
4. EIA-475: Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications.

F. Underwriters Laboratories:

1. UL 916: Energy Management Systems.
2. UUKL 864: UL Supervised Smoke Control if the BAS is used for smoke control.

G. NEMA Compliance:

1. NEMA 250: Enclosure for Electrical Equipment.
2. NEMA ICS 1: General Standards for Industrial Controls.

H. NFPA Compliance:

1. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
2. NFPA 70 National Electrical Code (NEC).

I. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 802.3: CSMA/CD (Ethernet – Based) LAN.
3. IEEE 802.4: Token Bus Working Group (ARCNET – Based) LAN.
4. IEEE 519: Recommended Practices and Requirements for Harmonic Control in Electric Power Systems.

J. Building Codes and local ordinances – refer to list on the Drawings.

1.5 SYSTEM REQUIREMENTS

A. BACnet IP Devices. Devices designed to connect directly to a BACnet network using the IP Protocol and in conformance with the requirements outlined in the BACnet Standard.

B. BACnet MS/TP devices. The use of BACnet device deployed in a master/slave network connection shall be for those systems of a non-critical nature, see network architecture. BACnet MS/TP may also be used for higher levels system but must be in a peer-to-peer on a sub LAN.

C. All BACnet devices supplied shall be BACnet Testing Laboratory (BTL) certified as required unless approved in advance. The component shall bare the BTL Mark Label.

D. Failure of single component shall not interrupt normal operation of other components. Supplier shall identify consequences of controller and device failures in the appropriate system Sequence of Operation.

E. BACnet Device Selection

1. Reference the Proposed System Architecture Drawings. The CIC shall supply a BAS that meets the intent of the propose system architecture with regards to BACnet device types. Alternate bid may be offered though the Owner may reject any bids failing to meet the intent of the proposed system architecture.
2. Supplier shall select BACnet Devices that provide a high-performance solution with minimum latency for data handling, built-in applications, alarm and event management, trending, scheduling, device and network management, etc. BACnet Controller devices with I/O or memory limits should be selected where there is sufficient processing and memory capability to handle significant data transmission overhead associated with multiple complex control algorithms, large quantities of data, alarms, events, messages, trending and web service requests. Controller Object Capacity.
3. Suppliers who offer multiple versions of Building Controllers (B-BC) and Custom Application Controllers (B-CAC) should select these controllers such that performance is not compromised when significant amounts of trend data, alarm data, event data, etc. are being processed or communicated to other devices., In particular they should be selected to allow for sufficient data storage in the event of a loss of communication to archival or supervisory storage.
4. The selection of the various BACnet Devices shall be at the discretion of the supplier but proposed system architecture is the Owner's preferred design. Acceptance of B-BC versus B-CAC will be contingent upon the specific features offered by each supplier. Do not supply B-ASC controllers where B-CAC controllers have been specified except as an alternate.

    a. BACnet specifications for B-BC, B-CAC, B-ASC shall meet the minimum requirements for support BIBBS. If the supplier's version of a given controller exceeds the BACnet BIBB specification this should be noted in their justification of a given controller type.

5. For each BACnet Device suppliers selects they shall indicate in their bids if there are higher performance models of the same BACnet device type available and the additional cost to provide this unit in lieu of the unit they have in their base bid

F. Operator Workstations. Operator workstation software may be resident at the B-BC or B-CAC controller or in other standalone configurations. This hardware shall be loaded as needed with any operation workstation software. CIC shall support Owner with loading of software.

G. The Enterprise Server shall collect and store data from every connected site for a minimum of five years. CIC shall submit with their bid the quantity of data storage needed to meet this requirement for initial phase plus the long term Owner's need (all campus building plus offsite building). This storage shall be supplied by the Owner and be attached to the Owner's Tier 1 Enterprise network. Alternate bid shall allow for Tier 1 data storage provided by the CIC, or Tier 2 data storage supplied by the CIC.

H. Data trending data shall be continuous and lapses in trend data due to communication failures should be avoided. Trend data stored at a local controller shall be in non-volatile memory and loss of network communication shall not cause the loss of any trend data. All BAS objects shall be trended.

1.6 DESIGN REQUIREMENTS OF THE CONTROLS INSTALLING CONTRACTOR (CIC)

A. Drawings and Narratives – Create, update, and prepare design documents and submit for approval.

1. System Architecture Drawing. Graphical representation of the overall system configuration indicating Tier 1, 2, and 3 networks and the configuration of control cabinets.
2. Network Drawings. One-line diagram indicating schematic locations of all control units, workstations, network interface devices, gateways, etc. Update provided drawing Indicating network number, device ID, address, device instance, MAC address, IP, drawing reference number, cable and port numbers, and controller type for each control unit.
3. P&ID Drawing.
4. Loop Drawing.
5. Panel Drawing.
6. Floor Plans showing control device location
7. Analog Loop Diagrams:

    a. Show all devices requiring electrical connections.
    b. Identify all wire and terminal numbers.
    c. Identify Controller I/O addresses.
    d. Identify location of loop power supply.
    e. Identify field devices, back-of-panel devices, and front-of panel devices.
    f. Show tabular summary of transmitter output capability, input impedance of each receiver, total loop impedance, and reserve output capacity.
    g. Reference tag number where assigned.

8. Control Panel Construction Drawings:

    a. Scaled drawings of all control panels and enclosures.
    b. Front panel elevation complete with nameplate legend.
    c. Back panel elevation complete with schedule of devices.

9. Control Panel Power and Environmental Requirements:

    a. Identify voltage and Ampacity requirements.

b. Show sizing calculations for environmental controls (ventilation, heat, air conditioning).

10. Control Panel Schematic Wiring Diagrams:

    a. Ladder type schematic diagrams.
    b. Show all devices requiring electrical connections.
    c. Identify all wire and terminal numbers.
    d. Identify Controller I/O addresses.
    e. Reference tag number where assigned.
    f. Cross-reference all relay contacts and coils.
    g. Identify switching action on all switching devices.
    h. Common diagrams will not be accepted unless they are provided with list all of the units that share the diagram and what each unit serves.
    i. Identify special installation procedures such as grounding.

11. Control Panel Plumbing Diagrams:

    a. Show all devices requiring plumbing connections (air or liquid).
    b. Show pipe/tube sizing.
    c. Show all control devices (regulators, filters, etc.).

12. Interconnecting Wiring Diagrams:

    a. Show all interconnections between control panels.
    b. Show all interconnections between control panels and motor control centers.
    c. Show all interconnections between control panels and field devices.
    d. Show all interconnections between motor control centers and field devices.
    e. Identify all wire and terminal numbers, including field terminal junction box terminals.

13. Control Device Installation Details
14. Sequence of Operation (SOO) shall be reviewed in conjunction with the P&IDs and legacy control schematics. Conflicts shall be noted and a resolution submitted. For applicable equipment and systems ASHRAE Guideline 36, High Performance Sequences of Operation for HVAC Systems shall be the basis SOO. The CIC's SOO shall contain the following sections:

    a. Drawing References
    b. General Description of the control
    c. Equipment List
    d. Instrument List
    e. Panel Designations
    f. Failure Analysis Summary
    g. Control Detail
    h. Loop Descriptions
    i. Control and Alarm Setpoints
    j. Trending points and trend parameters
    k. SCADA Interface Screen(S)

15. Instrument Location Drawings.
16. Instrumentation and Data Point Index. Contractor shall submit in table format the following information for each instrument and data point. The table is to be reviewed and approved by the Owner's representative prior to hardware and software installation and programming.

    a. Point/Variable name

b. Point description: provide building designation, system type, equipment type, engineering units, and functionality; include a description of its physical location
c. BACnet Object ID(s)
d. P&ID Drawing
e. SOO Number
f. Engineering Units at 0%
g. Engineering Units at 100%
h. Setpoint BACnet Object ID
i. Variable Type
j. Point Type

1) Bound or Polled
2) Digital Input
3) Digital Output
4) Analog Input
5) Analog Output
6) Virtual Point (Calculated)

k. Integration Requirement

1) Monitored
2) Controlled
3) Logged
4) Trended
5) Data trend interval
6) Number of samples stored in local controller before transfer to host computer/server database
7) Alarmed
8) Scheduled
9) Display (Local Panel)
10) Display (Operator GUI)
11) Graphic displays associated with point

l. Alarms

1) Low Limit
2) Low Low Limit
3) High Limit
4) High High Limit
5) Notification and Escalation Path

m. Sampling Rates
n. Data Buffer Limits

B. Integration of virtual data and data from non-BACnet devices

1. CIC shall design and supply an appropriate interface to networked BACnet devices containing virtual data points, non-BACnet third party systems which may include supply and installation of a gateway or application software such as OPC (PLCs (PLCopen / IEC 61131 compliant) to BACnet software.
2. CIC shall include sufficient BACnet Object IDs and virtual I/O to capture all of the needed data contained in the integrated systems. This estimate is for reference only and does not exclude CIC from providing requirements for all I/O as documented in the P&IDs.
3. CIC shall include necessary hardware and software for complete integration.
4. Integration shall include graphics, alarms, trending of all imported I/O.

C. Point naming, system points: For project with a previous point naming standard such standard will be used, else the following.

1. BACnet network numbers and Device Object IDs shall be unique throughout the network.
2. All assignment of network numbers and Device Object IDs shall be coordinated with the Owner.
3. Each Network number shall be unique throughout all facilities including future work and shall be assigned in the following manner unless specified otherwise:
4. Point names shall match point naming shown in points list in the Drawings.
5. Point names shall follow site standard. When site standard is not available naming should follow ISA naming convention or it may use following conventions: (AAAA-BBBBB-CCC-DD-EEE)

    a. Location in building or building identifier. (AAAA).
    b. System (BBBBB).
    c. Component or process of system (CCC).
    d. Unique identifier (DD)
    e. Type of variable (EEE) (Not an exhaustive list)

        1) Temperature (T).
        2) Humidity (H).
        3) Setpoint (SP).
        4) Pressure (P).
        5) Damper Actuator (DA).
        6) Current (I).

D. Alarms.

1. It is the Owner's intent to have a comprehensive alarm management system that allows for advanced alarm notification via web services and email notification. CIC shall design an alarm handling system that incorporates:

    a. Notification via OWS, via Owner's email system, paging system, and mobile devices
    b. Acknowledgement via OWS, via Owner's email system, paging system, and mobile devices
    c. Owner customizable escalation to selective users

2. CIC shall include necessary design and programming to support Owner's alarm management requirements including development of unique alarm notification path scripts and unique alarm escalation path scripts. Scripts shall be reviewed and approved by the Owner and tested during startup and commissioning.
3. There shall be 4 Alarm priority levels,

    a. Level 1: Life-safety; High Risk
    b. Level 2: Critical Equipment Message (i.e., equipment failure)
    c. Level 3: Urgent Message (i.e., comfort critical)
    d. Level 4: Normal Message (i.e., preventative maintenance)

E. Graphic User Interface (GUI).

1. The following are intended as guidelines and CIC shall conduct design sessions with the Owner's team to developed detailed GUI requirements. The CIC's graphic design session will cover basic graphic design covering normal equipment operations, control of equipment, loop tuning, trending, alarm management, point/device-naming conventions etc. CIC may at their discretion employ the use of an approved third-party graphics developer who shall lead session associated with their scope. An approved agenda shall

be issued prior to the meeting and expected deliverables and schedule shall also be presented.

2. GUI shall be high resolution with containing 3D and motion simulation, photo realistic simulations of equipment operations; dashboards, histograms, scatter plots, line plots, thermal analysis, etc. Graphics should visually convey necessary information to the user depending on the user's need whether engineering, operations, maintenance, diagnostics, utilities, forecasting, etc.
3. GUI presentation should be independent of operator workstation whether multi-screen display, laptop PC, tablet, or mobile device the graphics should be visible to approved users and scaling to fit the display format.
4. GUI screens shall be divided into types (minimum): Operational, Engineering, Analytics, Maintenance, Diagnostics, Occupant Education, and others as recommended by the CIC
5. Navigation: CIC shall present screen navigation options, short cuts, web links, etc. to the Owner for review and incorporate into the finished GUI.
6. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.
7. Graphics shall be capable of using data collected by individual BACnet devices, supervisory software, third part data sets (virtual or physical) within the Owner's enterprise system, and approved external data sources (e.g. weather data).
8. CIC shall create the following graphics screens

    a. Provide graphics for all systems and floor plans of the building. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant virtual points such as set points, calculated values, effective heat and cooling setpoints, FDD data, runtime hours, maintenance hours, etc.
    b. Summary tables and pages matching existing GUI practice.
    c. Electrical, Gas, and Weather Graphic Display a. Provide a graphic display for each electrical meter and gas meter and weather data point(s) with a data table and a current 24-hour trend plot. Include data values for the following time periods; today, previous day, week to date, previous week, month to date, previous month, year to date, previous year

9. Architectural Plans. Provide 3D site plan and floor plans based upon Owner's floor plans. Floor plans shall be used for communication of various information including location of control devices, thermal performance, energy consumption, equipment location, system boundaries, area served. Provide ability to click and zoom into selected locations of each floor.
10. Operational Graphic:

    a. Performance: Provide individual equipment graphics covering all control parameters.

        1) Control Device: Mode (H-O-A), On-line, Off-line, deviation from setpoint,
        2) Control Loops: Clicking on Loop control devices will show loop details, includes of P, I, D parameters, set point, process variable, auto/manual switch, loop output, a real time multi-pen trend of process variable, loop set point and loop output with history, text indicating whether the loop is direct or reverse acting.
        3) Trim and Respond Logic (T&R SL) performance summary tables
        4) Equipment Summary Tables and Floor Zone Heat Maps
        5) System Summary Tables and Overview Graphic per system
        6) All damper analog position displays will show percent open.
        7) Lead/Lag for parallel equipment. Provide 'button'-style graphical user interface objects to identify and change lead/lag equipment settings.

8) All VFDs shall display percent of full speed, actual speed, and setpoint. Energy per day, power, and other virtual data from VFDs used to convey critical operational data shall be available for display through equipment graphic link.
9) All tank analog level displays will show percent full.

b. Cost: When possible, provide operating cost visualization of each building, manufacturing space, equipment, group of equipment, and system.
c. Efficiency: Provide visualization of major equipment and systems concerning their operating performance such as COP, kW/cfm, ton-hours/area, cfm/area, utility data/occupant.

11. Calendars: Graphics shall contain calendar links allowing information to be easily filtered by day, week, month, calendar events (e.g., shutdowns, holidays, etc.)
12. Utility Data: Graphics shall convey utility consumption and cost data using local utility tariffs and input from utility meters (if allowed) or Owner's on-site meters.
13. Weather Data. Provide weather data as measured by locally measured instruments or optional connection to weather data from approved meteorological sources (ref plans). Weather data shall be presented discreetly on each screen with the ability to click and zoom in for detailed weather and historical weather data.
14. Dashboards.

a. Dashboards shall visualize various performance parameters associated with individual equipment, groups of similar equipment, systems, utilities, analytical data, etc.
b. Dashboards shall be organized by:

1) Total Campus
2) Building
3) Floor
4) Manufacturing Area
5) System
6) Equipment

15. Occupant Education. Provide up to (3) Graphics that increase occupant awareness through the display of building performance data, demonstrations of sustainable building features, tips on how to be efficient, and other interactive educational features. Graphics should be able to show comparative building performance data among buildings and/or floors. These graphics should be very high quality and resolution for display on very large display units or across multiple displays.
16. Diagnostics including Fault Detection and Diagnostics (FDD).

a. Provide dedicated graphic pages covering FDD data obtained from equipment containing FDD information such as RTUs, Chillers, etc.
b. Provide advanced diagnostics analysis for each of the various systems to help engineers and operators analyze performance parameters and identify anomalies. Use the latest research on fault diagnostics to develop graphics that will visualize the various systems and their performance issues. Provide drill down into individual equipment performance with comparisons of similar equipment (e.g., chiller to chiller performance comparisons, VAV/FCU comparisons); inefficient operations such as simultaneous heating and cooling

17. Maintenance.

a. Provide summary tables indicating runtime, maintenance, and lifetime equipment hours following current site standards.

b. Provide visualization of maintenance activities such as filter changes, sensor calibration, equipment overhauls, etc.
c. CIC shall identify needed input data to provide visualization, identify missing data, data links, normalization factors, etc. that prohibit any of the visualizations.

18. CIC shall identify needed input data to provide operating visualization, identify missing data, data links, normalization factors, etc. that prohibit any of the visualizations.
19. Normalization Metrics. Analytics shall include absolute data analysis as well as data normalized by area served, cost of operation, utilities consumed, cooling degree days, heating degree days, runtime, cycle time, etc.
20. Data Storage. Screen captures with data storage shall be implemented with simple on-screen button clicks capturing all important parameters and graphical elements.
21. Trend Graph Displays

    a. Design trend graphs that shall allow Operators to define and trend multiple data points over time on a graph for visualization as a diagnostic tool to identify inter-relationships between systems and associated components for:

22. Graphics impact on system performance.

    a. CIC shall summarize the data requirements for the graphics in their proposal
    b. CIC shall summarize the total memory requirements and network burden, if any, due to graphics.

1.7 SCHEDULE REQUIREMENTS

A. Schedule submitted with bid: The Contractor shall submit with their bid a project schedule depicting the major elements of the scope of work with sufficient detail to evaluate the overall project plan proposed by the CIC and demonstrate meeting of Owner's milestone schedule requirements. It shall include design, submittals, procurement, installation for each major piece of equipment, start-up, pre-commissioning, commissioning, and Acceptance, refer to bid tabulation tables. All required downtimes shall be noted in the schedule. Downtimes that impact the Owner's manufacturing operation may not be approved and CIC shall be required to work around Owner's schedule. No additional compensation shall be provided for work outside of normal working times unless previously approved.

B. A detailed project schedule using MS Project or other approved software shall be submitted within 2 weeks from the date of award for approval. The project schedule should be in alignment with the bid schedule. The schedule shall be updated every week thereafter by means of a progress report submitted to the Construction Manager, Owner, and/or Engineer.

C. The schedule shall include, but not be limited to, the following:

1. A network diagram consisting of intended sequence of work items, starting and completion dates for all main activities and constraints. Activities to be scheduled include design, submittals, material procurement and delivery, installation of hardware, installation of software, programming, shutdowns or disruptions of Owner equipment, equipment start-up, OAT, FAT, Commissioning, Close-out
2. Schedule should be based upon a 24 hour/ 7day work week noting working periods and non-working periods.
3. Provide Review dates, including design, submittals, and commissioning.
4. Construction of each main system indicating completion of the various phases of the project consistent with the time frame indicated by the Engineer.
5. All approved downtime for each equipment to receive new controllers or that will be controlled.

6. After review and approval of the schedule, all proposed revisions to the schedule shall be submitted to the Construction Manager, Owner, and Engineer in writing, and no such revision will be effective until it is approved in writing.
7. The work schedule of the Contractor will be continuously subject to review by the Owner, to ascertain that the schedules are to the best interest of the project, and that the work is properly coordinated among all parties.

1.8 SUBMITTALS

A. Submittals fully describing all control equipment and fully demonstrating its conformity to these Specifications are required to be submitted to before any components are procured, fabricated, and/or integrated into assemblies. The submittals details below are not exhaustive and some additional submittal requirements may be embedded within the Part 2 or Part 3 section of this document.

B. All drawings shall be submitted in electronic format (PDF) and, when requested by the Owner, in hard copy in a format agreed upon with the Owner.

C. Submit the following with the supplier's proposal for New BAS, may be deferred for existing systems

1. BAS Hardware:

a. A complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data. CIC shall use the Point and Controller Summary Table(s) for input sheets

1) BACnet compliant devices including but not limited to:

a) BACnet building controllers (B-BC).
b) BACnet custom application controllers (B-CAC).
c) BACnet application specific controllers (B-ASC).
d) BACnet gateway (B-GW).
e) BACnet Operator Workstations (B-OWS and B-AWS)
f) BACnet Operator Display (B-OD)
g) BACnet Smart Actuator/Sensor (B-SA, B-SS)

2) Complete list of hardware not covered by the BACnet standard. Details of these items will be submitted after the award as scheduled.

b. Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:

2. Point and Controller Summary Table(s) summarizing the following:

a. Physical I/O points per equipment
b. Virtual I/O points per equipment

3. Graphics

a. Total number of unique graphic screens, dashboards, face plates, 3D visualizations, animations, etc. CIC shall use the Point and Controller Summary Table(s) for input sheets

4. Provide BACnet Testing Labs certification for each type of controller, router, gateway, instrumentation, control device and operator interface included in the submittal.
5. Software. Submit software name, function, revision history, developer, etc. Identify software that will be delivered to the Owner as part of this project.

    a. Network software.
    b. Operator Interface equipment.
    c. Operating system software.
    d. Operator interface software.
    e. Color graphic editing software.
    f. Other, including diagnostic, protocol analyzer, network management, utilities.

6. Power summary for each enclosures and required power requirements (e.g. number of circuits, current requirements).

D. Submit the following information within 4 weeks of award of Contract:

1. System architecture diagrams showing any proposed changes or revisions to the architecture diagrams as provided.
2. Network drawings

E. Submit the following information at one or more of the scheduled design progress reviews. Schedule of submittal for each item shall be included in the CIC's proposal.

1. Updates to P&IDs
2. Updates to SOO
3. Instrumentation and Data Point index, see requirements above
4. Updates to Commissioning Plan
5. Location drawings showing any proposed changes or revisions to the location drawings for each control panel as provided.
6. Preliminary versions of Graphic screens, see design criteria section

    a. Process/Equipment/Floor Plan Graphics: each a comprehensive picture of specific segments of the process/equipment to be controlled.
    b. Performance Monitoring (if applicable)
    c. Energy Analytics (if applicable)
    d. Alarm Displays: a summary of alarms in text form which is in reverse-chronological order with the most recent at the top.
    e. Summary Displays: provides a number of displays which can be addressed by keyboard or other pointing device.
    f. Status Displays: a comprehensive set of displays showing the status of the system components. These displays provide the operator with sufficient information to easily identify a failed or malfunctioning system component.
    g. Faceplate Displays: a comprehensive picture of a conventional analog faceplate.
    h. Group Displays: a summary of the faceplate displays with in text form presenting point, loop, group, or device.
    i. Tuning Displays: displays designed to allow operator/Engineer interaction(s) to tune process parameters and program/implement control strategies.
    j. Loop Maintenance Displays: providing a summary of the tuning displays in text form presenting the data shown on the tuning displays.

7. Control Panel Construction Drawings
8. Control Panel Schematic Wiring Diagrams
9. Analog Loop Diagrams
10. Control Panel Plumbing Diagrams
11. Control Panel Power and Environmental Requirements

12. Interconnecting Wiring Diagrams
13. Control Device Installation Details
14. BACnet program documentation:

    a. Software logic control drawings (some of this may be captured by the P&IDs):

        1) Provide signal flow chart, which includes control loops. Where output or input of control loop is interconnected to other control loops, control loops shall be shown on same drawing using ISA control logic graphics or approved alternate.
        2) Indicate source or destination for measured variable input, setpoint (manual or reset schedule), enable/disable, and output signals.
        3) Reference software modules (control modules i.e. PID module, or reset schedules of enthalpy calculations, etc.) or other software programming to algorithmic program code.
        4) Control loop parameter settings shall be shown on drawings as part of "as-built" documentation including proportional band, reset, derivative, dead band, alarm limits, and other control adjustments. When control loops are contingent on other events or measured values, such as fan operation or outdoor temperature (as in economizer mode), contingencies shall be displayed on Drawings.
        5) Software logic control drawings and algorithmic program code shall constitute entire software for control loops.
        6) Drawing shall include terminal number, wire number, and cable number references. Referenced notations shall be identical to notations used on hardware.

F. Submit the following at Project Closeout

1. Project Record Drawings. As-built versions of all submittal drawings.
2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of acceptance test criteria
3. Operation and Maintenance (O & M) Manuals.
4. As-built versions of submittal product data
5. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
6. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
7. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
8. Documentation of all programs created using custom programming language including setpoints, tuning parameters, and object database.
9. Graphic files, programs, and database on magnetic or optical media.
10. List of recommended spare parts with part numbers and suppliers.
11. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
12. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
13. Licenses, guarantees, and warranty documents for equipment and systems.
14. Complete list of CIC users, user names and passwords.

15. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

1.9 WORKMANSHIP AND QUALITY ASSURANCE

A. The CIC shall complete the entire control system so that it is functional and operating to the satisfaction of the Owner. Execute the work in the best and most thorough manner and to the satisfaction of the Engineer/Owner, who will interpret the meaning of the drawings and specifications and shall have the power to reject any work and materials, which are not in full accordance therewith.

1.10 WARRANTY

A. The BAS warranty begins upon acceptance of the system. Acceptance occurs after an agreed-upon completion of a demonstration or acceptance test of the entire system. Warranty start date shall be the same for all systems, software, hardware, and any materials installed under this project. There will be no staged warranty start dates.

B. CIC shall warrant all products and labor for a period of one year after project Acceptance date. CIC shall propose costs for 2, 3, 4, and 5 years extended warranty/service contract.

C. At no cost to the Owner, during the Warranty Period, CIC shall provide maintenance services for software, firmware and hardware components as specified below:

1. Maintenance services shall be provided for all devices and hardware specified in the Contract Documents. Service all equipment per the manufacturer’s recommendations.
2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of critical environmental control shall be corrected and repaired following telephonic notification by the Owner to the CIC. Emergency service shall be provided 24 hours per day, 7 days per week, and 365 days per year with no exceptions and at no cost to the Owner.

    a. Response by telephone to any request for service shall be provided within two (2) hours of the Owner's initial telephone request for service. CIC shall acknowledge receipt of Owner’s request for service with an email within 15 minutes of the request to the Owner’s designated personnel (email addresses to be provided). Email shall contain time of request, requestors name, description of the problem, person receiving the request. Within 30 minutes an email will be sent updating the request with name of person assigned to respond to the request, estimated time to resolve the problem or to arrive at the Owner’s site.
    b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to the Owner's Site within four (4) hours of the Owner's initial telephone request for such services, as specified. An email will be sent to Owner’s designated personnel providing an update to the request.
    c. After the work is completed a final work order ticket describing in detail all work performed (i.e. hardware replaced or serviced, software or firmware modifications made, etc.), hours worked, follow-up work required, etc., must be signed by an authorized building operators. A email shall be sent indicating the work is completed as far as the CIC is concerned. Owner shall acknowledge that work is complete else indicate the work is not complete and request CIC to complete any items needed to close the service request.

3. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by the Owner to the CIC.

    a. Response by telephone to any request for service shall be provided within eight (8) working hours (during normal business hours) of the Owner's initial telephone request for service. CIC shall acknowledge receipt of Owner's request for service with an email within 15 minutes of the request to the Owner's designated personnel (email addresses to be provided). Email shall contain time of request, requestors name, description of the problem, person receiving the request. Within 30 minutes during normal business hours or 4 hours in after business hours an email will be sent updating the request with name of person assigned to respond to the request, estimated time to resolve the problem or to arrive at the Owner's site.
    b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to the Owner's Site within two (2) working days of the Owner's initial telephone request for such services, as specified. An email will be sent to Owner's designated personnel providing an update to the request.
    c. After the work is completed a final work order ticket describing in detail all work performed (i.e. hardware replaced or serviced, software or firmware modifications made, etc.), hours worked, follow-up work required, etc., must be signed by an authorized building operators. A email shall be sent indicating the work is completed as far as the CIC is concerned. Owner shall acknowledge that work is complete else indicate the work is not complete and request CIC to complete any items needed to close the service request.

4. At any time during the Warranty Period that CIC is on site for maintenance, emergency, or normal service, CIC shall notify Owner's designated representative. CIC shall notify said personnel of all work anticipated being involved for the service work. In addition, no work affecting system operation shall commence until express permission is granted. After the work is completed a work order ticket describing in detail all work performed (i.e. hardware replaced or serviced, software or firmware modifications made, etc.), hours worked, follow-up work required, etc., must be signed by an authorized building operators or Monitoring Services personnel.
5. Owner's Telephonic Request for Service: CIC shall specify a maximum of three telephone numbers for Owner to call in the event of a need for service. At least one of the lines shall be attended at any given time at all times. Alternatively, pagers can be used for technicians trained in system to be serviced. One of the three paged technicians shall respond to every call within 15 minutes.
6. At the conclusion of any work on site for maintenance, emergency, or normal service, CIC shall submit a satisfaction survey to the Owner's designated representative. Survey shall qualitatively and quantitatively document the Owner's perception of the most recent work.
7. Technical Support: CIC shall provide technical support by telephone throughout the Warranty Period.
8. Preventive maintenance shall be provided throughout the Warranty Period in accordance with the hardware component manufacturer's requirements.
9. Once per quarter CIC shall schedule a quarterly business review meeting. Meeting shall review past quarter's service requests, response time, satisfaction survey results, software revisions completed and those forecasted for the coming two quarters.
10. In the last month of the Warranty Period, all System software and controller firmware, software, drivers, etc. will be upgraded to the latest release (version) in effect at the end of the Warranty Period.

1.11 DELIVERY, STORAGE, & HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons while shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

B. All supplied material and equipment shall be handled with care to prevent mechanical and moisture damage. Equipment and materials for outdoor use which arrive at the construction site prior to the installation time shall be stored indoors or otherwise suitably protected.

C. Protect hardware from theft by cataloging and storing in secure area.

D. Protect Warranty Inventory Spares from theft, damage, degradation, etc.

E. Protect software licenses from theft, duplicating, cloning, etc. according to the license agreements.

1.12 SOFTWARE LICENSING

A. Tools. All software, databases, configuration tools, and analysis tools shall be delivered as part of the project. All software shall be properly licensed and conveyed at contract sign off. In no circumstances shall any software keys, licenses, or tools be licensed to a contractor or subcontractor on the Owner's behalf. Deliver all software licenses, keys, dongles, or other software security mechanisms.

B. Supplier Software

1. Supervisory Software. Provide standard software license cost for the following:

   a. Twenty-five (25) concurrent users and unlimited number of unique user credentials.

2. Application Software. May include additional software supplied by the CIC such as configuration tools, management tools, diagnostic tools, graphic tools, and utilities. Provide standard software license cost for the following:

   a. Five (5) concurrent users and unlimited number of unique user credentials.

3. Configuration Software. Provide controller configuration software. compatible with latest version of system.

1.13 PASSWORD PROTECTION

A. Multiple-level password access protection shall be provided to allow the Owner's authorized BAS Administrator to limit workstation control, display and database manipulation capabilities as BAS Administrator deems appropriate for each user, based upon an assigned user name with a unique password.

B. All passwords for the system shall be provided to the Owner including administrator, dealer, or factory level passwords for the systems provided under this Project. No backdoor passwords will be allowed.

C. User Credentials and access rights shall be completely customizable for each unique user ID. Access rights may be restricted to any group of BACnet Object IDs, control units, graphics screens, etc.

D. Operators shall be able to perform only those commands available for the access level assigned to their user name.

E. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving interface device software on-line.

1.14 OWNERSHIP OF PROPRIETARY MATERIAL

A. Product-specific software and documentation shall become the Owner's property. This includes but is not limited to the following:

1. Graphics.
2. Record drawings.
3. Database.
4. Application programming code.
5. Documentation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEM MANUFACTURERS

A. JCI Metasys.

2.2 MATERIALS

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Do not use this installation as a product test site unless explicitly approved in writing by the Owner. New products with enhanced features and performance may be submitted as alternate bid.

2.3 SECTION INCLUDES

A. Communication

B. Operator Interface

C. Controller Software

D. Building Controllers and Custom Application Controllers

E. Application-Specific Controllers

F. Control Panels

G. Power Supplies

H. Auxiliary Control Devices

I. Wiring And Raceways

2.4 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a open protocol BAS. Controller and operator interface communication shall conform to open-protocol body conformance and/or certification requirements.

B. Each controller shall have a communication port for connection to an operator interface.

C. Project drawings indicate remote buildings or sites to be connected by a nominal 56,000 baud modem over voice-grade telephone lines. In each remote location a modem and field device connection shall allow communication with each controller on the internetwork as specified in Paragraph D.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to the BAS shall allow the operator to interface with each internetwork controller as if directly connected. BAS information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internetwork controller.
2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified BAS operation. An authorized operator shall be able to manage, maintain and access the BAS network of controllers.

E. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring. Expansion shall not require operator interface hardware additions or software revisions.

F. Workstations, Building Control Panels and Controllers with real-time clocks shall use the open-protocol time synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight savings and standard time as applicable.

2.5 OPERATOR INTERFACE

A. Operator Interface. PC-based workstations shall reside on high-speed network with building controllers as shown on system drawings. Each workstation or each standard browser connected to server shall be able to access all BAS information.

B. Hardware. Each operator workstation or web server shall consist of the following:

1. Computer: Hardware shall meet or exceed BAS manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The following hardware requirements also apply:

a. The hard disk shall have sufficient memory to store:

1) All required operator workstation software
2) A B database at least twice the size of the delivered system database
3) One year of trend data based on the points specified to be trended at their specified trend intervals.

b. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.

C. System Software

1. Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications. Examples

include Microsoft Excel, Microsoft Access or other SQL database software. Acceptable operating systems are Windows, the latest Windows Server release, Linux, and UNIX.

2. System Graphics. The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
3. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, and GEM. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer or AutoCAD.
4. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

D. System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation:

1. Automatic System Database Save and Restore. Each workstation shall store on the hard disk a copy of the current database of each Building Controller. This database shall be updated whenever a change is made in any system panel. The storage of these data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel. This capability may be disabled by the operator.
2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection.
4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the functions accessible to viewing and/or changing each system application, editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time period shall be user-adjustable. All system security data shall be stored in an encrypted format.
6. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, alarm limit differentials, states, and reactions for each object in the system.
8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying upon acronyms or other mnemonics.
9. Alarm Reactions. The operator shall be able to determine (by object) what, if any, actions are to be taken during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation, or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day.
10. Trend Logs. The operator shall be able to define a custom trend log for any data object in the system. This definition shall include interval, start time, and stop time. Trend data shall be sampled and stored on the building controller panel, be archivable on the hard disk, and be retrievable for use in spreadsheets and standard database programs Trend data shall be exportable in a standard electronic format [(.xls, .csv, .xml)] for analysis external to the BAS..
11. Alarm and Event Log. The operator shall be able to view all system alarms and change of states from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.
12. Group Trend Time Series Plots

    a. Provide user-selectable Y points.
    b. Provide user-editable titles, point names, and Y axis titles.
    c. Individual trended points shall be able to be grouped in groups of up to four points per plot with up to four plots per page.

13. X-Y Trend Plots

    a. User-selectable X and Y trend inputs.
    b. User-editable titles, point names, and X and Y axis titles.
    c. User-selectable time period options:

        1) a 1-day 24-hour period;
        2) a 1-week 7-day period;
        3) a 1-month period, with appropriate days for the month selected; or (4) a 1-year period.
        4) The user shall be able to select the beginning and ending period for each X-Y chart, within the time domain of the database being used.
        5) User-selectable display of up to 6 plots per screen in 2 columns.

14. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.
15. Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archivable on the hard disk for historical reporting. Provide the ability for the operator to obtain real-time logs of all objects by type or status (e.g., alarm, lockout, normal). Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications, including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer and shall be set to be printed either on operator command or at a specific time each day.
16. Standard Reports. The following standard BAS system reports shall be provided for this project. Provide ability for the Owner to readily customize these reports for this project.

a. All Objects/Points/Variables: All system (or subsystem) objects and their current values.
b. Alarm Summary: All current alarms (except those in alarm lockout).
c. Disabled Objects/points: All objects that are disabled.
d. Alarm Lockout Objects/points: All objects in alarm lockout (whether manual or automatic).
e. Alarm Lockout Objects/points in Alarm: All objects in alarm lockout that are currently in alarm.

1) Logs:
2) Alarm History
3) System Messages
4) System Events
5) Trends

17. Custom Reports. Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.
18. Tenant Override Reports. Provide a monthly report showing the daily total time in hours that each tenant has requested after-hours HVAC and lighting services. Provide an annual summary report that shows the override usage on a monthly basis.
19. Electrical, Gas, and Weather Reports

a. Electrical Meter Report: Provide a monthly report showing the daily electrical consumption and peak electrical demand with time and date stamp for each building meter.
b. Provide an annual (12-month) summary report showing the monthly electrical consumption and peak demand with time and date stamp for each meter.
c. Gas Meter Report: Provide a monthly report showing the daily natural gas consumption for each meter. Provide an annual (12-month) report that shows the monthly consumption for each meter.
d. Weather Data Report: Provide a monthly report showing the daily minimum, maximum, and average outdoor air temperature, as well as the number of heating and cooling degree-days for each day. Provide an annual (12-month) report showing the minimum, maximum, and average outdoor air temperature for the month, as well as the number of heating and cooling degree-days for the month. If there is a weather station within 25 miles of the facility, provide real-time weather information via SOAP/XML. Otherwise, use weather values from the BAS.

20. Electrical, Gas, and Weather Graphic Display a. Provide a graphic display for each electrical meter and gas meter and weather data point(s) with a data table and a current 24-hour trend plot. Include data values for the following time periods; today, previous day, week to date, previous week, month to date, previous month, year to date, previous year.

E. Workstation Applications Editors. Each PC workstation shall support editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at one or more of the controller panels.

1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.
2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and month. This shall consist of a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a

schedule. The start and stop times for each object shall be adjustable from this master schedule. Schedules shall be easy to copy to other objects and/or dates.

3. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The BAS shall be fully operable while custom routines are edited, compiled, and downloaded. The programming language shall have the following features:

    a. The language shall be English language oriented, be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and allow for free-form programming (i.e., not column-oriented or “fill in the blanks”). Alternatively, the programming language can be graphically based using function blocks as long as blocks are available that directly provide the functions listed below and that custom or compound function blocks can be created.
    b. A full-screen character editor/programming environment shall be provided. The editor shall be cursor/mouse-driven and allow the user to insert, add, modify, and delete custom programming code. It also shall incorporate word processing features such as cut/ paste and find/replace. The debugger also shall provide error messages for syntax and execution errors.
    c. The programming language shall support conditional statements (IF/THEN/ELSE/ ELSE-IF) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
    d. The programming language shall support floating-point arithmetic using the following operators: +, □, □, ×, and square root. The following mathematical functions also shall be provided: absolute value and minimum/ maximum value from a list of values.
    e. The programming language shall have predefined variables that represent time of day, day of the week, month of the year, and the date. Other predefined variables shall provide elapsed time in seconds, minutes, hours, and days. These elapsed time variables shall be able to be reset by the language so that interval-timing functions can be stopped and started within a program. Values from all of the above variables shall be readable by the language so that they can be used in a program for such purposes as IF/THEN comparisons, calculations, etc.
    f. The language shall be able to read the values of the variables and use them in programming statement logic, comparisons, and calculations.
    g. The programming language shall have predefined variables representing the status and results of the System Software and shall be able to enable, disable, and change the set points of the System Software described below.
    h. The programming language shall allow independently executing program modules to be developed. Each module shall be able to independently enable and disable other modules.
    i. The editor/programming environment shall have a debugging/simulation capability that allows the user to step through the program and observe any intermediate values and/or results. The debugger also shall provide error messages for syntax and execution errors.

2.6 CONTROLLER SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation.

B. System Security

1. User access shall be secured using individual security passwords and user names.

2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
3. User Log On/Log Off attempts shall be recorded.
4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.

C. System Coordination. Provide a standard application for the proper coordination of equipment. This application shall provide the operator with a method of grouping together equipment based on function and location. This group may then be used for scheduling and other applications.

D. Scheduling. Provide the capability to schedule each object or group of objects in the BAS. Each schedule shall consist of the following:

1. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.
2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
3. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
4. Before project close-out, the contractor shall create schedules for each piece of equipment (not just provide the capability to do so).

E. Binary Alarms. Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.

F. Analog Alarms. Each analog object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.

G. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display graphics.

H. Remote Communication. The system shall have the ability to transmit the alarm/event using the open protocol control network.

I. Demand Limiting.

1. The demand-limiting program shall monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter or from a watt transducer or current transformer attached to the building feeder lines.
2. The demand-limiting program shall predict the probable power demand such that action can be taken to prevent exceeding the demand limit. When demand prediction exceeds demand limit, action will be taken to reduce loads in a predetermined manner. When demand prediction indicates the demand limit will not be exceeded, action will be taken to restore loads in a predetermined manner.
3. Demand reduction shall be accomplished by the following means:

    a. Reset air-handling unit supply temperature set point up by 1ºC (2ºF).

b. Reset space temperature set points up by 1ºC (2ºF).
c. De-energize equipment based upon priority.

4. Demand-limiting parameters, frequency of calculations, time intervals, and other relevant variables shall be based on the means by which the local power company computes demand charges.
5. Provide demand-limiting prediction and control for any individual meter monitored by the system or for the total of any combination of meters.
6. Provide the means for an operator to make the following changes on-line:

a. Addition and deletion of loads controlled.
b. Changes in demand intervals.
c. Changes in demand limit for meter(s).
d. Maximum shutoff time for equipment.
e. Minimum shutoff time for equipment.
f. Select rotational or sequential shedding and restoring.
g. Shed/restore priority.

7. Provide the following information and reports, to be available on an hourly, daily, and monthly basis:

a. Total electric consumption.
b. Peak demand.
c. Date and time of peak demand.
d. Daily peak demand.

J. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.

K. Sequencing. Provide application software based upon the sequences of operation specified to properly sequence chillers, boilers, and pumps.

L. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, set point, and PID gains shall be user-selectable.

M. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user-selectable.

N. Energy Calculations.

1. Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [gpm]) to be accumulated and converted to energy usage data.
2. Provide an algorithm that calculates a sliding-window average (e.g., rolling average). The algorithm shall be flexible to allow window intervals to be user specified (e.g., 15 minutes, 30 minutes, 60 minutes).
3. Provide an algorithm that calculates a fixed-window average. A digital input signal will define the start of the window period (e.g., signal from utility meter) to synchronize the fixed-window average with that used by the utility.

O. Anti-Short Cycling. All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

P. On/Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and set point. The algorithm shall be direct-acting or reverse-acting and incorporate an adjustable differential.

Q. Run-Time Totalization. Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.

2.7 BACnet BUILDING CONTROLLERS (B-BC) and CUSTOM APPLICATION CONTROLLERS (B-CAC)

A. General: Provide as needed controllers to achieve the performance specified.

1. Data shall be shared between all networked controllers.

    a. Ability to provide the values of any of its BACnet objects
    b. Ability to retrieve the values of BACnet objects from other devices
    c. Ability to allow modification of some or all of its BACnet objects by another device

2. Each unit shall have sufficient memory to support its own operating system, databases, and control programs as required to meet performance requirements, and to provide supervisory control for all control level devices.
3. Selection of B-BC or B-CAC shall be based upon performance configuration covering memory, COM ports, application software, etc. B-CAC that cannot store trends, alarms, events, locally should not be used.
4. The building controllers shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

    a. assume a predetermined failure mode, and
    b. generate an alarm notification

5. Alarm and Event Management

    a. Generation of alarm / event notifications and the ability to direct them to recipients
    b. Maintain a list of unacknowledged alarms / events in nonvolatile memory
    c. Notifying other users that the acknowledgment has been received
    d. Adjustment of alarm / event parameters

B. Communication Ports. At a minimum provide the following:

1. BACnet: BACnet/IP and MS/TP, port configurable
2. BACnet IP

    a. 100BASE-T with option for 1000BASE-T.
    b. Connections shall be made using 8-pin RJ-45, Option for Industrial connectors in hazardous environments with IP65 Enclosure rating

3. BACnet MS/TP EIA-485

    a. Data transmission speeds of a minimum 30 kbit/s with preferred speed of 70kbit/s or higher
    b. Connection shield twisted pair, 18 AWG

C. Provide indicator lamps for:

1. Panel power.

2. CPU status.
3. Error status.
4. COM Port Status (Ethernet, MS/TP, etc.) one for each.
5. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card by ribbon cable. Terminal strips should use DIN rail mounts.

D. Power

1. Input Power shall be 24v 60 Hz Class 2. Contractor shall provide 100v-230v/1Φ/60 Hz to panel. Stepdown transformers shall be included by CIC if other power is needed to power the unit.
2. Backup Power: Coordinate with electrical contractor to provide 100v-230v/1Φ/60 Hz UPS circuit (max 15 A) as required at each panel. CIC shall submit power requirements for all panels and auxiliary equipment requirements that are fed from the panel's power supply. CIC shall coordinate with Owner for location of UPS panel.
3. The unit shall employ nonvolatile Flash memory to store all programs and data. The unit shall employ a data protection battery to save data and power the real time clock if primary power is interrupted.
4. Automatic Restart After Power Failure.

    a. Upon restoration of power after an outage, the B-BC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.

E. Construction

1. UL 916 C-UL US Listed
2. UL94-5VB
3. EN 61000-6-3; FCC Part 15, Sub-part B, Class B
4. Electronic, solid-state, printed circuit board.
5. Plug-in type connections.
6. Minimum Enclosure Rating NEMA 1, IP 12. Option for NEMA 3R, IP 54
7. Ambient Operating 32 to 122°F; 10 to 90% RH, 86°F maximum dew point conditions
8. Optional Data Protection Battery data protection on power failure using rechargeable12V or 24V battery
9. Clock Battery Maintains real-time clock through a power failure. Onboard cell; typical life 10 years at 70°F

F. Input/output

1. B-BC shall allow for direct I/O connection via integrated I/O input modules or via external BUS connected I/O modules. Remote I/O connection shall be via a minimum 78 kbits/sec
2. Provide Inputs/outputs modules as needed with the following capabilities

    a. Analog inputs.
    b. Analog outputs.
    c. Digital inputs.
    d. Digital outputs.
    e. Pulse inputs.
    f. Thermistor Input
    g. RTD Input
    h. Thermocouple Input

G. Override switches and monitoring:

1. All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the B-BC and shall provide feedback to the controller and supervisory system so that the position of the override switch can be obtained through software. In addition, each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3-position manual override switch is placed in the ON position

H. Memory. Provide sufficient memory to meet the performance requirements

1. History Logging:

a. Size on-board storage according to Part 1.
b. Every physical input and output point within the B-BC and/or attached I/O modules shall be trend capable.
c. Each B-BC controller shall be capable of locally logging any input, output, calculated value, error logs, alarm events or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. Each log can record either the instantaneous, average, minimum or maximum value of the point. No data shall be overwritten and data storage shall be continuously monitored to insure no loss of data. Alarm operators when data storage capacity is < 10% free

2.8 BACnet APPLICATION-SPECIFIC CONTROLLERS (B-ASC)

A. General: Provide as needed controllers to achieve the performance specified.

1. Data shall be shared between all networked controllers.
2. Each unit shall have sufficient memory to support its own operating system, databases, and control programs as required to meet performance requirements, and to provide supervisory control for all control level devices.
3. Selection of B-ASC controllers shall be based upon performance configuration covering memory, COM ports, application software, etc.
4. The controllers shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall

a. assume a predetermined failure mode, and
b. generate an alarm notification

B. Communication Ports. At a minimum provide the following

1. BACnet MS/TP EIA-485

a. Data transmission speeds of a minimum 30 kbit/s with preferred speed of 50kbit/s or higher
b. Connection shield twisted pair, 18 AWG

2. Optional Ethernet

a. 10BASE-T.
b. Connections shall be made using twisted pair, 8-pin RJ-45

C. Provide indicator lamps for:

1. Panel power.

2. CPU status.
3. Error status.
4. COM Port Status (Ethernet, MS/TP, etc.) one for each.
5. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card by ribbon cable. Terminal strips should use DIN rail mounts.

D. Power

1. Input Power shall be 24v 60 Hz Class 2. Contractor shall provide 100v-230v/1Φ/60 Hz to panel. Stepdown transformers shall be included by CIC if other power is needed to power the unit.
2. Backup Power: Coordinate with electrical contractor to provide 100v-230v/1Φ/60 Hz UPS circuit (max 15 A) as required at each panel. CIC shall submit power requirements for all panels and auxiliary equipment requirements that are fed from the panel's power supply. CIC shall coordinate with Owner for location of UPS panel.
3. The unit shall employ nonvolatile Flash memory to store all programs and data. The unit shall employ a data protection battery to save data and power the real time clock if primary power is interrupted.
4. Automatic Restart After Power Failure.

    a. Upon restoration of power after an outage, the B-BC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.

E. Construction

1. UL 916 C-UL US Listed
2. UL94-5VB
3. EN 61000-6-3; FCC Part 15, Sub-part B, Class B
4. Electronic, solid-state, printed circuit board.
5. Plug-in type connections.
6. Minimum Enclosure Rating NEMA 1, IP 12. Option for NEMA 3R, IP 54
7. Ambient Operating 0 to 50°C (32 to 122°F); 10 to 90% RH, 30°C (86°F) maximum dew point Conditions
8. Optional Data Protection Battery data protection on power failure using rechargeable12V or 24V battery
9. Clock Battery Maintains real-time clock through a power failure. Onboard cell; typical life 10 years at 21°C (70°F)

F. Variable air volume (VAV) controllers:

1. Support, but not be limited to, control of following:
   Single-duct VAV.
   Fan-powered VAV.
   Dual-duct VAV.
   Supply or exhaust VAV.

2. Integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece. Integrated electric actuator with manual override, local drive shaft indicator. The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in 60 seconds or less
3. Each controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature / humidity effects.

4. The controller shall utilize a built-in proportional plus integration (PI) algorithm for the space temperature control loops.
5. The controller shall provide the ability to download and upload configuration files, both locally and via the communications network. Controllers shall be able to be loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
6. Control setpoint changes initiated over the network shall be written to non-volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.
7. The controller firmware shall be flash-upgradeable remotely via the communications bus.
8. The controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
9. Controller performance shall contain on-board diagnostics which shall consist of control loop performance measurements executing at each control loop's sample interval, which may be used to continuously monitor and document system performance.

    a. temperature loop error
    b. airflow loop error
    c. Average damper actuator duty cycle

10. The controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall consist of:

    a. Unreliable space temperature sensor
    b. Unreliable differential pressure sensor
    c. Starved box
    d. Actuator stall
    e. Insufficient cooling
    f. Insufficient heating

11. The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The controller would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.
12. Inputs.

    a. Inputs: Include both analog and digital type.
    b. Support Smart Sensor (B-SS) Input from room sensors.

13. Manage own alarm conditions and report alarms as specified.

2.9 SUPERVISORY SOFTWARE SERVER

A. Base Proposal shall be provided by the Owner.

B. Location: Coordinate with Owner.

C. Performance Monitoring. Follow recommended performance monitoring as presented in ASHRAE Guideline 13 – 2105 Level 3. Including

1. Site Weather: On-site outdoor ambient air temperatures obtained external to the building.

    a. Outdoor ambient air dry-bulb temperature (°F)
    b. Outdoor ambient air wet-bulb temperature (°F)
    c. Average daily outdoor air temperature

2. Building Analysis: provide analytical data for whole building, cleanroom, office, and support spaces. Identify in bid any missing data points and propose needed measurement points.

    a. peak power
    b. electric energy-use intensity
    c. natural gas energy-use intensity
    d. Total HVAC electric power
    e. lighting power
    f. plug power
    g. HVAC electric energy-use intensity
    h. lighting energy-use intensity
    i. plug energy-use intensity

D. Maintenance management: System shall monitor equipment status and generate maintenance messages based on user-designated run-time, starts, and/or calendar date limits.

E. Sequencing: Provide application software based upon sequences of operation specified to properly sequence chillers, cooling towers, boilers, pumps, and other Owner / operated equipment which would have an impact on demand.

F. Staggered start: Provide application to prevent controlled equipment from simultaneously restarting after power outage. Order in which equipment (or groups of equipment) is started, along with time delay between starts shall be definable by user.

G. Energy calculations:

1. Provide software to allow instantaneous power (e.g. kW) or flow rates (e.g. gpm) to be accumulated and converted to energy usage data.
2. Provide algorithm calculating sliding window average (e.g. rolling average). Algorithm shall be flexible to allow window intervals to be user-specified (e.g., 15 minutes, 30 minutes, 60 minutes, etc.)
3. Provide algorithm calculating fixed window average. Digital input signal shall define start of window period to synchronize fixed window average with that used by utility.

H. Equipment and system protection:

1. System software:

    a. Include provisions for limiting of equipment cycling.
    b. Provide protection against excessive demand situations during startup periods by incorporating time delays between successive start commands.
    c. Provide automatic restart of equipment based on current program time and program requirements without operator intervention.

2. Upon resumption of normal power, panels and controllers shall analyze status of controlled equipment, compare status with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

I. Run-time totalization: Provide software for binary input objects. A high runtime alarm shall be assigned, as required, from operator workstation.

2.10 CONTROL PANELS

A. Local Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control (or as close as feasible). Provide common keying for all panels.

B. Enclosures shall be a minimum 14-gauge steel and shall encompass the following features:

1. UL 508 Compliant
2. NEMA 3R or IP 55 with Gasketed overlapping doors.
3. Latching mechanism operated by oil-tight, key-locking handle. All panels shall be keyed alike.
4. Heavy gauge hinges.
5. Print pocket.
6. Heavy-duty lifting eyes, where required.
7. Panel supports/brackets.
8. Oil-resistant door gasket.
9. Collar studs.
10. Internal panel light, where required.
11. Panel provision for raceway entry.

C. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

D. Provide on/off power switch with overcurrent protection for control power sources to each local panel.

E. Panel-Mounted Equipment: All panel mounted equipment; except safety devices. Mount devices with adjustments accessible through front of panel (if appropriate).

F. Schematic/Legend: Furnish and install color-coded graphic, laminated-plastic displays on cabinet doors, schematically showing points, component legend and system being controlled, with protective, clear plastic sheet bonded to cabinet door.

G. Do not mount BAS controllers on the door of cabinet enclosures. Mount on back panel only.

H. All connections for future functions shall be wired to numbered terminal blocks. Terminal blocks shall be grouped to keep AC circuits separate from DC circuits.

I. Panels shall have no exposed terminals (i.e. terminal screws shall be in wells or covered.)

J. Comply with NEMA ICS 6 – Enclosures for Industrial Controls and Systems.

K. All electrical instruments shall be UL recognized and installed in a panel to meet the requirements of UL 508 for safety industrial control equipment. Exception shall be submitted in advance for approval.

2.11 POWER SUPPLIES

A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish overcurrent protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.

    a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
    b. Line voltage units shall be UL recognized and CSA approved.

B. Provide 120V convenience receptacle at power supply.

2.12 AUXILIARY CONTROL DEVICES

A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:

1. Equal to Ruskin model ‘CD60’.
2. Damper frames shall be 16 gauge galvanized steel with reinforced corner bracing.
3. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 14 gauge.
4. Damper shaft bearings shall be as recommended by manufacturer for application.
5. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 4 CFM per square foot at 1.0" w.c. differential pressure. All leakage testing and pressure ratings will be based on AMCA Publication 500.
6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.
7. Control dampers shall be parallel or opposed blade types as scheduled on Drawings; if not scheduled, damper shall be opposed blade.

B. Electric damper actuators

1. Unless noted otherwise in the Drawings, actuators shall be configured for 24V power.
2. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
3. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
4. All rotary spring return actuators shall be capable of both clockwise or counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.
5. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.
6. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
7. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
8. Actuators shall be Underwriters Laboratories Standard 873 listed.
9. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.

C. Wired Temperature Sensors

1. Temperature sensors shall be RTD or thermistor.

2. Duct-mounted and equipment mounted air temperature sensors shall be single point or averaging as indicated in the Drawings. Averaging sensors shall be a minimum of 5 ft. in length per 10 sq. ft. of airway cross section.
3. Provide matched temperature sensors for differential temperature measurement.
4. Space sensors shall be equipped with setpoint adjustment and override switch as indicated in the controls Drawings and a display and communication port.

D. Static Pressure Sensors

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.

E. Low Limit Thermostats

1. Safety low limit thermostats shall be vapor pressure type with an element 20 ft. minimum length. Element shall respond to the lowest temperature sensed by any one foot section.
2. Low limit shall be manual reset only.

F. Carbon Dioxide Sensors

1. Carbon Dioxide sensors shall measure CO2 in PPM in a range of 0-2000 ppm. Accuracy shall be +/- 3% of reading with stability within 5% over 5 years. Sensors shall be duct or space mounted as indicated in the sequence of operation.

G. Flow Switches

1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
2. Differential pressure type switches (air service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as specified.

H. Relays

1. Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
2. Time delay relays shall be UL listed solidstate plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

I. Transformers and Power Supplies

1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
3. Unit shall operate between 0 C and 50 C.
4. Unit shall be UL recognized.

J. Current Switches

1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.
2. Current switches for EC motors shall be applicable for EC motor standby current specifically. Equal to KMC Controls 'ECMCS' series.

K. Current transmitters

1. AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, with internal zero and span adjustment and ±1% full-scale accuracy at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

L. Pressure Transducers

1. Transducer shall have linear output signal. Zero and span shall be field adjustable.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.

M. Differential Pressure Type Switches (Air Service)

1. Shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as shown.

N. Airflow Measuring Stations

1. Ebtron 'Gold GTx116e-PC' series
2. Airflow Monitor ELECTRA-flo/MM series (air straightening devices NOT acceptable)

O. AHU Safety Alarm Circuit

1. Equal to RIB model 'RIBMNLB-6'.

P. Space Pressure Monitor (where indicated in Drawings)

1. Equal to Setra 'MRMS' multi-room (up to 8) monitoring station with color touch screen, IP-54 wipe-down flush mount design, BACnet MS/TP interface, and configurable audible and visual alarm. Multi-room station shall connect to individual space pressure monitors equal to Setra 'SPRM' with color-changing digital display for visual alarm and audible alarm feature. Refer to Drawings for layout of sensors and connections.
2. Units shall be furnished with all hardware and accessories required to accomplish the monitoring and sequence of operations shown on the Drawings.

2.13 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of this specification.

B. All insulated wire to be copper conductors, UL labeled for 90°C (194°F) minimum service.

PART 3 - EXECUTION

3.1 CONTRACTOR RESPONSIBILITIES

A. Installation of the building automation system shall be performed by the CIC, or Owner approved designated subcontractor. However, all installation shall be under the personal supervision of the CIC. The prime Controls Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor.

B. CIC shall examine the project plans thoroughly for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Owner / Engineer for resolution before rough-in work is started

C. CIC shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Owner / Engineer for resolution before rough-in work is started.

D. Demolition work will include removal of controls and control devices which do not remain as part of the final BAS, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The Owner will inform the CIC of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the CIC in a manner approved by the Owner.

E. CIC shall coordinate and schedule site work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

1. Where site work will be installed in close proximity to, or will interfere with, work of other trades, the CIC shall assist in working out space conditions to make a satisfactory adjustment. If the subcontractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the Controls contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
2. Coordinate with Owner prior to connection or disconnection of power or communications wiring to any existing BAS controller or field device.

F. Test and Balance

1. The contractor shall furnish a single set of all tools necessary to interface to the BAS for test and balance purposes.
2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

G. Life Safety

1. The contractor shall interlock smoke detectors to air handlers for shutdown as described in P&ID and SOO
2. Smoke dampers and actuators required for duct smoke isolation are provided under a Section of Division 23. The contractor shall interlock these dampers to the air handlers as described in P&ID and SOO

H. Cleanup:

1. The CIC shall clean up all debris resulting from their activities daily. The CIC shall remove all cartons, containers, crates, etc., under their control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
2. At the completion of work in any area, the CIC shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
3. At the completion of work, all equipment whether furnished under this section, or otherwise, shall be checked for paint damage, and paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.
4. Failure to maintain a clean workspace shall be noted and if not corrected the Owner may clean the workspace and back-charge the CIC for all necessary cleaning expenses. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas around equipment provided under this contract shall be cleaned.

3.2 INSTALLATION - GENERAL

A. Coordinate with Owner prior to connection or disconnection of power or communications wiring to any existing BAS controller or BAS system related field device.

B. Install equipment, piping, and wiring/raceway as indicated, in accordance with applicable codes, and to comply with manufacturer's written instructions.

C. Install equipment in readily accessible locations as defined in latest edition of NEC and in accordance with provisions of Division 26.

D. Install equipment, piping, wiring, and raceway parallel to or at right angles to building structure (i.e., horizontal, vertical, and parallel to walls) wherever possible. Provide adequate support at uniform intervals as specified.

E. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

F. Provide numbered terminal strips in control panels for interfacing with others. Furnish others with control drawings indicating points of electrical interface, refer to labeling specification.

G. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

H. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

I. Provide complete programming of control functions, sequences, setpoints, alarms, and graphic displays.

3.3 EQUIPMENT PROTECTION

A. CIC shall protect all work and material, including that of subcontractors, from theft, vandalism, or damage and shall be liable for all damage. CIC shall also protect any material that is not immediately installed from damage.

B. CIC shall be responsible for work and equipment until finally inspected, tested, and accepted. Controls Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent foreign object entry.

C. Corrosion Protection: All control panels, enclosures, and other equipment containing electrical and instrumentation and control devices, including spare parts, shall be protected from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, the capsules shall be provided within the shipping containers and equipment as recommended by the capsule manufacturer. During the construction period, the capsules shall be replaced periodically in accordance with the capsule manufacturer's recommendations. All capsules shall be replaced by the CIC prior to Owner's final acceptance of the equipment.

3.4 WIRING INSTALLATION

A. All control and interlock wiring shall comply with national and local electrical codes and Division 26. Where the requirements of this section differ from those in Division 26, the requirements of this section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway according to NEC and Division 26 requirements. Where wiring is located in areas exposed to the outdoors, wiring shall be in conduit meeting all Division 26 requirements and all penetrations shall be sealed watertight.

C. All low-voltage wiring shall meet NEC Class 2 requirements. Where wiring is located in areas exposed to the outdoors, wiring shall be in conduit meeting all Division 26 requirements and all penetrations shall be sealed watertight. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.

D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenums shall be UL Listed specifically for that purpose.

E. All wiring in mechanical, electrical, or service rooms—or where subject to mechanical damage—shall be installed in raceway at levels below 3 m (10 ft).

F. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

G. Do not install wiring in raceway containing tubing.

H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.

I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.

M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

O. Size of raceway and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.

P. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

Q. Use coded conductors throughout with conductors of different colors.

R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

S. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).

T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

U. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.

V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

W. The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

3.5 COMMUNICATION WIRING INSTALLATION

A. CIC shall be responsible to manage the work schedule of the Owner's approved communication wiring contractor including integration of schedules, prioritization of work, verification of workmanship and loop checks.

3.6 LABELING

A. All devices relating to the work or systems included herein, including controllers, valves, relays, etc., shall be identified with a unique identification number or name on the submitted control drawings. This identification number or name, along with the service of the device (discharge air temperature, freeze-stat, etc.), shall be permanently affixed to the respective device.

B. All field devices shall be supplied with a label indicating its function and point name. Labels shall be "DYMO"-type electronically printed approximately 2-1/2" x 3/4". Surface shall be cleaned before installing labels. No handwritten labels shall be accepted.

C. Space sensors (temperature, humidity, CO2, etc.) shall be labeled to match the designation of the associated equipment on the drawings (e.g. thermostat shall be labeled "V7-1" to indicate its associated VAV box).

D. Damper shall be labeled indicating which direction is towards open/bypass position (i.e. CW=BYPASS; CCW=OPEN).

E. Label ceiling grid where sensors installed above ceiling when applicable.

F. BAS Panels shall be supplied with a nameplate indicating the equipment being served (i.e. AHU-1 Cafeteria, CO2 Monitoring, etc.). Nameplates shall be engraved on rigid plastic labels approximately 3" x 1". "DYMO" tape will not be accepted. Only black phenolic with white lettering will be accepted.

G. All 120 VAC power shall be labeled with source panel and circuit number.

H. All BAS Junction Boxes covers shall be spray-painted green with "BAS" stenciled over.

I. All controls wiring, tubing and cabling both inside and outside of control panels shall be labeled at both ends using BRADY PermaSleeve Black on White Wire Marker Sleeves or equal (do not shrink). The wire designations shall match those on the shop and installation drawings. All markings shall be mechanically produced. No handwritten labels shall be accepted.

J. Communication wiring shall be labeled to specify where it is coming from (previous device) and where it is going next (next device) at each communication drop (e.g. each controller inside a control panel, each VFD provided with a communication card).

3.7 INSTALLATION OF SENSORS

A. Installation of sensors shall be carefully coordinated with the architectural Drawings, including floor plans, elevations, and reflected ceiling plans. Where conflicts are noticed or arise in the field, the Engineer shall be contacted with sketches or photos indicating the conflict for a resolution prior to installation.

B. Install sensors in accordance with the manufacturer's recommendations.

C. Mount sensors rigidly and adequately for the environment within which the sensor operates.

D. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

E. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

F. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

G. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m of sensing element for each 1 m2 (1 ft of sensing element for each 1 ft2) of coil area.

H. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

I. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.

J. Airflow monitoring stations shall be installed per the manufacturer's IOM, adhering to all straight inlet and outlet requirements, without the use of blank-off plates; where manufacturer requires minimum velocity and airway size is too large to meet this requirement, Contractor shall contact Engineer to review solutions without the use of blank-off plates.

K. Differential air static pressure.

1. Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
2. Return Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.
3. Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
6. All air differential pressure sensors shall have gauge tees mounted adjacent to the taps.

L. Actuators

1. Where damper actuators are not furnished by the equipment manufacturer for dampers integral to equipment, the CIC shall furnish and install actuators compatible with the BAS.

2. Mount and link control damper actuators according to manufacturer's instructions.

   a. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
   b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
   c. Provide all mounting hardware and linkages for actuator installation.

3. Electric/Electronic

   a. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.

M. Warning Labels

1. Permanent warning labels shall be affixed to all equipment that can be automatically started by the BAS.

   a. Labels shall use white lettering (12-point type or larger) on a red background.
   b. Warning labels shall read as follows:

C A U T I O N
This equipment is operating under automatic control and may start or stop at any time without warning.
Switch disconnect to “Off” position before

2. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

   a. Labels shall use white lettering (12-point type or larger) on a red background.
   b. Warning labels shall read as follows:

C A U T I O N
This equipment is fed from more than one power source with separate disconnects.
Disconnect all power sources before servicing.

3.8 COMMISSIONING - GENERAL

A. Prior to acceptance, control system shall undergo series of performance test to verify, document, and report operation and compliance with this specification and the engineer’s design. Tests shall occur after CIC has completed installation, loop check, start-up of systems, and performed control system checkout and initial testing.

B. Performance tests specified shall be performed in addition to tests CIC performs necessary as part of installation, loop check, start-up, and debugging process. Either Owner or Engineer will be present to observe and review test, unless noted otherwise.

C. Provide equipment required to prove proper operation.

D. Demonstrate compliance with sequences of operation through all modes of operation for the current season and prepare a plan cover opposite season commissioning.

E. Demonstrate complete operation of operator interfaces.

F. Demonstrate following additional items:

1. DDC loop response.
2. Alarm Notification and Escalation
3. Optimum start-stop.
4. Lead/Lag Sequencing
5. Integration of third-party systems
6. Graphics for each system and type
7. Reports.
8. Operational logs for each system that indicate all setpoints, operating points, mode, and equipment status shall be submitted to the Owner / Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

G. Repeat tests which fail to demonstrate operation of system. Repair or revise hardware or software as necessary to successfully complete tests.

H. Upon receipt of adjustment list from Owner, CIC shall prepare written report indicating by system, each outstanding item on adjustment list. CIC shall correct items appearing on installation-inspection report and present written request for re-inspection and approval to Owner.

3.9 DETAILED COMMISSIONING REQUIREMENTS

A. Commissioning is the systematic process of ensuring that all critical building systems perform individually and interactively to meet the design intent and the Owner's operational needs. It is intended to achieve the following objectives:

1. Ensure that equipment and systems are properly installed and have received adequate operational checks by the installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Ensure that the Owner's operating personnel are adequately trained.
4. Assemble and certify comprehensive documentation of equipment and systems, including all test reports, operation & maintenance manuals, and commissioning checklists and reports.

B. Pre-Commissioning.

1. Loop checking is defined as pre-Commissioning activity which is initiated after installation of all devices contained in an individual control loop including sensor, instruments, actuators, wiring termination, junction boxes. etc.
2. Initial Loop Tuning. Tuning a control loop is the adjustment of its control parameters (proportional band/gain, integral gain/reset, derivative gain/rate) to the optimum values for the desired control response. Stability (no unbounded oscillation) is a basic requirement. Pre-commissioning loop tuning is the initial set-up of each control loop insuring proper identification of process variables, measured variables, set-points, dead band allowance, stability definition, etc. CIC shall submit proposed loop tuning plan identifying each tuning parameter and those devices (by tag) that will be associated with each control loop.
3. Adaptive Loop Tuning will be approved on a case by case basis. CIC shall submit justification for use of adaptive tuning, adaptive tuning

C. Loop Check: An operational check of the field, controller and HMI elements of a control loop. A Loop Check is intended to ensure the integrity of the following.

1. The field sensing device is properly installed in accordance with engineering specifications.
2. The field sensing device is calibrated in accordance with engineering specifications.
3. The field sensing device is properly connected to its communication path to the Control System Controller.
4. The field sensing device develops and transmits a proper analogous signal in response to a variable impressed upon it or a simulation command issued to it.
5. The corresponding logic in the DDC Controller is ranged accordingly for the field sensing device analog and engineering units.
6. The HMI of the System Controller accurately displays the engineering unit response to the signal of the field sensing device.
7. Alarm points are properly documented and entered into the logic of the Controller and the HMI displays and logs these appropriately as they are reached.
8. Where control functionality is required, that the signal from the field sensing device is received by the control algorithm and generates the appropriate corrective output signal.
9. If present, the field control device, (e.g. Variable Speed Control etc.), is properly installed in accordance with engineering specifications.
10. The field control device is calibrated in accordance with engineering specifications.

11. As part of the loop check procedure the CIC should simultaneously perform red-lines to any drawings noting correct labeling, terminal block assignments, location drawings, network routing, faceplate assignments, etc.
12. The Loop Check is intended to locate and identify deficiencies in the Field/Controller/HMI interface. This includes, but is not limited to, wiring and cabling issues, engineering issues and mechanical installation issues. It is not the focus of the Loop Check to correct all deficiencies found. Correction will depend upon deficiencies discovered during loop check. Minor corrections can be performed during loop check and accepted, but this should be limited in scope. Regulate and adjust thermostats, humidistats, pressure sensors, controllers, operators, and other equipment provided under this Contract

D. Commissioning includes pre-functional and functional performance tests. Include documentation (e.g. checklists) with dates and initials of the individual representing the BAS controls contractor that performed the work as described below:

1. Pre-functional testing:

    a. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to start control systems.
    b. Perform pre-commissioning Loop Checks
    c. Test and adjust controls and safeties.
    d. Replace damaged or malfunctioning controls and equipment.
    e. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.
    f. Standardize all temperature sensors with a calibrated device intended for this purpose. Document the dates the reference device was last performed and the next date calibration is due.
    g. Verify, document, and report that all BAS graphics are updated, accurate and complete per these specifications and the project requirements.
    h. Ensure all designated alarms follow the approved notification and escalation paths.

2. Demonstration / Functional Performance Testing:

    a. Include a 48 hour trend log of supply air temperatures and space temperatures showing stable control during this 48 hour period.
    b. Recorded and document the temperature data at 30 minute or smaller intervals.
    c. Provide documentation verifying this testing was successfully conducted and completed.
    d. Using the BAS system trending capability to capture and document the data is acceptable.

3. Alarms and interlocks:

    a. Check each alarm separately by including appropriate signal at value to trip alarm.
    b. Trip interlocks using field contact to check logic, and to ensure fail-safe condition for all actuators in proper direction.
    c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

E. Commissioning begins during construction. Following is a brief schedule of a typical process. Actual commissioning requirements for each to be determined by the Owner or Owner’s Representative for each specific project:

1. Scope meetings.
2. Project observation and coordination, planning and scheduling meetings.

3. Equipment documentation (shop drawing and equipment submittals) including start-up procedures.
4. Development of start-up plans and documentation formats, including pre-functional test checklists.
5. Start-up, pre-functional testing, and completion of checklists.
6. Development of functional performance test procedures.
7. Functional performance testing.
8. Correction of non-complying items and re-testing.
9. Integrated systems testing.
10. Submittal of O&M manuals and as-built documentation.
11. Training of Owner's personnel.
12. Submittal of final commissioning report.

F. Vendor and installing Contractor shall include time for factory-authorized personnel to start up equipment, complete factory start-up checklist, perform pre-functional and functional testing, and participate in integrated systems testing.

3.10 BAS COMMISSIONING - DOCUMENTATION REQUIREMENTS

A. All Commissioning documents shall have been approved during the design phase and integrated into the overall commissioning plant.

B. Provide detailed checkout and startup / commissioning sheets for all equipment with dates, signatures of technician / witness. Include point-to-point verification of all connected field devices and points, verification and proof of proper operation for all control sequences including fire alarm shutdown sequences for BAS equipment.

C. As a minimum:

1. Verify, document, and report BAS system has been fully configured and implemented as required.
2. Verify, document, and report all engineering units are properly designated (e.g. temperatures are Deg F, pressures are PSI, etc.)
3. Verify, document, and report all alarm limits are appropriately defined per the specifications and based on intended usage.
4. Verify, document, and report appropriate significant digits are displayed on all graphics.
5. Verify, document, and report event and alarm priority designations are appropriately defined (e.g. critical, priority, routine).
6. Verify, document, and report trending is defined and configured for all critical points.
7. Verify, document, and report no controller LAN communication errors.
8. Security: After commissioning and handover to the Owner all user accounts and passwords will be reviewed by the Owner for justification. All generic users (e.g. "admin", "user", etc.) will be deleted. No backdoors or unauthorized user accounts shall be allowed.

D. Document BAS Equipment in CMMS - Fill out Maximo CMMS data sheets (AQD0980) for all BAS equipment and related field devices. Forward all completed sheets to the Facility O&M Preventive Maintenance Coordinator to allow creation of equipment and device tag numbers (to be used to generated work orders for PM activities and to document future repairs).

E. Completion and signoff of Commissioning documents shall include date of Acceptance and start of warranty period.

3.11 SEQUENCE OF OPERATION

A. Provide sequence of operation as shown on Drawings.

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SPECIFIER NOTES: Coordinate all training requirements with Owner, including initial training instructor time, any additional advance training time, on-site training time and/or training time at next cooling or heating season.
If training is included as an alternate, coordinate with Div. 0 Bid Form

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3.12 OWNER TRAINING & DOCUMENTATION

A. Provide the services of a factory-authorized service representative to train Owner's personnel as specified below.

1. Forty (40) hours total dedicated instructor time on-site.
2. Coordinate scheduling (start dates, times and duration of sessions) with the Owner in order to train personnel that work on various shifts in multiple groups.
3. Training to be provided shall be developed to reflect the BAS system actually installed and implemented.
4. Provide training to Owner’s operation and maintenance personnel on all aspects of the BAS system such as BAS startup and shutdown, troubleshooting, servicing, preventive maintenance, data display, alarm acknowledgement, alarm/event descriptors, requesting data, execution of commands, requesting reports / logs, etc.
5. All documentation including operation and maintenance manuals shall reflect the installed BAS system and its components. This same documentation is to be used for reference during the training sessions. Also provide a quick reference sheet for BAS system operators.
6. All training is to be conducted onsite by factory authorized personnel with thorough technical knowledge of the BAS system.

B. On-Site Training: Provide services of BAS Provider’s qualified technical personnel for five 8-hour days to instruct Owner's personnel in operation and maintenance of BAS. Instruction shall be in classroom setting at the Project Site for appropriate portions of the training. Training may be in non-contiguous days at the request of the Owner. The Owner shall notify CIC seven (7) calendar days in advance of each day of requested training. The CIC’s designated training personnel shall meet with the Owner for the purpose of discussing and fine-tuning the training agenda prior to the first training session. Training agenda shall generally be as follows:

1. Basic Operator Workstation (OWS) Training – For all potential users of the OWS:

   a. Brief walk-through of building, including identification of all controlled equipment and condensed demonstration of controller portable and built-in operator interface device display capabilities.
   b. Brief overview of the various parts of the O&M Manuals, including hardware and software programming and operating publications, catalog data, controls installation Drawings, and DDC programming documentation.
   c. Demonstration of workstation login/logout procedures, password setup, and exception reporting.

C. All agreed upon training is to be scheduled and completed before final project handover.

D. Train Owner’s operating personnel to perform following:

1. Day-to-day operations:

   a. Proficiently operate system.
   b. Understand control system architecture and configuration.

c. Understand DDC system components.
d. Understand system operation, including DDC system control and optimizing routines (algorithms).
e. Operate workstation and peripherals.
f. Log on and off system.
g. Access graphics, point reports, and logs.
h. Adjust and change system setpoints, time schedules, and holiday schedules.
i. Recognize malfunctions of system by observation of printed copy and graphical visual signals.
j. Understand system drawings and operation and maintenance manual.
k. Understand job layout and location of control components.
l. Access data from any / all DDC controllers.
m. Operate portable operator's terminals.

2. Advanced operations:

a. Make and change graphics on workstation.
b. Create, delete and modify alarms, including annunciation and routing of alarms.
c. Create, delete, and modify point trend logs and graph or print both on ad-hoc basis and at user-definable time intervals.
d. Create, delete, and modify reports.
e. Add remove and modify system's physical points.
f. Create modify and delete programming.
g. Add panels when required.
h. Add operator interface stations.
i. Create, delete, and modify system displays both graphical and others.
j. Perform DDC system field checkout procedures.
k. Perform DDC controller unit operation and maintenance procedures.
l. Perform workstation and peripheral operation and maintenance procedures.
m. Perform DDC system diagnostic procedures.
n. Configure hardware including PC boards, switches, communication and I/O points.
o. Maintain calibrate, troubleshoot, diagnose, and repair hardware.
p. Adjust, calibrate, and replace system components.

3. System management and administration:

a. Maintain software and prepare backups.
b. Interface with job-specific, third-party operator software.
c. Add new users and understand password security procedures.

E. Divide objectives of training into multiple logical lessons. Participants may attend 1 or more of lessons depending on level of knowledge required.

F. Provide additional 24-hour period of instruction at beginning of next heating and cooling season.

PART 4 - APPENDIX

4.1 DEFINITIONS

A. BACnet Application Specific Controller (B-ASC): Controller meant for specific application (e.g. VAV terminal unit) which has a limited control point type/count made for that specific purpose.

B. BACnet Building Controller (B-BC): Top-level controller used for routing information between controllers and users (i.e. via IP communications to an HMI) and/or act as a supervisory controller for other controllers (CACs and ASCs) for scheduling, trending, alarming, etc.

C. BACnet Custom Application Controller (B-CAC): Controller with wide range of point types/counts with expansion capability meant for flexible applications with complex equipment (e.g. air handling units) and may come with capability for scheduling and alarming, especially when controlling associated ASCs.

D. BACnet Interoperability Building Blocks (BIBB): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device in a Specification.

E. Binding: In the general sense, binding refers to the associations or mappings of the sources network variable and their intended or required destinations.

F. BACnet Operator Workstation (B-OWS): The user's interface with the BAS system. As the BAS network devices are stand-alone, the OWS is not required for communications to occur.

G. BTL: BACnet Testing Laboratory.

H. Building Automation System (BAS): The entire integrated management, monitoring, and control system.

I. Change of Value (COV): An event that occurs when a measured or calculated analog value changes by a predefined amount (ASHRAE/ANSI 135).

J. Controls Installing Contractor (CIC): Contractor party responsible for installation of the building automation system, typically a sub-contractor to the General Contractor on a project and works with other sub-contractors and the commissioning agent, where applicable.

K. Client: A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.

L. Continuous Monitoring: A sampling and recording of a variable based on time or change of state (e.g. trending an analog value, monitoring a binary change of state).

M. Enterprise Server. A server running a collection of software applications providing historical data archiving, relational database management for trend data, alarm data, messaging data, report writer, configuration application, etc. The Enterprise Server communicates to other BACnet devices to transfer or exchange information. The Enterprise Server may also contain other applications and utilities needed for graphics creation and editing, system diagnostics, device mapping, network management, etc. The combination of all application running on the Enterprise Server may be also be referred to as the supervisory software.

N. Functional Profile: A collection of variables required to define key parameters for a standard application. For the HVAC industry, this would include applications like VAV terminal units, fan coil units, etc.

O. Open Database Connectivity (ODBC): An open standard application-programming interface (API) for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system (DBMS) is handling the data.

P. Project Acceptance: The date agreed to between CIC and Owner reflecting the start of the warranty period. It shall be after completion of commissioning for all systems and equipment, after correction of any punch list items, and Owner acceptance of items list in the Project Closeout.

Q. Protocol Implementation Conformance Statement (PICS): A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device (ASHRAE/ANSI 135).

R. Server: A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.

S. SOO: Sequence of Operation, a step-by-step definition of how controls devices (fans, dampers, etc.) shall operate.

T. SQL: Standardized Query Language, a standardized means for requesting information from a database.

U. Smart Device: A control I/O device such as a sensor or actuator that can directly communicate with the controller network to which it is connected. This differs from an ASC in that it typically deals only with one variable.

V. Virtual Data: Networked data received or created into the system via gateways or BACnet interfaces. This data may be calculated from existing physical data points, from third party system, smart sensors, and complex equipment parameters such as chillers or VFDs.

W. XML (Extensible Markup Language): A specification developed by the World Wide Web Consortium. XML is a pared-down version of SGML, designed especially for Web documents. It allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.

X. OPC Server/Client. OPC is the interoperability standard for the secure and reliable exchange of data in the industrial automation space and in other industries. It is platform independent and ensures the seamless flow of information among devices from multiple vendors. The OPC Foundation is responsible for the development and maintenance of this standard. OPC was designed to provide a common bridge for Windows-based software applications and process control hardware. The purpose of OPC is to define a common interface that is written once and then reused by any business, SCADA, HMI, or custom software packages.

END OF SECTION

Landscape Requirements:

1. Perform all work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State, and local authorities in supply, transportation, and installation of materials.

2. The contractor shall be responsible for the verification of all underground utility lines (telephone, gas, water, electrical, cable, TV, etc.) and all overhead utility easements prior to start of any planting works.

3. All plant materials shall possess the following minimum qualities:
   a. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of the project for at least twelve months.
   b. All plants shall be heavy, symmetrical, tightly knit, so trained or favored for development and appearance as to be superior in form, number of branches, compactness, and symmetry.
   c. Plants shall be sound, healthy and vigorous, well branched, and densely foliated when in leaf. They shall be free of disease, insects, pests, eggs, or larvae.
   d. All plants shall be true of species and variety and shall conform to measurements (caliper size, trunk heights, spread) as specified on the drawings.
   e. Container grown stock when specified shall have grown in the container in which delivered for at least six months, but not over two years. Samples must prove no rootbound conditions exist.
   f. Caliper measurements shall be taken at a point on the trunk six inches (6") above natural ground line for trees up to four inches (4") in caliper.
   g. All trees shall be staked by a minimum of two metal "T" stakes for single trunk trees and three stakes for all multi-trunk trees.

4. Planting mix shall be thoroughly mixed in the following proportions:
   a. Prepared soil as backfill for shade and ornamental trees shall be: 5 part clay loam topsoil + 2 part compost + 1 part sharp sand + 4 Lbs. Commercial fertilizer per CY Or 10 Lbs. Organic fertilizer.
   b. Prepared soil as backfill for shrubs and groundcovers and seasonal colors shall be: 1 part enriched mulch + 1 part compost bark mulch + 1 part enriched topsoil + 1 part No. 1 Bank Sand + 3 Lbs. Time- released fertilizer, 14-14-14 per CY or 8 Lbs. Organic fertilizer.

5. Excavation work and Surface drainage works shall conform to the following requirements:
   a. Test drainage of plant beds and plant pits by filling with water twice in succession. Conditions permitting the retention of water for more than 24 hours shall be brought to the attention of the Owner.
   b. Work shall include the final responsibility for proper surface drainage of planted areas. Any obstructions on the site, or prior work done by another part, which precludes establishing proper drainage shall be brought to the attention of the Owner in writing.
   c. Excavate each tree hole 18" deep plus the depth of the tree container size (15 gal. Or 30 gal. Or 65 gal. Or 100 gal.).
   d. Excavate entire shrub bed to a depth of 8" plus the depth of the shrub container size (5 gal.) unless noted as being pit planted on landscape legend.
   e. Excavate entire groundcover bed to a depth of 6" plus the depth of the groundcover container size (4" pot or 1 gal.).

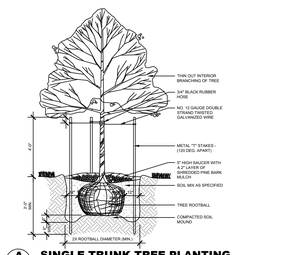
6. Additional work requirements on landscape areas:
   a. Prior to installation of any planting works (trees, shrubs,groundcover and grass works); apply "Round Up" in all planting areas to eradicate all weed growths on site.
   b. ADD ALTERNATE: Install weed control barriers in all trees, shrub and groundcover planting areas. Weed barrier fabric shall be back polypropylene sheet 27 mils thick, 4 oz/s y. grab tensile strength per ASTM D-4632; 90 lbs. (machine direction) 50 lbs.(cross machine direction). Provide DeWitt "Weed Barrier" or approved substitute.
   c. Use **"Shovel Edge"** to separate all plant beds from grass areas.
   d. Spread a minimum two inch layer of pine bark mulch overall shrub and groundcover bed areas.

7. Landscape maintenance work by the Landscape Contractor after final acceptance shall include the following:
   a. The maintenance period shall commence upon inspection and approval at Final Acceptance and shall be for a period of Sixty Days (60).
   b. The landscape contractor shall coordinate the watering program for all the landscape work with the Owner.
   c. Maintenance of new plantings shall consist of watering, cultivating, weeding, mulching, restaking, tightening and repair of guys; resetting plants for proper grades or upright position, and furnishing and application of pesticides/herbicides; sprays, and invigorants as are necessary to keep plantings free of insects and disease and in a thriving condition.

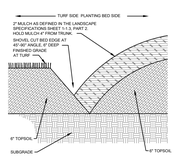
8. Warranty Periods, Plant Guarantees, and Replacements:
   a. Planting supplied shall be warranted to remain alive and healthy for a period of twelve months (12) after the date of Final Acceptance by Owner. Plants in an impaired, dead, or dying condition after initial acceptance or within 12 months shall be removed and replaced immediately to the satisfaction of the Owner.

Grass Hydromulching Work Requirements:

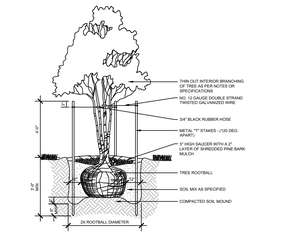
1. Grass works:
   a. Seed which has become wet, moldy and otherwise damaged in transit or in storage will not be acceptable.
   b. All grass seed shall be fresh, re-cleaned grass seed of the latest crop, mixed in the following proportions by weight and meeting the accepted standards of pure live seed content, purity and germination.
   c. Grass seed shall have the following minimum ratio:
      Summer Mix:
      Cynodon Dactylon (Hulled Common Bermuda Grass) 85% pure live seed at 75 Lbs. Pure live seed per acre.
      Winter Mix:
      Cynodon Dactylon (Unhulled - Common Bermuda Grass) 85% pure live seed at 75 Lbs. Pure live seed per acre. Annual Rye Grass or equal, 85% pure live seed at 175 Lbs. Pure live seed per acre.
2. Slurry Mix Component per Acre shall be Wood cellulose fiber mulch = 2,000 pounds + Grass Seed as specified + fertilizer (13-13-13) 800 pounds.
3. Hydromulched seeding on Prepared finished grades:
   a. Install and spread out a minimum of one inch layer of topsoil over all areas to be hydromulched.
   b. Bed preparation: Immediately after the finished grade has been approved, begin hydroseeding operation to reduce excessive weed growth and erosion.
   c. Apply seed, fertilizer and mulch by spraying them on the previously prepared seedbeds in the form of an aqueous mixture and by using the methods and equipment described herein.
   d. Particular care shall be exercised by the contractor to insure that the application is made uniformly and at the prescribed rate and to guard against miss and overlapped areas.
   e. Where slope of areas to be grassed exceed a 3:1 H:V, an erosion control fabric shall be installed prior to hyromulching process.
4. Maintenance:
   a. Maintenance shall consist of weeding, fertilizing, insect control, watering, replanting, mowing, maintaining of existing grades and repair of any erosion damages.
   b. Guarantee growth and coverage of hydromulch planting shall be a minimum on ninety five percent 95% of the area planted will be covered with specified planting after sixty days with no bare spots visible.
   c. Watering: Coordinate with the Owner to properly operate irrigation system to assure a regular, deep watering program.
5. Inspection and Final Acceptance:
   Final acceptance of lawn establishment shall mean that hydroseed areas are Ninety Five percent 95% uniform coverage of grass in excess of one inch height. No bare spots will be acceptable.



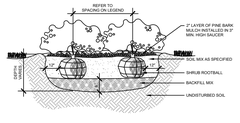
A L1.1 **SINGLE-TRUNK TREE PLANTING**
SCALE: NOT TO SCALE



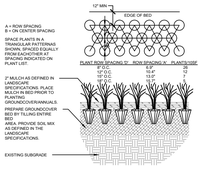
E L1.1 **SHOVEL CUT BED EDGE**
SCALE: NOT TO SCALE



B L1.1 **MULTI -TRUNK TREE PLANTING**
SCALE: NOT TO SCALE



C L1.1 **SHRUB PLANTING**
SCALE: NOT TO SCALE



D L1.1 **GROUNDCOVER PLANTING**
SCALE: NOT TO SCALE

CITY OF HOUSTON
DEPARTMENT OF PLANNING & DEVELOPMENT
LANDSCAPE ANALYSIS FORM

Non-Single Family Residential
(Staff may create an artificial lot)

1. **TREE AND SHRUB PLANTING REQUIREMENTS**

A. **STREET TREES: Sec. 33-126 (a)**
Length of property line in lineal feet as measured along each street separately / 30 = trees required

Street name	Lineal feet	Tree Planting Requirements	Equivalent Credits*	Total Trees Planted
Harrington St. (N)	363.06LF	12	4	9
Harrington St. (S)	319.21 LF	11	8	3
Keene St.	213.00 LF	7	N/A	7
Brooks St.	91.87 LF	8	7	1
North Main St.	300.64 LF	10	22	4
		Total Street Trees: 43	36	26

*Maximum street tree credits can not exceed 50% of each block face.

B. **PARKING LOT TREES: Sec. 33-127 (a)**
50% of parking lot trees must be large trees.
Each parking space must be within 120' of a tree. 1 tree per 10 spaces.

Tree Planting Requirements for Parking Lots: NORTH						
Total Number of Proposed Parking Spaces	# of Spaces	Tree Planting Requirements	Equivalent Credits	Large Trees	Small Trees	Total Trees Planted
108	108	11	n/a	13	6	19

Tree Planting Requirements for Parking Lots: SOUTH						
Total Number of Proposed Parking Spaces	# of Spaces	Tree Planting Requirements	Equivalent Credits	Large Trees	Small Trees	Total Trees Planted
15	15	2	n/a	2	0	2

C. **SHRUBS: Sec. 33-127 (b)**
75% of the shrubs must be planted along the perimeter of the parking lot.
(Shrubs are required for new or the expanded portion of parking lots)

Shrubs Requirements:
# of Shrubs = the number of trees x 10

Street Tree Planting Requirements	Requirements	Total shrub Requirements	Shrubs Provided
43	430	430	433

D. **LANDSCAPE BUFFER: Sec. 33-128 (1) Wood, concrete masonry opaque screening fence. (Min. 6') Sec. 33-128 (2) Evergreen screening.**

A 6' high wood, concrete masonry opaque screening fence, or 15' wide evergreen planting strip along the total length of property line adjacent to existing single family residential, or limit of expansion adjacent to existing single family residential. (Site plan must show land use on all sides of the property).

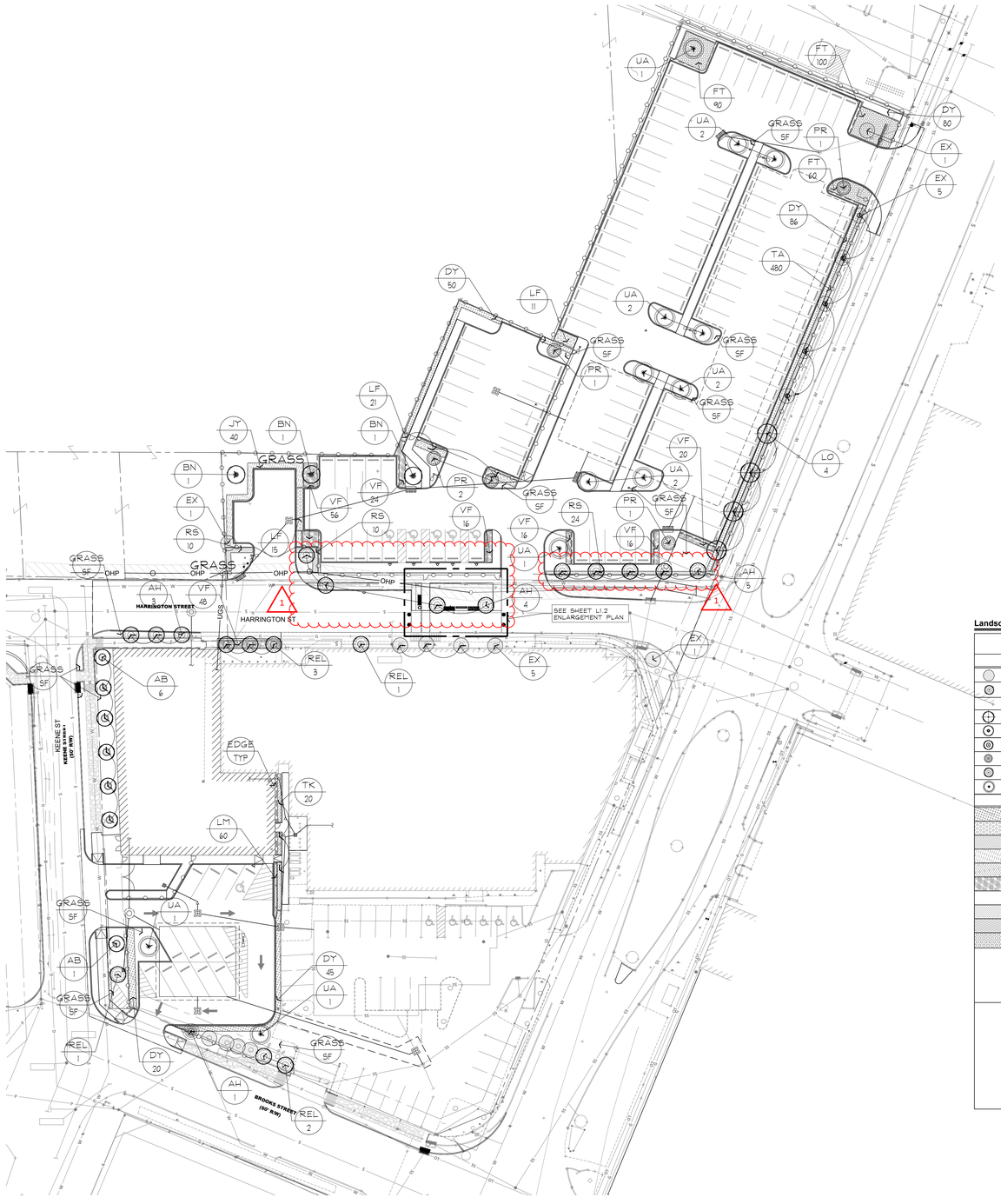
CREDITS WORKSHEET **Sec. 33-123 (a) Tree Planting Equivalency Credits**

	Street	Parking
1. Number of proposed trees exceeding 4" in caliper. Each 4" trees is two (2) credit.	6	n/a
2. Depositing of monies with parks and Recreation Departments. $ 155.00 per tree. Proposed credits cannot exceed 30% of tree Planting requirements above. Amount to be deposited: Proposed Credits_____ x $155.00=$_____(The combined credits under items 1 & 2 may no exceed 50% of total tree planting requirements.)	n/a	n/a
3. Preservation of on-site trees, per the following schedule in caliper: Minimum 4" to 6" 2 Trees Greater than 6" but less than 12" 3 Trees 2 x 3= 6 credits 12" and greater 4 Trees 6 x 4 = 24 credits Total number of tree credits for this option_____30_____ tree credits.	26	4
4. Credit for preserving existing right of way street trees.	36	n/a
5. Proposed total number of tree credits. (to receive credits, documentations must be provided in conformance to section 33-122).	n/a	n/a

ROW TREE MITIGATION:
Total Caliper: 18" caliper inches to be mitigated.
North Main Street: 12"
Keene Street: 6"

PROPOSAL FOR MITIGATION:
North Main Street:
Required Street Trees: 10 trees
Provided Street Trees: Taking 22 credits from protecting Trees # 22, 23, 24, 25, 26, and 28.
Planting 3 (4" caliper) trees for tree mitigation purposes
= 12" caliper provided for tree mitigation.

Keene Street:
Required Street Trees: 7 trees
Provided Street Trees: Planting 7 (3" caliper) trees (when 2" caliper is required).
Therefore we are taking credit for each inch over the minimum 2"
= 7" caliper provided for tree mitigation.



KEYNOTE LEGEND

GENERAL INFORMATION LEGEND

Landscape Legend:

	Symbolic Name	Quantities (Verify)	Botanical Name	Common Name	Size and Plant Requirements
	EXISTING TREES				
	EX	17	Existing protected tree		Existing tree shall be fence protected. See L1.0
	REL	6	Existing protected tree to be relocated		Existing tree shall be fence protected and relocated per plan.L1.1
	TREES				
	LO	4	Quercus Virginiana	Live Oak	4" cal. 100 gal. container; 12' to 14'ht.
	BN	3	Betula Nigra	River Birch	3" cal. 65 gal. container; 12' to 14' ht.
	AB	7	Acer Barbatum	Texas Sugar Maple	3" cal. 65 gal. container; 10' to 12'ht.
	PR	5	Prunus mexicana	Mexican Plum	2" cal. 30 gal. container; 9' to 10' ht.
	AH	12	Ilex x attenuata 'eagleston'	Eagleston Holly	2" cal. 30 gal. container; 9' to 10' ht.
	UA	12	Ulmus Americana	American Elm	2" cal. 30 gal. container; 9' to 10' ht.
	SHRUBS, PERENNIALS, ORNAMENTAL GRASSES				
	DY	281	Ilex Vomitoria 'Nana'	Dwarf Yaupon Holly	5 gal. planted at 36"o.c. triangularly spaced.
	LF	47	Leucophyllum Frutescens 'compacta'	Microburst Texas Sage	5 gal. planted at 36" o.c. triangularly spaced.
	RS	44	Spiraea x bumalda 'anthony waterer'	Red Spirea	5 gal. planted at 36" o.c.
	JY	40	Podocarpus Macrophylla	Japanese Yew	5 gal. planted at 36" o.c. single row.
	TK	20	Thelypteris kunthii	River Fern	5 gal. planted at 36" o.c. triangularly spaced.
	VF	196	Dianella Tasmanica 'variegata'	Variegated Flax Lily	3 gal. planted at 24" o.c. triangularly spaced.
	GROUNDCOVER / VINES				
	LM	233	Liriope Muscari	Liriope	1 gal. planted at 12" o.c. triangularly spaced
	TA	480	Trachelospermum Asiaticum	Asian Jasmine	1 gal. planted at 12" o.c. triangularly spaced
	FT	278	Ficus Tikoa	Sandy Leaf Fig Ivy	1 gal. planted at 24" o.c. triangularly spaced
	Grass	Verify SF.	Cynodon Dactylon	Common Bermda	Hydromulch for all areas within the limits of the project plus all right of way areas. All areas to be grassed shall be cleaned up with a minimum one inch layer of topsoil. All areas to be fine graded to adhere to civil grading/drainage plans.
	Edge	Verify LF.	Proposed 12" wide maintenance band to be constructed along all building edge.		Excavate a 12" wide channel to a depth of 3". Compact subgrade and slope away building. Overlay entire excavated areas with geotextile filter fabric membrane and than fill the entire channel with approved Black Star Crushed granite. If deemed necessary by project structural engineer, a french drain system shall be install directly below this 12' wide edge. French drain line shall have clean out pipes at every 20' on center. Connect french drain line to closest drain inlet or storm line. Coordinate this work with project general contractor.

Owner's Responsibility For Maintenance
Client acknowledges and agrees that proper Project maintenance is required after the Project is complete. A lack of or improper maintenance in areas such as, but not limited to, operation and maintenance of automatic irrigation system, all site drainage and all planting materials maintenance may result in damage to property or persons. Client further acknowledges that he is solely responsible for the results of any lack of or improper maintenance.
Landscape Contractor's Responsibilities:
All drainage (surface and subsurface) of all landscape areas within the project limits shall be the responsibility of the installing landscape contractor and landscape maintenance company. All grading of areas along all building areas must absolutely have positive slope away from building. In no case shall any plant bed be constructed along edge of building that will impede water flow away from building. If planting beds are located at edges of building, landscape contractor shall make sure that these areas drain properly (surface and subsurface-wise). Contractor shall install moisture barrier along building as necessary to keep water from penetrating underneath building slab.

"REFER TO FINISHED GRADES SHOWN ON PROJECT CIVIL GRADING PLAN. IT WILL REPRESENT FINAL ELEVATIONS. CARE SHOULD BE TAKEN BY THE LANDSCAPE CONTRACTOR NOT TO INCREASE THESE FINISHED GRADES WITH LANDSCAPING OR OTHER ALTERATIONS. THE THICKNESS OF SOD, GRASS AND LANDSCAPING MATERIALS SHOULD BE DEDUCTED FROM THE FINISHED GRADE ELEVATIONS IN THESE CIVIL GRADING PLANS IN ORDER TO DETERMINE THE GROUND ELEVATIONS DURING CONSTRUCTION."

1 L1.1 **LANDSCAPE PLAN**
SCALE: 1" = 30'-0"
0 5' 15' 30' 60'
SCALE: 1" = 30'

N

O'CONNELL ROBERTSON
Austin
San Antonio
Houston
81 I Barton Springs Road, Suite 900, Austin, Texas 78704 p: 512.478.7284 f: 512.478.7441
(404) Broadway, Suite 300, San Antonio, Texas 78209 p: 210.224.4032 f: 210.224.4453
1301 Fannin Street, Suite 755, Houston, Texas 77002 p: 713.487.1383 f: 713.487.1573

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HARRIS HEALTH
SCP ACS SUNSET HEIGHTS URGENT CARE
1615 N MAIN ST. HOUSTON, TX. 77009

REGISTERED LANDSCAPE ARCHITECT EDWARD HOWARD MOSS 2870 STATE OF TEXAS

Revisions:

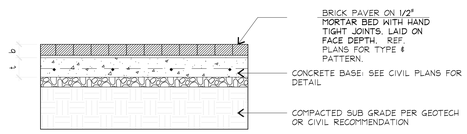
NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025
Project No. 2321.06 &
25-3SCP00178
100% CONSTRUCTION DOCUMENT

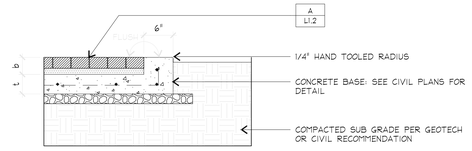
LANDSCAPE PLAN
L1.1

BRICK PAVER DROP SLAB DIMENSION:
FOR BRICKS LAID ON FACE DEPTH b= 3"
FOR BRICKS LAID ON EDGE DEPTH b= 3-7/8"

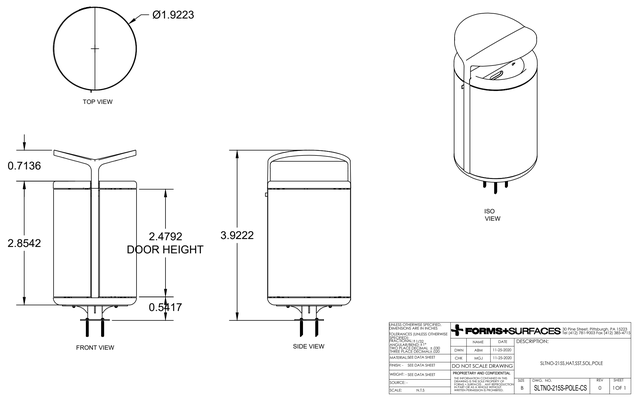
DROP SLAB AREAS TO BE NO GREATER THAN 400SF WITHOUT EXPANSION JOINTS OR AS SHOWN ON PLANS.



A L1.2 **BRICK PAVER ON MORTAR SETTING BED - FLUSH JOINTS - ON CONCRETE**
SCALE: NOT TO SCALE

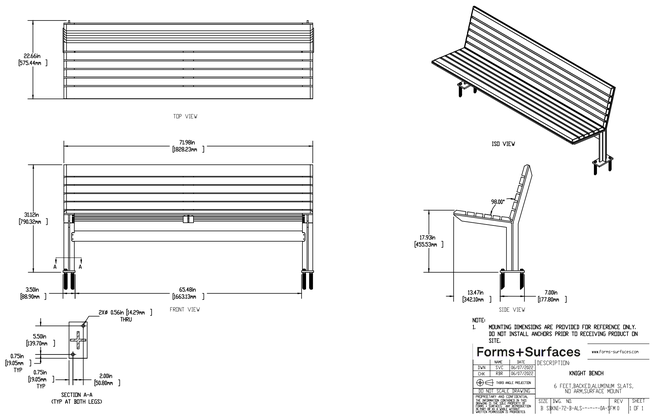


B L1.2 **BRICK PAVER CONCRETE CONTAINMENT EDGE**
SCALE: NOT TO SCALE



ACCESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES (UNLESS OTHERWISE SPECIFIED): FRACTIONAL ± 1/32 TWO PLACE DECIMAL ± .030 THREE PLACE DECIMAL ± .010	FORMS+SURFACES 30 Pine Street, Pittsburgh, PA 15223 ph (412) 781-9003 Fax (412) 781-4715			
MATERIAL SEE DATA SHEET		NAME	DATE	DESCRIPTION
FINISH – SEE DATA SHEET	DRWN	ABH	11.20.2020	
WEIGHT – SEE DATA SHEET	CHK	HELU	11.20.2020	SLTNO-215S.HAT.SST.SOL.POLE
SOURCE:	DO NOT SCALE DRAWING			
SCALE: N.T.S.	PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF FORMS+SURFACES. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF FORMS+SURFACES IS PROHIBITED.	SIZE B	DWG. NO. SLTNO-215S-POLE-CS	REV. D
				SHEET 1 OF 1

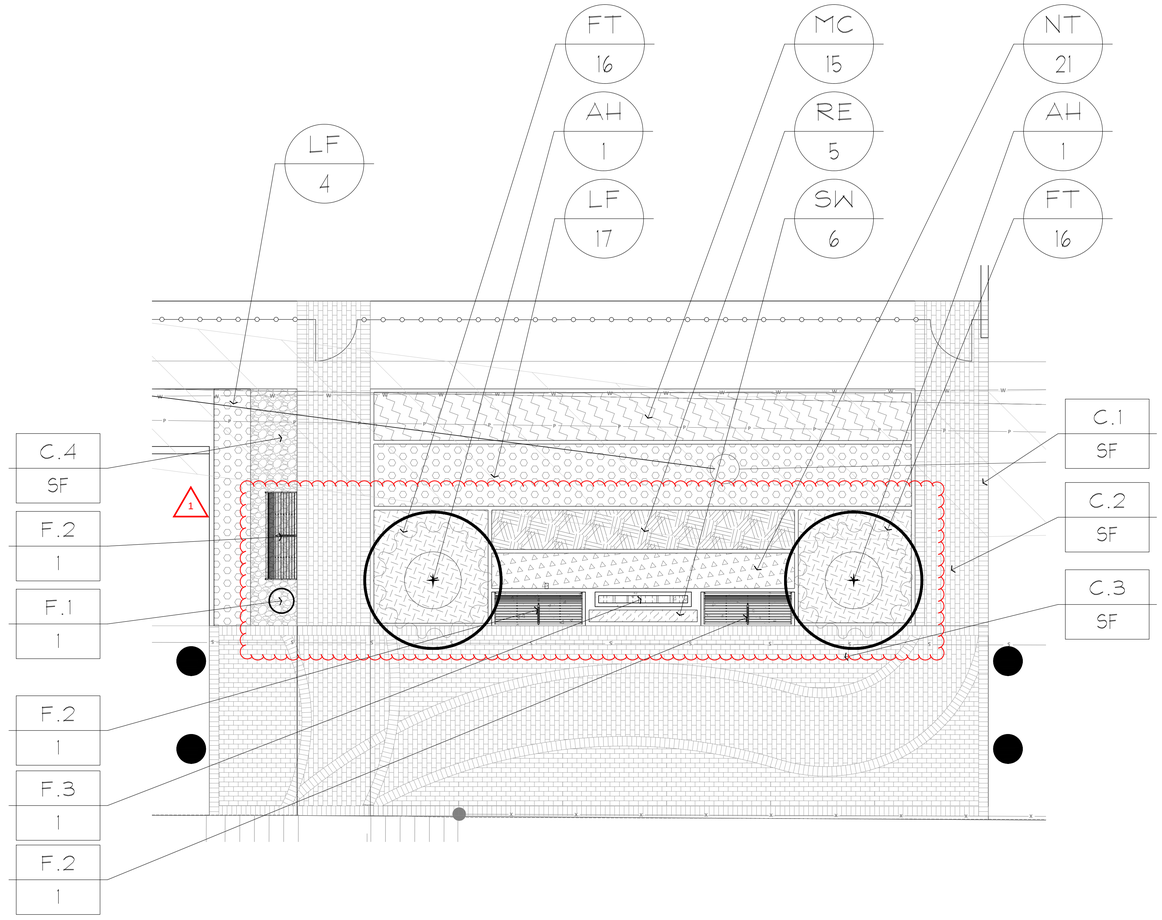
C L1.2 **LITTER RECEPTACLE**
SCALE: NOT TO SCALE



NOTE:
1. MOUNTING DIMENSIONS ARE PROVIDED FOR REFERENCE ONLY. DO NOT INSTALL ANCHORS PRIOR TO RECEIVING PRODUCT ON SITE.

Forms+Surfaces			www.forms-surfaces.com	
	NAME	DATE	DESCRIPTION	
DVK	TVT	09/27/2022	KNIGHT BENCH	
CHK	KBR	09/27/2022		
1	TWIN WALL PEDESTAL		6 FEET BACKED ALUMINUM SLATS, NO ARMS,SURFACE MOUNT	
DO NOT SCALE DRAWING				
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF FORMS+SURFACES. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF FORMS+SURFACES IS PROHIBITED.			SIZE B	DWG. NO. 6FBKN-72-9-ALS
			REV 1	SHEET 1 OF 1

D L1.2 **BENCH**
SCALE: NOT TO SCALE



KEYNOTE LEGEND

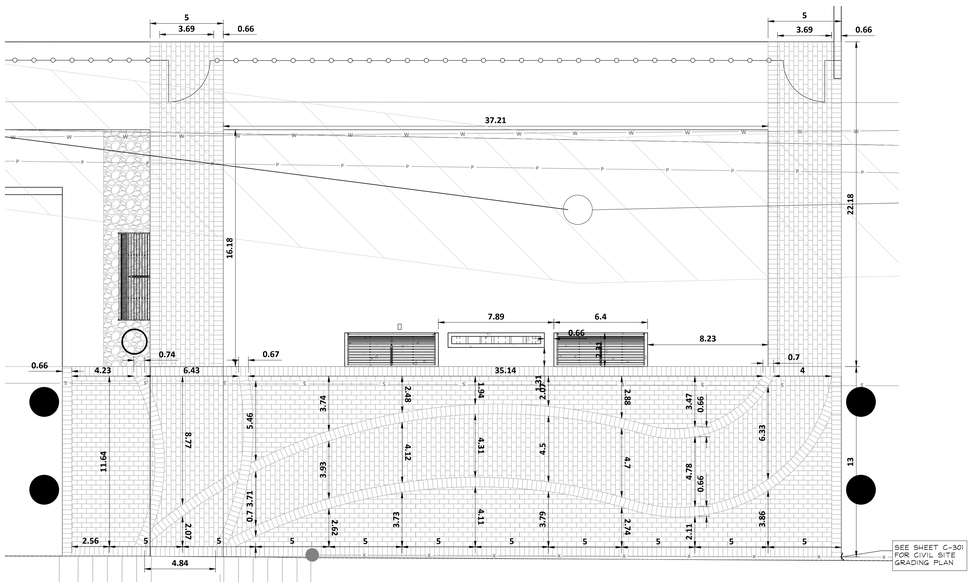
GENERAL INFORMATION LEGEND

Landscape Legend:

Key	Symbolic Name	Quantities (Verify)	Botanical Name	Common Name	Size and Plant Requirements
TREES					
	AH	accounted for in L1.1	Ilex x attenuata 'eagleston'	Eagleston Holly	2" cal. 30 gal. container; 9' to 10' ht.
SHRUBS, PERENNIALS, ORNAMENTAL GRASSES					
	LF	21	Leucophyllum Frutescens x **candidum**	**Microburst** Texas Sage	5 gal. planted at 36" o.c. single row
	MC	15	Muhlenbergia Capillaris	Gulf Muhly	3 gal. planted at 36" o.c. triangularly spaced.
	NT	21	Nassella Tenuissima	Mexican Feather Grass	3 gal. planted at 18" o.c. triangularly spaced.
	RE	5	Russelia Equisetiformis	Firecracker Fern	3 gal. planted at 36" o.c. triangularly spaced.
	SW	6	Scutellaria Wrightii	Wright's Purple Scullcap	3 gal. planted at 12" o.c. triangularly spaced.
GROUNDCOVER / VINES					
	FT	32	Ficus Tikoua	Sandy Leaf Fig	3 gal. planted at 24" o.c.

Hardscape Legend:

Key	Quantities (Verify)	Description / Model Number	Color/Finish	Contact	Remarks
CONCRETE / STONE / PAVER					
C.1	sf	Traditional Prest Brick Nominal 4"x4" with Square Edge (3 $\frac{5}{8}$" x 3 $\frac{5}{8}$" x 3")	Granite Collection: GCB91004 Ground Tudor	Hanover Architectural Products: info@hanoverpavers.com	-Contractor to provide sample for landscape architect approval prior to installation. -Contractor to verify quantity prior to ordering and installation. -Refer to plans for design and location -Mortar installation
C.2	sf	Traditional Prest Brick Nominal 4"x8" with Square Edge (3 $\frac{5}{8}$" x 7 $\frac{5}{8}$" x 3")	Granite Collection: GCB91001 Ground Tudor	Hanover Architectural Products: info@hanoverpavers.com	-Contractor to provide sample for landscape architect approval prior to installation. -Contractor to verify quantity prior to ordering and installation. -Refer to plans for design and location -Mortar installation
C.3	sf	Traditional Prest Brick Nominal 4"x8" with Square Edge (3 $\frac{5}{8}$" x 7 $\frac{5}{8}$" x 3")	Granite Collection: GCB91006 Ground Tudor	Hanover Architectural Products: info@hanoverpavers.com	-Contractor to provide sample for landscape architect approval prior to installation. -Contractor to verify quantity prior to ordering and installation. -Refer to plans for design and location -Mortar installation
C.4	sf	Gravel	.38" - .75" Antique Grey	Alamo Stone Office: 281-240-4600	-Contractor to provide sample for landscape architect approval prior to installation. -Contractor to verify quantity prior to ordering and installation. -Refer to plans for design and location
FURNISHING					
F.1	1	TONYO LITTER AND RECYCLING RECEPTACLE	ARGENTO TEXTURE	Forms + Surfaces. T 800.451.0410 | www.forms-surfaces.com	- Install Per Manufacturer's Recommendations -Refer to plans for quantity and location -Contractor to provide cut sheet & color samples for approval prior to ordering
F.2	3	KNIGHT BENCH, 6FT, BACKED aluminum slats, no arms, surface mount	ARGENTO TEXTURE	Forms + Surfaces. T 800.451.0410 | www.forms-surfaces.com	- Install Per Manufacturer's Recommendations -Refer to plans for quantity and location -Contractor to provide cut sheet & color samples for approval prior to ordering
F.3	1	"HEAL" Sculpture	by others	by others	by others



Owner's Responsibility For Maintenance
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Landscape Contractor's Responsibilities:
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1 L1.2 **ENLARGEMENT PLAN**
SCALE: 3" = 1'-0"

0 1" 3" 6" SCALE: 3" = 1'-0"

O'CONNELL ROBERTSON
Austin
San Antonio
Houston
81 Barton Springs Road, Suite 900, Austin, Texas 78704 p: 512.478.7284 f: 512.478.7441
4040 Broadway, Suite 300, San Antonio, Texas 78209 p: 210.224.4032 f: 210.224.4453
1301 Fannin Street, Suite 755, Houston, Texas 77002 p: 713.487.1583 f: 713.487.1573

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HARRIS HEALTH
SCP ACS SUNSET HEIGHTS URGENT CARE
1615 N MAIN ST, HOUSTON, TX, 77009

REGISTERED LANDSCAPE ARCHITECT EDWARD WARE 2470 STATE OF TEXAS

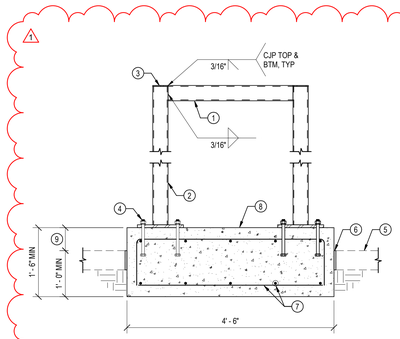
Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025
Project No. 2321.06 & 25-3SCP00178
100% CONSTRUCTION DOCUMENT

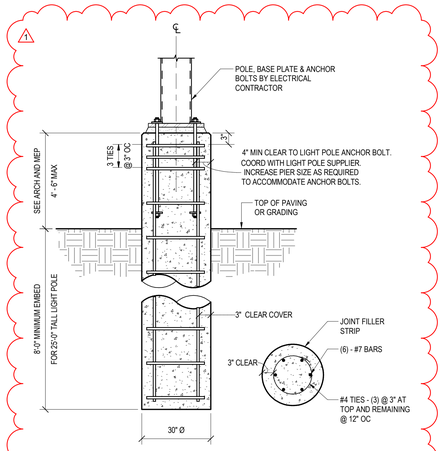
ENLARGEMENT PLAN
L1.2

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1. HSS4X4X1/4" BM.
2. HSS4X4X1/4" COL. COORDINATE COLUMN LOCATION WITH ARCH.
3. CAP PLATE TO MATCH HSS THICKNESS AND GRADE.
4. 3/4" x 12" x 12" TYPE 1 BASE PLATE W/ 3/4" DIA ANCHORS. REFER TO 1 / S10 FOR INFORMATION NOT SHOWN.
5. FINISH GRADE, PAVING, ETC, SEE ARCH/CIVIL DWGS.
6. 1 1/2" COMPRESSIBLE MATERIAL, 4 SIDES.
7. #4 @ 12" EA WAY TOP & BOTTOM W/ CORNER BARS.
8. 4' - 6" LONG x 1' - 8" WIDE REINFORCED CONCRETE FOOTING.
9. 3" MIN, VERIFY WITH ARCH.

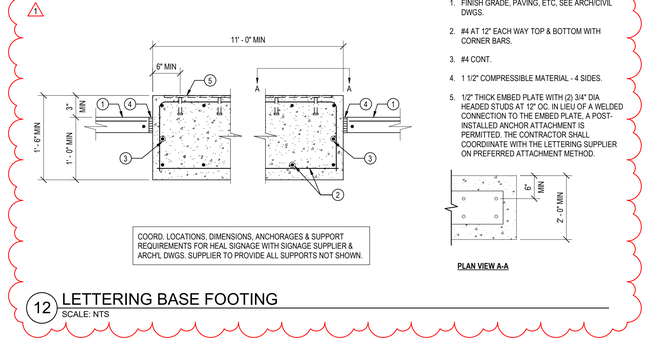
11 CHARGING STATION BASE FOOTING
SCALE: NTS



NOTES:

1. CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 4000 PSI WITH A MAXIMUM AGGREGATE SIZE OF 3/4" AND A MAXIMUM WATER/CEMENT RATIO OF 0.54.
2. ALL REINFORCEMENT SHALL CONFORM TO ASTM A615, GR 60.
3. ASSUMPTIONS FOR FOUNDATION DESIGN INCLUDE A 5" DIA, 25 FT POLE W/ FIXTURES AND A MAXIMUM EQUIV PROJECTED AREA OF 6 SQ FT.
4. SEE ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
5. HOLES FOR THE LIGHT POLE FOUNDATION TO BE DRILLED USING AN AUGER OF THE APPROPRIATE DIMENSION. OTHER EXCAVATION METHODS WILL COMPROMISE THE STRUCTURAL INTEGRITY OF THE SOIL AND SHOULD NOT BE USED.

10 LIGHT POLE DETAIL
SCALE: NTS

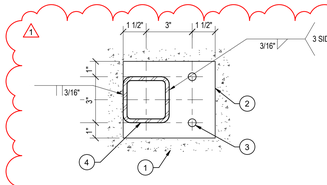


1. FINISH GRADE, PAVING, ETC, SEE ARCH/CIVIL DWGS.
2. #4 AT 12" EACH WAY TOP & BOTTOM WITH CORNER BARS.
3. #4 CONT.
4. 1 1/2" COMPRESSIBLE MATERIAL - 4 SIDES.
5. 1/2" THICK EMBED PLATE WITH (2) 3/4" DIA HEADED STUDS AT 12" OC. IN LIEU OF A WELDED CONNECTION TO THE EMBED PLATE, A POST-INSTALLED ANCHOR ATTACHMENT IS PERMITTED. THE CONTRACTOR SHALL COORDINATE WITH THE LETTERING SUPPLIER ON PREFERRED ATTACHMENT METHOD.

COORD. LOCATIONS, DIMENSIONS, ANCHORAGES & SUPPORT REQUIREMENTS FOR HEAL SIGNAGE WITH SIGNAGE SUPPLIER & ARCHL DWGS. SUPPLIER TO PROVIDE ALL SUPPORTS NOT SHOWN.

PLAN VIEW A-A

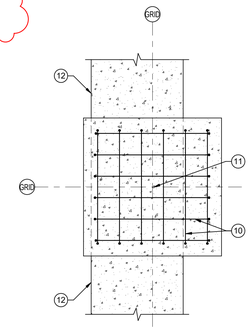
12 LETTERING BASE FOOTING
SCALE: NTS



1. PROVIDE 12" THICKENED SLAB UNDER BASE PLATE. MINIMUM WIDTH SHALL ACCOMMODATE MINIMUM 3" COVER AROUND BOLT.
2. 1/2" THICK BASE PLATE.
3. (2) 1/2" DIA F1554 BOLTS WITH SNUG TIGHT NUT AND 6" EMBEDMENT.
4. HSS3x3, SEE PLAN.

PLAN VIEW

9 OFFSET HSS POST BASE
SCALE: NTS



SECTION A-A

O'CONNELL ROBERTSON
Austin
San Antonio
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811 Barton Springs Road, Suite 900, Austin, Texas 78704 p: 512.478.7284 f: 512.478.7441
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1301 Fannin Street, Suite 750, Houston, Texas 77002 p: 713.467.1383 f: 713.467.1373

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1. DOME TOP OF CONCRETE.
2. 5" DIA EXTRA STRONG GALVANIZED PIPE BOLLARD FILLED WITH 3000 PSI (MINIMUM) CONCRETE, REFER TO PLANS AND ARCHITECTURAL DRAWINGS FOR LOCATIONS.
3. SEE CIVIL DRAWINGS.
4. 1 ADDITIONAL SET OF TIES AT TOP OF SHAFT.
5. 18" DIA SHAFT.
6. 4-#5 VERT.
7. #3 TIES AT 10"
8. 90° STD HOOKS.
9. PROVIDE 4'-6" EMBEDMENT INTO PIER.
10. SEE ARCHITECTURAL DRAWINGS.

NOTES:

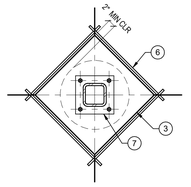
1. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF BOLLARD LOCATIONS WITH THE ARCHITECTURAL DRAWINGS AND SHALL PROVIDE BOLLARDS WHERE REQUIRED WHETHER SHOWN ON THE STRUCTURAL DRAWINGS OR NOT.
2. THIS DETAIL IS APPLICABLE ONLY IF THE BOLLARD IS LOCATED SUCH THAT THE DISTANCE MEASURED IN ANY DIRECTION FROM THE BOLLARD TO A CONSTRUCTION JOINT, CONTROL/CONTRACTION JOINT, OR SLAB EDGE IS NOT LESS THAN 5'-0".
3. TYPICAL BOLLARD IS AN IBC VEHICLE RATED BOLLARD APPROXIMATELY EQUIVALENT TO A 6,000 LB LOAD APPLIED HORIZONTALLY IN ANY DIRECTION TO THE BARRIER SYSTEM.
4. REFER TO ARCHITECTURAL SITE PLAN DRAWING FOR ADDITIONAL BOLLARD LOCATIONS NOT SHOWN ON THE STRUCTURAL DRAWINGS.

8 BOLLARD DETAIL
SCALE: NTS

NOTES:

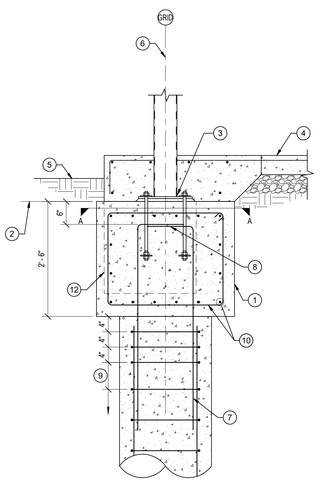
1. SEE DETAILS FOR DOWELS INTO GRADE BEAM AND PILE CAPS.
2. PIERS SHALL BE POURED IMMEDIATELY UPON COMPLETION OF EXCAVATION AND CLEANING OF PIER BEARING SURFACE. ALL SPOIL FROM THE DRILLED PIER EXCAVATIONS SHALL BE REMOVED FROM THE BUILDING PAD.

7 DRILLED SHAFT DETAIL
SCALE: NTS



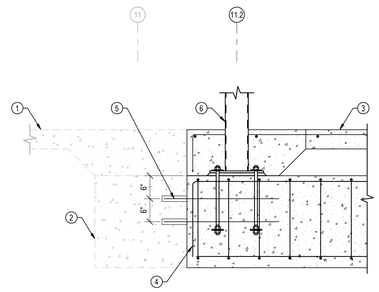
1. PIER, SEE PLAN.
2. STEEL COLUMN, SEE PLAN.
3. CONSTRUCTION JOINT.
4. SEE PLAN FOR SLAB DEPTH AND REINF.
5. #4 AT 12" OC EW.
6. 2-#4 EA SIDE, TYP.
7. TYPICAL BASE PLATE, SEE SCHEDULE.
8. PROVIDE 3 ADD'L TIES AT TOP OF PIER - SPACED AT 4" OC.
9. TYPICAL TIE SPACING.

6 INTERIOR PIER DETAIL
SCALE: NTS



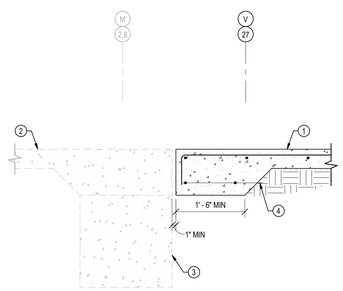
1. 3'-0" SQ x 2'-6" PILE CAP.
2. TOP OF PILE CAP, SEE PLAN.
3. COLUMN AND BASE PL, SEE SCHEDULE.
4. SLAB-ON-GRADE, SEE PLAN.
5. FINISH GRADE OR EXTERIOR SLAB-ON-GRADE WHERE OCCURS, SEE CIVIL.
6. CL OF PILE CAP AND PIER.
7. DOWELS TO MATCH AND LAP PIER REINF.
8. STD HOOK.
9. TIE SPACING PER SCHEDULE.
10. #3 ☐ TIES AT 6" OC MAX.
11. COLUMN NOT SHOWN FOR CLARITY.
12. GRADE BEAM. RUN REINF CONT THROUGH PILE CAP (REINF NOT SHOWN).

5 EXTERIOR PIER DETAIL
SCALE: NTS



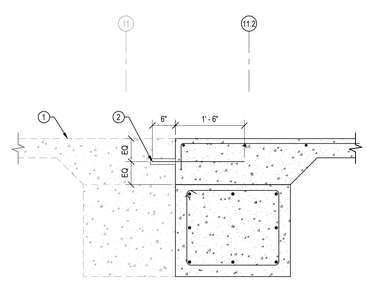
1. DOME TOP OF CONCRETE.
2. EXISTING SLAB-ON-GRADE.
3. EXISTING CONCRETE BEAM.
4. SLAB-ON-GRADE, SEE PLAN.
5. GRADE BEAM TOP REINF.
6. DRILL & EPOXY 4-#4 DOWEL INTO EXISTING CONCRETE BEAM. SPACE AT 6" OC INTO EA WAY.
7. COL AND BASE PLATE, SEE SCHEDULE.

4 NEW GRADE BEAM TO EXISTING GRADE BEAM
SCALE: NTS



1. SLAB-ON-GRADE, SEE PLAN.
2. EXISTING SLAB-ON-GRADE, SEE PLAN.
3. EXISTING CONCRETE BEAM.
4. 2-#4 CONT.

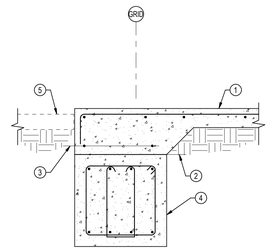
3 SLAB ADJACENT TO EXIST BLDG
SCALE: NTS



1. EXISTING CONCRETE SLAB AND CONCRETE GRADE BEAM.
2. DRILL & EPOXY #4 DOWEL INTO EXISTING CONCRETE SLAB, SPACE AT 18" OC.

NOTE:
SEE DETAIL 1 / S6 FOR INFO NOT SHOWN.

2 EXTERIOR GRADE BEAM ADJACENT TO EXIST BUILDING
SCALE: NTS



1. SLAB-ON-GRADE, SEE PLAN.
2. TOP OF GRADE BEAM, SEE PLAN.
3. 2-#4 CONT.
4. GRADE BEAM, SEE PAN AND DETAIL 5/S7.
5. FINISH GRADE OR EXTERIOR SLAB-ON-GRADE WHERE OCCURS, SEE CIVIL.

1 TYPICAL EXTERIOR GRADE BEAM
SCALE: NTS

HARRIS HEALTH
SCP ACS SUNSET HEIGHTS URGENT CARE
1615 N MAIN ST, HOUSTON, TX, 77009

STATE OF TEXAS
GREGORY M. GORDON
153011
LICENSED PROFESSIONAL ENGINEER
01/16/26

Engineering Firm:
H2B, INC.
Firm Registration No. 8856

Revisions:

NO.	DESCRIPTION	DATE
1	ADD 001	01/16/26

12/19/2025
Project No. 2321.06
25-35CP00178
100% CONTRACT DOCUMENTS

FOUNDATION SECTIONS AND DETAILS

S6

1/15/2026 7:56:16 PM
Autodesk Docs://Harris Health - Sunset Heights Clinic/2321.06_24_HHS - Sunset Height UC_STR_Central.rvt

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ALARM & SYSTEM VALVES

	WET PIPE ALARM VALVE
	DRY PIPE VALVE
	DELUGE VALVE
	PREACTION VALVE

GENERAL & AREA SPECIFIC SYMBOLS

	RISER LOCATION
	SYSTEM COVERAGE BOUNDARY
	SPECIAL AREA-SPECIFIC REQUIREMENTS
OH2	HAZARD CLASSIFICATION (IF OTHER THAN LIGHT HAZARD)

HYDRANTS & YARD PIPING

	HYDRANT, TWO HOSE OUTLET (OPEN SYMBOL INDICATES PRIVATE)
	FIRE HYDRANT - TWO HOSE OUTLET & PUMPER CONNECTION (FILLED SYMBOL INDICATES PUBLIC)

MISC. SYSTEM ACCESSORIES & APPURTENANCES

	FIRE DEPARTMENT - TWO HOSE OUTLET, FREE STANDING
	FIRE DEPARTMENT - TWO HOSE OUTLET
	FREESTANDING TEST HEADER
	WALL-MOUNTED TEST HEADER
	PRESSURE GAUGE

SPRINKLER HEADS

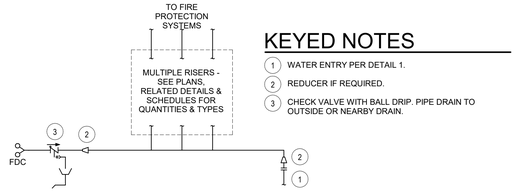
	UPRIGHT SPRINKLER
	PENDANT SPRINKLER
	UPRIGHT SPRINKLER - NIPPLE UP
	PENDANT SPRINKLER - ON DROP NIPPLE
	SPRINKLER WITH GUARD
	SIDEWALL SPRINKLER

SUPERVISORY & ALARM DEVICES

FS	FLOW DETECTOR/SWITCH
PS	PRESSURE DETECTOR/SWITCH
TS	TAMPER SWITCH
	ELECTRIC ALARM BELL

VALVES

	VALVES (GENERAL)
	VALVE IN PIT
	POST-INDICATOR VALVE
	KEY OPERATED VALVE
	OS&Y VALVE (RISING STEM)
	INDICATING BUTTERFLY VALVE
	NONINDICATING VALVE (NONRISING STEM)
	CHECK VALVE
	BACKFLOW PREVENTER - LISTED DOUBLE CHECK TYPE
	BACKFLOW PREVENTER - REDUCED PRESSURE ZONE (RPZ) TYPE
	PRESSURE REGULATING VALVE
	PRESSURE RELIEF VALVE
M	METER
	ANGLE VALVE (ANGLE HOSE VALVE)



NOTE: RISER WITHOUT INTERIOR DOUBLE CHECK ASSEMBLY.

1 MULTIPLE RISER MANIFOLD
NOT TO SCALE

KEYED NOTES

1. WATER ENTRY PER DETAIL 1.
2. REDUCER IF REQUIRED.
3. CHECK VALVE WITH BALL DRIP. PIPE DRAIN TO OUTSIDE OR NEARBY DRAIN.

Hydrant Flow Test Report

Test Date 11/14/2025 **Test Time** 9:00 am

Location

Harris Health Casa De Amigos
1615 N Main St.
Houston, TX 77009

Tested by

Notes

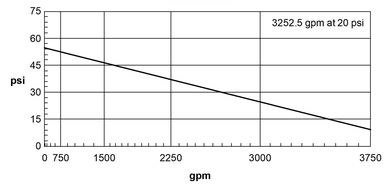
Read Hydrant

55 psi **static pressure**
51 psi **residual pressure**
-6 ft **hydrant elevation**

Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	-6	2.5	0.9	36	1007 gpm

Flow Graph



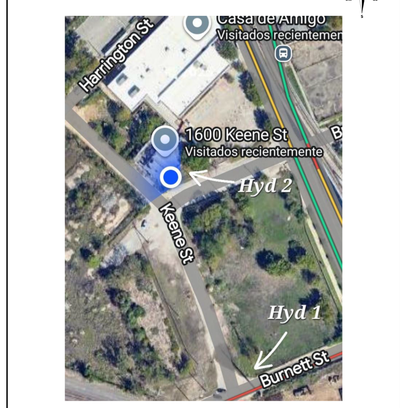
Created with the free hydrant flow test program from www.igneusinc.com

CODE COMPLIANCE

ALL FIRE PROTECTION AND RELATED WORK SHALL BE IN COMPLIANCE WITH THE FOLLOWING CODES AND APPLICABLE LOCAL AMENDMENTS:

1. INTERNATIONAL FIRE CODE, 2021 EDITION.
2. INTERNATIONAL BUILDING CODE (2021 EDITION) WITH ANY APPLICABLE LOCAL AMENDMENTS.
3. NFPA 13 - STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS, CURRENT EDITION.
4. NFPA 25 - STANDARD FOR THE INSPECTION, TESTING AND MAINTENANCE OF WATER-BASED FIRE PROTECTION SYSTEMS, CURRENT EDITION.
5. NFPA 72 - NATIONAL FIRE ALARM AND SIGNALING CODE, CURRENT EDITION.
6. NFPA 101 - LIFE SAFETY CODE, CURRENT EDITION.
7. NFPA 241: STANDARD FOR SAFEGUARDING CONSTRUCTION, ALTERATION, AND DEMOLITION OPERATIONS (2022 EDITION).

HYDRANT MAP



GENERAL NOTES

SYSTEM DESIGN REQUIREMENTS

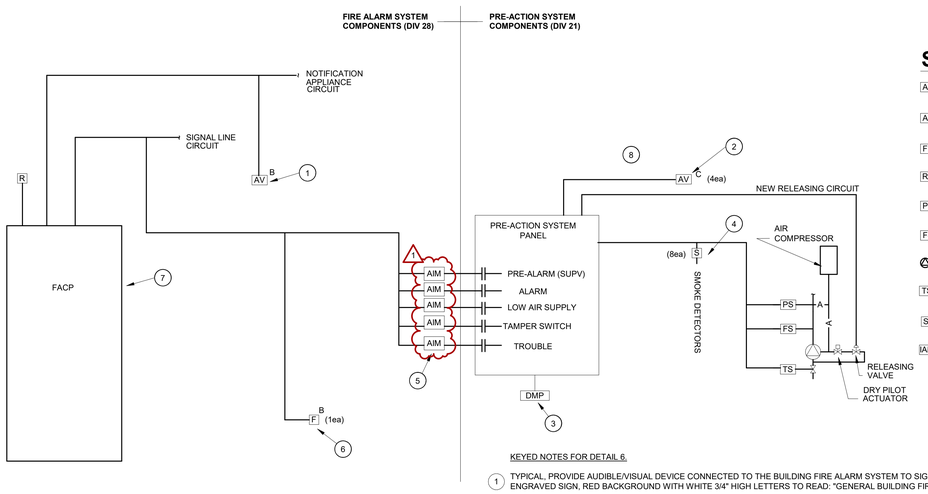
1. THE FIRE PROTECTION DRAWINGS AND SPECIFICATIONS FOR THIS PROJECT ARE INTENDED TO PROVIDE PERFORMANCE CRITERIA SUFFICIENT FOR DESIGN PURPOSES. THE CONTRACTOR SHALL PREPARE A DESIGN FOR THE SYSTEM TO MEET THE PERFORMANCE CRITERIA REQUIRED BY THESE DRAWINGS AND THE SPECIFICATIONS.
2. THE DESIGN SHALL BE PREPARED, SIGNED AND SEALED BY EITHER A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TEXAS & KNOWLEDGEABLE IN THE FIELD OF FIRE PROTECTION ENGINEERING, OR RESPONSIBLE MANAGING EMPLOYEE (RME) LICENSED BY THE STATE OF TEXAS FIRE MARSHALL'S OFFICE.
3. THE CONTRACTOR SHALL FURNISH WORKING PLANS AND CALCULATIONS FOR THE DESIGN. THE WORKING PLANS AND CALCULATIONS SHALL INCLUDE ALL ITEMS REQUIRED NFPA 13 SECTIONS 22.1 AND 22.2, AS WELL AS THE REQUIREMENTS OF OTHER CODES WHEN APPLICABLE. WORKING PLANS AND CALCULATIONS SHALL BE SUBMITTED TO BOTH THE AUTHORITY HAVING JURISDICTION AND THE PROJECT ENGINEER FOR REVIEW BEFORE BEGINNING WORK.
4. AVAILABLE WATER SUPPLY INFORMATION PROVIDED ON THIS SHEET WAS ACCUMULATED FROM VARIOUS SOURCES, THE ACCURACY OF WHICH HAS NOT BEEN VERIFIED. FOR BID PURPOSES, THE CONTRACTOR MAY USE THE INFORMATION GIVEN IN PREPARING HIS BID.
5. AFTER AWARD OF CONTRACT AND BEFORE BEGINNING DESIGN, THE CONTRACTOR AT HIS EXPENSE SHALL ARRANGE FOR OR CONDUCT FLOW TESTS TO BE USED AS A BASIS FOR FINAL DESIGN. ALL FLOW TESTS SHALL BE CONDUCTED AND REPORTED IN ACCORDANCE WITH APPLICABLE NFPA 291 REQUIREMENTS. NOTIFY THE ENGINEER IMMEDIATELY, IN WRITING, IF THE AVAILABLE WATER SUPPLY APPEARS DEFICIENT AS COMPARED TO THE DATA PROVIDED FOR BID PURPOSES.
6. THE BUILDING(S) SHALL BE FULLY SPRINKLERED PER NFPA 13 TO MEET LIGHT HAZARD OCCUPANCY REQUIREMENTS, EXCEPT WHERE MORE STRINGENT REQUIREMENTS ARE NOTED ON THE PLANS. THE SYSTEM SHALL BE HYDRAULICALLY CALCULATED AND DESIGNED TO PROVIDE A MINIMUM 10 PSI MARGIN OF SAFETY BETWEEN CALCULATED SYSTEM DEMAND, INCLUDING HOSE STREAM ALLOWANCE, AND AVAILABLE WATER SUPPLY AS DETERMINED BY THE CONTRACTORS FLOW TEST (ITEM 5 ABOVE).

SITE CONDITIONS AND COORDINATION

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS PRIOR TO BIDDING AND CONSTRUCTION.
2. REFER TO ARCHITECTURAL PLANS FOR ANY PHASING OF CONSTRUCTION AND COORDINATE BIDDING AND EXECUTION ACCORDINGLY.
3. SELECTED MAJOR PIPING RUNS MAY BE INDICATED ON THE PLANS AND SHALL GENERALLY FOLLOW THE ROUTING INDICATED. CONTRACTOR SHALL ROUTE PIPING IN WALLS AND ABOVE CEILING IN CONCEALED SPACES WHEREVER POSSIBLE. WHERE PIPING MUST BE RUN EXPOSED ROUTE INLINE WITH AND HOLD TIGHT TO STRUCTURE.
4. ALL PIPING MUST BE COORDINATED WITH THE WORK OF OTHER TRADES AND THE BUILDING CONSTRUCTION. COORDINATE ROUTING OF PIPING AND PLACEMENT OF SPRINKLER HEADS WITH MECHANICAL AND ELECTRICAL SYSTEMS AS WELL AS ARCHITECTURAL CEILING DESIGNS AND FEATURES. NO FIRE SPRINKLER PIPING SHALL BE INSTALLED UNTIL FULLY COORDINATED SHOP DRAWINGS SHOWING RELATIVE LOCATIONS OF FIRE PIPING, DOMESTIC WATER PIPING, HVAC PIPING, DUCTWORK, CONDUITS, CEILINGS, DIFFUSERS/REGISTERS, LIGHT FIXTURES AND OTHER CEILING ELEMENTS HAVE BEEN SUBMITTED AND ACCEPTED.
5. COORDINATE TIE-IN LOCATIONS WITH WORK PROVIDED BY OTHER TRADES OR UNDER SEPARATE CONTRACT.
6. ALL PIPING PENETRATIONS THROUGH FIRE RATED WALLS, FLOOR ASSEMBLIES AND SOUND WALLS SHALL BE MADE WITH THE PIPING AT RIGHT ANGLES TO THE PENETRATED WALLS. PENETRATIONS THROUGH FIRE RATED WALLS AND CEILING ASSEMBLIES SHALL BE SEALED WITH U.L. LISTED SYSTEMS AND METHODS AS SPECIFIED FOR THIS PROJECT IN ORDER TO MAINTAIN ASSEMBLY RATING. PENETRATIONS THROUGH SOUND WALLS SHALL BE SEALED WITH NON-COMBUSTIBLE SOUND PROOFING.
7. COORDINATE AND ROUTE PIPING TO AVOID STRUCTURAL PENETRATIONS WHEREVER POSSIBLE. WHERE STRUCTURAL PENETRATIONS CANNOT BE AVOIDED, COORDINATE AND PROVIDE SLEEVES AND BLOCKOUTS. ALL SUCH PENETRATIONS MUST BE REVIEWED AND BE FOUND ACCEPTABLE BY THE PROJECT STRUCTURAL ENGINEER.
8. THE CONTRACTOR SHALL COORDINATE WITH THE FIRE ALARM INSTALLATION FOR ALL FIRE ALARM CONNECTIONS ASSOCIATED WITH FIRE SUPPRESSION SYSTEMS.

PIPING MATERIALS AND INSTALLATION

1. ALL PIPING SHALL BE U.L. LISTED AND/OR F.M. APPROVED FOR FIRE PROTECTION SERVICE AND THE INTERIOR SURFACE SHALL BE COATED TO REDUCE MICROBIOLOGICALLY INFLUENCED CORROSION (MIC).
2. ALL PIPING SMALLER THAN 2" SHALL BE SCHEDULE 40 STEEL PIPE, AS SPECIFIED, WITH MALLEABLE IRON OR CAST IRON THREADED FITTINGS.
3. ALL PIPING 2" AND LARGER SHALL BE SCHEDULE 10 OR SCHEDULE 40 STEEL PIPE, AS SPECIFIED, WITH WELDED, FLANGED, OR ROLLED GROOVED FITTINGS. CUT GROOVES ARE NOT ACCEPTABLE.
4. ALL PIPE AND FITTINGS FOR WET SYSTEMS SHALL BE BLACK STEEL. ALL PIPE AND FITTINGS FOR DRY SYSTEMS SHALL BE GALVANIZED STEEL.
5. BRANCH TAPS MAY BE MADE WITH WELDED TAPS. ALL SUCH PIPE SHALL BE FABRICATED BY AN AWS CERTIFIED SHOP. FIELD WELDING OF BRANCH TAPS IS NOT ACCEPTABLE.
6. FIELD WELDING OF FLANGES AND WELD FITTINGS IN MAINS IS ACCEPTABLE PROVIDED THAT ALL LOCATIONS AND REQUIREMENTS ARE CLEARLY DENOTED ON THE CONTRACTOR'S WORKING PLANS. ALL WELDING SHALL BE PERFORMED BY AWS CERTIFIED WELDERS.
7. INSTALLATION OF FLOW SWITCHES AND TAPS TO EXISTING MAINS MAY BE MADE WITH LISTED SADDLE TAPS. THE CONTRACTOR SHALL RETRIEVE ALL DRILLED COUPONS, DATE WITH SUITABLE PERMANENT MARKINGS, AND SECURE AT THE TAP LOCATION USING PLATED #3 JACK CHAIN, OR EQUIVALENT.
8. PROVIDE FLOOR CONTROL VALVES AT RISER TAPS FEEDING EACH FLOOR LEVEL. INCLUDE FLOW SENSING DEVICES AT FLOOR VALVE.
9. ALL WATER SUPPLY AND SECTIONALIZING VALVES, EXCEPT KEY OPERATED BURIED GATE VALVES, SHALL BE PROVIDED WITH SUPERVISORY (TAMPER) SWITCHES.
10. ALL HANGERS SHALL BE DESIGNED & SPACED IN ACCORDANCE WITH NFPA 13, CHAPTER 9. ARMOVERS GREATER THAN 2'-0" SHALL BE SUPPORTED WITH HANGER.
11. TEST PIPING PER NFPA 13 AND 25 AS APPLICABLE AND SUBMIT REPORTS AS PART OF CLOSE OUT DOCUMENTS.



SYMBOLS

- B AV - AUDIBLE VISUAL ALARM DEVICE (CONNECT TO BUILDING FIRE ALARM SYSTEM)
- C AV - AUDIBLE VISUAL ALARM DEVICE (CONNECT TO PRE-ACTION PANEL)
- B F - MANUAL PULL STATION (CONNECT TO BUILDING FIRE ALARM SYSTEM)
- R - AIR HANDLER SHUTDOWN RELAY (CONNECT TO BUILDING FIRE ALARM SYSTEM)
- PS - PRESSURE SWITCH (CONNECT TO PRE-ACTION PANEL)
- FS - FLOW SWITCH (CONNECT TO PRE-ACTION PANEL)
- A - ALARM VALVE ASSEMBLY, PREACTION
- TS - TAMPER SWITCH (CONNECT TO PRE-ACTION PANEL)
- S - AREA SMOKE DETECTOR (CONNECT TO PRE-ACTION PANEL)
- IAM - INDIVIDUAL ADDRESSABLE MODULE (CONNECT TO BUILDING FIRE ALARM SYSTEM)

KEYED NOTES FOR DETAIL 6.

1. TYPICAL, PROVIDE AUDIBLE/VISUAL DEVICE CONNECTED TO THE BUILDING FIRE ALARM SYSTEM TO SIGNAL GENERAL BUILDING EVACUATION. PROVIDE A NEW ENGRAVED SIGN, RED BACKGROUND WITH WHITE 3/4" HIGH LETTERS TO READ: "GENERAL BUILDING FIRE ALARM - EVACUATE BUILDING".
2. TYPICAL, PROVIDE ANNUNCIATION DEVICE CONNECTED TO THE RELEASING PANEL. PROVIDE A NEW ENGRAVED SIGN, YELLOW BACKGROUND WITH BLACK 3/4" HIGH LETTERS TO READ: "SMOKE DETECTED IN AIDR/IDR ROOM".
3. PROVIDE DMP PANEL WITH WIRELESS CELLULAR COMMUNICATOR TO CONTACT THREE (3) PERSONNEL VIA PHONE, TEXT, AND E-MAIL WHEN THE PANEL DETECTS A FAULT. THIS IS NOT A PART OF THE FIRE SYSTEM MONITORING OR DISPATCH.
4. PROVIDE SMOKE DETECTORS ON CEILING.
   CONNECT ALL DETECTORS TO NEW RELEASING PANEL.
   REFER TO FIRE ALARM PLANS.
5. LOCATE "AIM" INPUT DEVICES PER DETAIL ADJACENT TO PANEL.
6. PROVIDE MANUAL PULL STATION. CONNECT TO MAIN BUILDING FIRE ALARM CONTROL PANEL (FACP).
7. ADDRESSABLE MAIN BUILDING FIRE ALARM CONTROL PANEL (FACP): USE THE DATA LOOP FOR SIGNALS FROM DETECTION RELEASE PANEL AND OTHER DETECTION AND ANNUCIATING DEVICES TO CONNECT TO THE FACP. PROVIDE IAM FOR DEVICES AS REQUIRED.
8. PROVIDE SPRINKLER HEAD LAYOUT IN AIDR/IDR ROOM AS REQUIRED TO MAINTAIN COVERAGE. PROVIDE INTERMEDIATE TEMPERATURE SPRINKLER HEADS.

2 PRE-ACTION SCHEMATIC
NOT TO SCALE

1 GENERAL NOTES FOR DETAIL 2.

PROVIDE PRE-ACTION ALARM VALVE WITH TRIM AND SHUTOFF VALVE. PROVIDE A TAMPER SWITCH AND FLOW SWITCH PER NFPA 13. PROVIDE INDIVIDUAL ADDRESSABLE MODULES FOR THE TAMPER SWITCH AND FLOW SWITCH AND CONNECT TO THE MAIN BUILDING FIRE ALARM CONTROL PANEL (FACP).

AREA OF COVERAGE FOR THE NEW PRE-ACTION SPRINKLER SYSTEM SERVING THE AIDR/IDR ROOM. PROVIDE PRE-ACTION SYSTEM WITH UPRIGHT, PENDANT OR SIDEWALL-TYPE, INTERMEDIATE TEMPERATURE SPRINKLER HEADS, ON RETURN BENDS. THE PRE-ACTION SYSTEM SHALL UTILIZE AN ELECTRO-PNUEMATIC DOUBLE INTERLOCK SYSTEM SUCH THAT THE DETECTION SYSTEM MUST ACTUATE A SOLENOID VALVE AND A LOSS OF AIR PRESSURE MUST OCCUR BEFORE WATER ENTERS THE THE PIPE. UTILIZE NEW AREA TYPE SMOKE DETECTORS TO SENSE SMOKE CONDITIONS IN THE PROTECTED SPACE.

INSTALL DETECTION AND RELEASING PANEL TO
ANNUNCIATE ALARM, SUPERVISORY OR TROUBLE CONDITIONS; AND TO SEND SIGNALS TO THE MAIN BUILDING FIRE ALARM CONTROL PANEL. PROVIDE NEW DEVICES AS REQUIRED FOR AN ELECTRO-PNUEMATIC DOUBLE INTERLOCK SYSTEM.

THE PRE-ACTION SHALL BE A DOUBLE INTERLOCK SYSTEM AND REQUIRING A SPRINKLER ACTIVATION AND DETECTION DEVICE ACTIVATION. REFER TO SEQUENCE OR OPERATION BELOW,

PROGRAM THE PANEL TO PERFORM THE FOLLOWING FUNCTIONS:

a. UPON ACTIVATION OF ONE OF THE AREA SMOKE DETECTORS.

1) ACTIVATE THE LOCAL A/V DEVICES.
2) ANNUNCIATE THE CONDITION BY SMOKE DETECTOR ID# AT THE ALPHANUMERIC DISPLAY IN THE PANEL.
3) SEND SUPERVISORY ALARM TO THE FACP.
4) SEND CELLULAR COMMUNICATION TO PROGRAMMED PERSONNEL.

b. UPON ACTIVATION OF TWO OR MORE OF THE AREA SMOKE DETECTORS,

1) ACTIVATE THE LOCAL A/V DEVICES LOCATED WITHIN THE SPACE.
2) ANNUNCIATE THE CONDITION BY SMOKE DETECTOR ID# AT THE ALPHANUMERIC DISPLAY IN THE PANEL.
3) SEND 'FIRE ALARM' SIGNAL TO FACP.
4) OPEN RELEASING VALVE (SOLENOID). DOES NOT DISCHARGE WATER INTO THE SPACE.
5) SEND CELLULAR COMMUNICATION TO PROGRAMMED PERSONNEL.

c. UPON ACTIVATION OF AIR MAINTENANCE DEVICE DUE TO LOSS OF AIR PRESSURE (OR LESS THAN 7PSI) DUE TO THE ACTIVATION OF A SPRINKLER HEAD OR DAMAGE TO THE TO SYSTEM PIPING

1) ANNUNCIATE THE CONDITION AT DETECTION AND RELEASING PANEL.
2) SEND 'SUPERVISORY' SIGNAL TO THE FACP
3) SEND CELLULAR COMMUNICATION TO PROGRAMMED PERSONNEL.

d. UPON ACTIVATION OF BOTH THE DETECTION CONDITION AND THE ACTIVATION OF A SPRINKLER.

1) ACTIVATE THE LOCAL A/V DEVICES LOCATED WITHIN THE SPACE.
2) ANNUNCIATE THE CONDITION BY SMOKE DETECTOR ID# AT THE ALPHANUMERIC DISPLAY IN THE PANEL.
3) SEND 'FIRE ALARM' SIGNAL TO FACP.
4) OPEN RELEASING VALVE (SOLENOID). DISCHARGE WATER INTO THE SPACE.
5) SEND CELLULAR COMMUNICATION TO PROGRAMMED PERSONNEL.

1

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LICENSED PROFESSIONAL ENGINEER
01/16/2026

Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708

Revisions:

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CONTRACT DOCUMENTS

FIRE PROTECTION NOTES, SYMBOLS AND ABBREVIATIONS

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PLUMBING ABBREVIATIONS

NOT ALL WILL APPEAR ON THE DRAWINGS

A	COMPRESSED AIR	G	GAS, NATURAL
AAV	AUTOMATIC AIR VENT	GAL	GALLON
AC	ABOVE CEILING	GALV	GALVANIZED
AD	AREA DRAIN	GC	GAUGE COCK
AFF	ABOVE FINISHED FLOOR	G.C.	GENERAL CONTRACTOR
ANC	ANCHOR	GLV	GLOBE VALVE
ANV	ANGLE VALVE	GPH	GALLONS PER HOUR
AP	ACCESS PANEL	GPM	GALLONS PER MINUTE
AQ	AQUASTAT	GPR	GAS PRESSURE REGULATOR
ATC	AUTOMATIC TEMPERATURE CONTROL	GV	GATE VALVE
ATV	ATMOSPHERIC VENT (STEAM OR HOT WATER)	HB	HOSE BIB
AV	ACID VENT PIPING, CHEMICAL RESISTANT	HD	HUB DRAIN
AW	ACID WASTE PIPING, CHEMICAL RESISTANT	HPG	HIGH PRESSURE GAS, NATURAL
BF	BELOW FLOOR	HW	HOT WATER, DOMESTIC
BFP	BACKFLOW PREVENTER	HWC	HOT WATER CIRCULATING, DOMESTIC
BFV	BUTTERFLY VALVE	HWR	HOT WATER RETURN, DOMESTIC
BG	BELOW GRADE	IPS	INTERNATIONAL PIPE STANDARD
BLDG	BUILDING	INV	INVERT (ELEV/FLOW LINE)
BOP	BOTTOM OF PIPE	LAV	LAVATORY
BR	BRANCH	MH	MANHOLE
BS	BELL AND SPIGOT	MPT	MALE PIPE THREAD
BTC	BRANCH TO CONNECTION	MSB	MOP SERVICE BASIN
BTM	BOTTOM OF PIPE	N.C.	NORMALLY CLOSED
BV	BALLVALVE	NH	NO-HUB (CAST IRON)
BWV	BACKWATER VALVE	N.O.	NORMALLY OPEN
CD	CONDENSATE DRAIN	NOM	NOMINAL
CFH	CUBIC FEET PER HOUR	OSD	OPEN SITE DRAIN
CI	CAST IRON	OS&Y	OUTSIDE SCREW & YOKE
CLG	CEILING	OFD	OVERFLOW DRAIN
CO	CLEANOUT	PD	PRESSURE DROP
COTG	CLEANOUT TO GRADE	PLBG	PLUMBING
CSS	CLINICAL SERVICE SINK	PRV	PRESSURE REDUCING VALVE
CW	COLD WATER, DOMESTIC	PS	PRESSURE SWITCH
D	DRAIN	RD	ROOF DRAIN
DCO	DOUBLE CLEANOUT	RV	RELIEF VALVE
DCOTG	DOUBLE CLEANOUT TO GRADE	SAN	SANITARY WASTE
DFU	DRAINAGE FIXTURE UNIT	SD	STORM DRAIN
DI	DE-IONIZED WATER	SHR	SHOWER
DIA	DIAMETER	SS	SERVICE SINK
DN	DOWN	S.S.	STAINLESS STEEL
DS	DOWNSPOUT (EXTERIOR)	SSD	SUB SOIL (FRENCH) DRAIN
DW	DISTILLED WATER	SV	SOLENOID VALVE
(E)	EXISTING	T	THERMOSTAT
ECC	ELECTRICAL CONTROL CENTER	TPR	TEMPERATURE AND PRESSURE RELIEF
ELEV	ELEVATION	TDH#	TOTAL DYNAMIC HEAD (PSIG)
EMER	EMERGENCY	TDH'	TOTAL DYNAMIC HEAD (FEET)
EPG	MEDIUM PRESSURE GAS, NATURAL	TH	THERMOMETER
EWC	ELECTRIC WATER COOLER	TMV	THERMOSTATIC MIXING VALVE
EWH	ELECTRIC WATER HEATER	UN	UNION
EXIST.	EXISTING	V	SANITARY VENT
EX. JT.	EXPANSION JOINT	VTR	VENT THROUGH ROOF
FC	FLEXIBLE CONNECTION	WC	WATER CLOSET
FCO	FINISHED FLOOR CLEANOUT	WCO	WALL CLEANOUT, FINISHED
FD	FLOOR DRAIN	WHA	WATER HAMMER ARRESTOR
FL	FLOW LINE	WB	WALL BOX
FLR	FLOOR		
FPM	FEET PER MINUTE		
FPT	FEMALE PIPE THREAD		
FS	FLOW SWITCH		
FT	FEET		
FTG	FITTING		
FV	FLUSH VALVE		

PLUMBING SYMBOL SCHEDULE

NOT ALL WILL APPEAR ON THE DRAWINGS

COLD WATER PIPE		BALL VALVE
COLD WATER PIPE, EXISTING		CHECK VALVE
EQUIPMENT DRAIN		GAS COCK
EXISTING PIPE TO BE REMOVED		GATE VALVE
GAS PIPE		GLOBE VALVE
GAS PIPE, EXISTING		OUTSIDE SCREW & YOKE VALVE
HOT WATER PIPE		PRESS. REDUCING VALVE (PRV)
HOT WATER PIPE, EXISTING		PRESS./TEMP. RELIEF VALVE
HOT WATER RETURN PIPE		VALVE IN BOX (VIB)
HOT WATER RETURN PIPE, EXISTING		THERMOSTATIC RECIRCULATION VALVE
SANITARY SOIL/WASTE		AUTOMATIC FLOW REGULATOR
SANITARY SOIL/WASTE, EXISTING		BRANCH OUT OF TOP
SANITARY VENT PIPE		DROP OR RISE
SANITARY VENT PIPE, EXISTING		BRANCH OUT OF BOTTOM
STORM DRAIN PIPE		BRANCH OUT OF TOP
STORM DRAIN PIPE, EXISTING		CAP OR PLUG
NEW CONNECTION TO EXISTING		CLEANOUT (EXPOSED) (CO)
ACID VENT		FLOOR CLEANOUT (FCO)
ACID WASTE		UNION
REMOVE TO THIS POINT		CLEANOUT TO GRADE (COTG)
GREASE WASTE		DOUBLE CLEANOUT TO GRADE (DCOTG)
COMPRESSED AIR		FIRE HYDRANT
PURIFIED WATER SUPPLY		FLOOR DRAIN (FD)
PURIFIED WATER RETURN		FLOOR SINK (FS)
	HB	HOSE BIB
		ROOF DRAIN (RD)
		VENT THROUGH ROOF (VTR)
		GAS REGULATOR
		CONTROL VALVE
	FPHB	FREEZE PROOF HOSE BIB

GENERAL NOTES

1. LOCATIONS OF PLUMBING SYSTEMS TAKEN FROM COMBINATION OF A VISUAL SURVEY AND ORIGINAL DRAWINGS. CONTRACTOR TO FIELD VERIFY EXISTING SYSTEMS AND CONDITIONS.
2. ALL WORK SHALL BE PERFORMED IN COMPLIANCE WITH THE CODES LISTED BELOW AND ALL LOCAL AMENDMENTS AND REGULATIONS AS ADOPTED BY THE AUTHORITY HAVING JURISDICTION. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THESE PLANS AND SHALL BE PERFORMED WITH THE LATEST INDUSTRY ACCEPTED STANDARDS.
3. ALL NEW SANITARY WASTE AND VENT PIPING SHALL BE ROUTED AT NO LESS THAN 1/8 INCH PER FOOT SLOPE.
4. ALL VENT PIPING ON PLANS ARE SHOWN SCHEMATICALLY FOR CLARITY. CONTRACTOR IS TO ROUTE PIPING IN WALLS AND ABOVE CEILING IN CONCEALED SPACES. WHERE PIPING IS EXPOSED ROUTE INLINE WITH STRUCTURE AND HOLD TIGHT TO ROOF STRUCTURE.
5. ALL PIPING PENETRATIONS THROUGH FIRE RATED WALLS AND SOUND WALLS SHALL BE MADE WITH THE PIPING AT RIGHT ANGLES TO THE PENETRATED WALLS. PENETRATIONS THROUGH FIRE RATED WALLS SHALL BE SEALED WITH U.L. OR F.M. LISTED FIRESTOPPING MATERIAL AND METHODS AS REQUIRED TO MAINTAIN THE RATING OF THE WALL. PENETRATIONS THROUGH SOUND WALLS SHALL BE SEALED WITH NON-COMBUSTIBLE SOUND PROOFING. REFER TO SPECIFICATIONS FOR INFORMATION PERTAINING TO PIPING PENETRATIONS THROUGH FIRE RATED AND CORRIDOR WALLS.
6. PROVIDE CLEANOUTS AS INDICATED ON THE DRAWINGS AND AS REQUIRED. CLEANOUTS SHALL BE AS NOTED IN THE PLUMBING FIXTURE SCHEDULE OR AS CALLED OUT ON THE PLANS.
7. COORDINATE SLEEVES AND BLOCKOUTS THROUGH GRADE BEAMS, FOUNDATION BEAMS, AND JOISTS WITH GENERAL CONTRACTOR.
8. COORDINATE FLOOR/ROOF PENETRATIONS OF SANITARY/VENT, ETC., WITH STRUCTURAL TO AVOID STRUCTURAL BEAMS AND JOISTS.
9. REFER TO ARCHITECTURAL PLANS FOR ANY PHASING OF CONSTRUCTION AND COORDINATE BIDDING AND EXECUTION ACCORDINGLY.
10. KEEP ALL V.T.R.'S A MINIMUM OF 10 FEET AWAY FROM ALL OUTSIDE INTAKES, DOORS AND WINDOWS.
11. ALL EXPOSED GAS PIPING (INTERIOR AND EXTERIOR) SHALL BE PAINTED. REFER TO ARCHITECTURAL PAINTING SPECIFICATIONS FOR PAINT TYPE AND APPLICATION.
12. REFER TO ARCHITECT/ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR MOUNTING INFORMATION AND EXACT LOCATION FOR ALL PLUMBING FIXTURES AND TRIM. OFFSET ROUGH-INS AS REQUIRED. COORDINATE WITH GENERAL CONTRACTOR ACCORDINGLY.
13. SOME CONDITIONS MAY EXIST WHICH RESULT IN MINIMAL ROUGH-IN TOLERANCES FOR FIXTURES DUE TO POSSIBLE BELOW SLAB BEAM LOCATIONS. VERIFY SUCH ON SITE VIA SLAB CUTS. WHERE THIS OCCURS, ROUTE PIPING ABOVE SLAB IN PARTITIONS OR CHASES TO BEYOND THE BEAM LINES AND THEN DROP BELOW SLAB. COORDINATE WITH GENERAL CONTRACTOR AND ARCHITECT/ENGINEER IF/AS NEEDED.
14. PLUMBING CONTRACTOR SHALL PROVIDE ALL EQUIPMENT, MATERIAL, LABOR, ETC. NECESSARY TO PROVIDE A COMPLETE WORKABLE PLUMBING SYSTEM. ALL FIXTURES SHALL COME COMPLETE WITH NECESSARY TRIM, CHROME PLATED ESCUTCHEONS, P-TRAPS, TAIL PIECE CONNECTIONS, AND CARRIERS. PROVIDE ANGLE SUPPLY STOPS FOR DOMESTIC HOT AND COLD WATER CONNECTIONS TO PLUMBING FIXTURES. INSTALL SHOCK-STOP ASSEMBLIES AS REQUIRED TO PREVENT WATER HAMMER.
15. PROVIDE AND INSTALL FIXTURES FULLY OPERATIONAL FOR FIXTURE TYPES SCHEDULED.
16. FURNISH AND INSTALL VALVES AND UNIONS AT EACH PIECE OF EQUIPMENT TO ALLOW THE ITEM TO BE ISOLATED AND REMOVED FROM THE SYSTEM, AS REQUIRED, WITHOUT DISTURBING THE REMAINING SYSTEM.
17. WHEN FLOOR AND SLAB IS SAW CUT TO INSTALL NEW PIPE OR TO GAIN ACCESS TO EXISTING PIPE, THE PLUMBING CONTRACTOR IS REQUIRED TO PATCH AND REPAIR FLOOR TO MATCH EXISTING.
18. THE CONTRACTOR SHALL COORDINATE WITH THE GENERAL CONTRACTOR AND THE OWNER WHEN IT IS NECESSARY TO INTERRUPT UTILITIES.
19. THE CONTRACTOR SHALL CLEAN AND DISINFECT WATER LINES. REFER TO SPECIFICATIONS. DISINFECTION OF WATER LINES SHALL OCCUR WITHIN A MAXIMUM OF 3 WEEKS PRIOR TO OCCUPANCY. IF MORE THAN 3 WEEKS PASS BEFORE OCCUPANCY THE DOMESTIC WATER SHALL BE DISINFECTED AGAIN AT THE CONTRACTOR'S EXPENSE.
20. INSTALLATION OF BACKFLOW PREVENTERS SHALL BE IN ACCORDANCE WITH IPC AND AWWA M14 "RECOMMENDED PRACTICE FOR BACKFLOW PREVENTION AND CROSS CONTROL." TESTING OF BACKFLOW PREVENTERS SHALL OCCUR UPON INSTALLATION TESTING SHALL BE CONDUCTED BY A TCEQ LICENSED BACKFLOW PREVENTION ASSEMBLY TESTER REGISTERED WITH THE AUTHORITY HAVING JURISDICTION.
21. ALL FLOOR DRAINS SHALL BE PRIMED BY EITHER AND ELECTRONIC TRAP PRIMER OR FLUSH VALVE TRAP PRIMER. TRAP GUARD OR SIMILAR PRODUCTS WILL ONLY BE CONSIDERED IN SPECIAL CASES AND ONLY AS APPROVED BY THE OWNER.
22. BEFORE SAW CUTTING OR CORING THROUGH EXISTING FLOOR OR SLAB THIS CONTRACTOR SHALL X-RAY OR UTILIZE GROUND PENETRATING RADAR (GPR) TO LOCATE ANY REBAR, EMBEDDED ELECTRICAL CONDUIT OR OTHER EMBEDDED UTILITY. CLEARLY MARK AREA FOR REVIEW BY THE GENERAL CONTRACTOR.

CODE COMPLIANCE

1. INTERNATIONAL BUILDING CODE (2021 EDITION) WITH ANY APPLICABLE LOCAL AMENDMENTS.
2. INTERNATIONAL ENERGY CONSERVATION CODE (2021 EDITION) WITH ANY APPLICABLE LOCAL AMENDMENTS.
3. UNIFORM MECHANICAL CODE (2021 EDITION) WITH ANY APPLICABLE LOCAL AMENDMENTS.
4. UNIFORM PLUMBING CODE (2021 EDITION) WITH ANY APPLICABLE LOCAL AMENDMENTS.
5. NFPA 241: STANDARD FOR SAFEGUARDING CONSTRUCTION, ALTERATION, AND DEMOLITION OPERATIONS (2022 EDITION).

1

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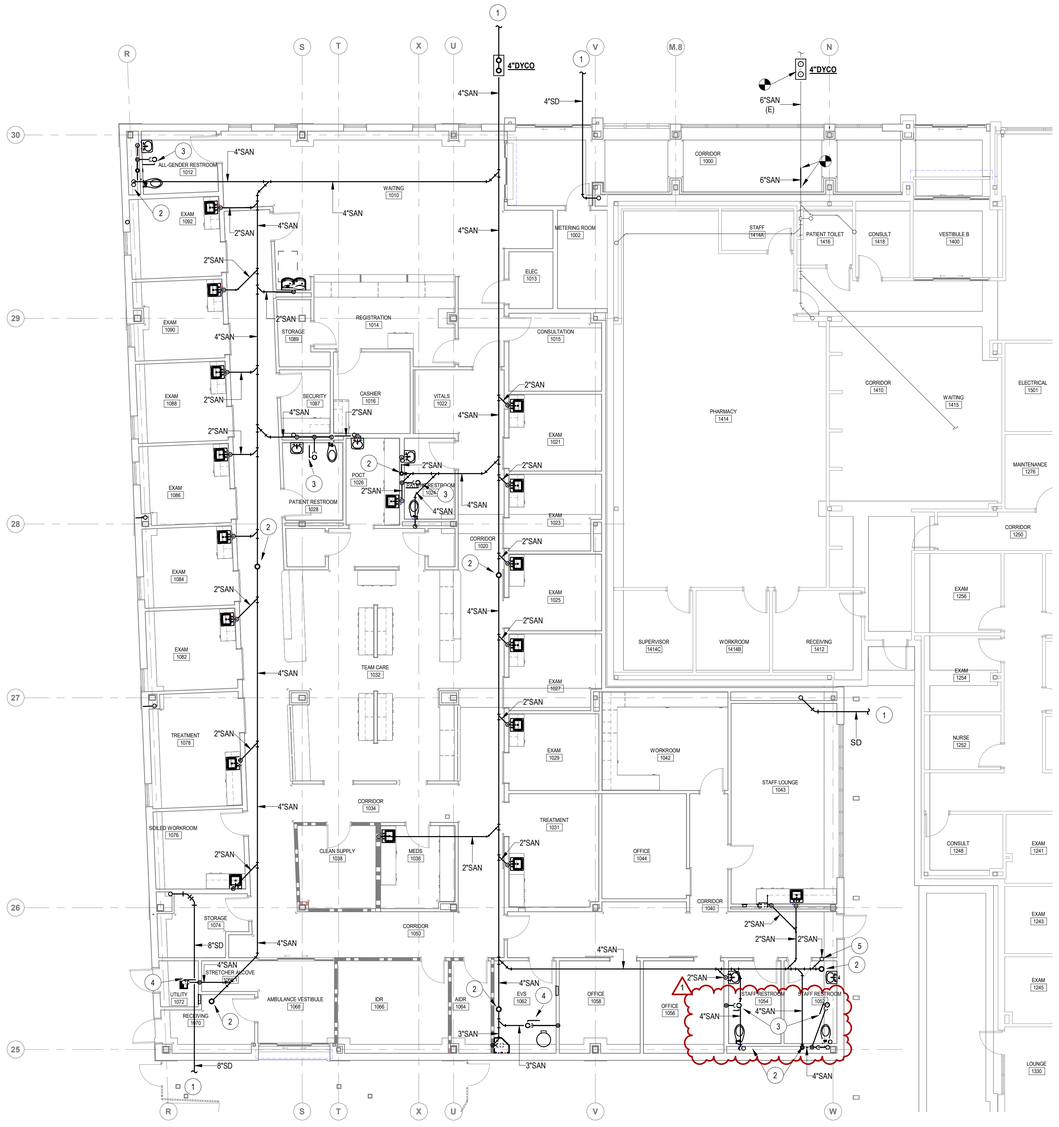
PLUMBING NOTES, SYMBOLS AND ABBREVIATIONS

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1 PLUMBING UNDERFLOOR PLAN
SCALE: 1/8" = 1'-0"

GENERAL NOTES

1. REFER TO SHEET P1.1 FOR GENERAL PLUMBING NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. ALL EXISTING PIPING SIZES & LOCATIONS ARE TAKEN FROM BEST AVAILABLE RECORD DOCUMENTS & SITE OBSERVATIONS. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION.

KEYNOTE LEGEND

1 REF. CIVIL FOR CONTINUATION.

2 SAN UP TO WALL/FLOOR CLEANOUT.

3 ROUTE 1/2"CW LINE FROM TAIL PIECE TRAP PRIMER ON ADJACENT SINK OR LAVATORY TO FLOOR DRAIN.

4 1/2"CW FROM TRAP PRIMER ABOVE TO FLOOR DRAIN OR FLOOR SINK. PIPE ROUTING BELOW SLAB SHOWN DIAGRAMMATICALLY FOR CLARITY. ROUTE SEPARATE 1/2" LINE TO EACH FLOOR DRAIN OR FLOOR SINK. INSTALL CW PIPING BELOW PER SPECIFICATIONS.

5 ROUTE 2" SAN LINE UP WALL AND AROUND TO SINK TO AVOID GRADE BEAM.

TRUE NORTH

PLAN NORTH

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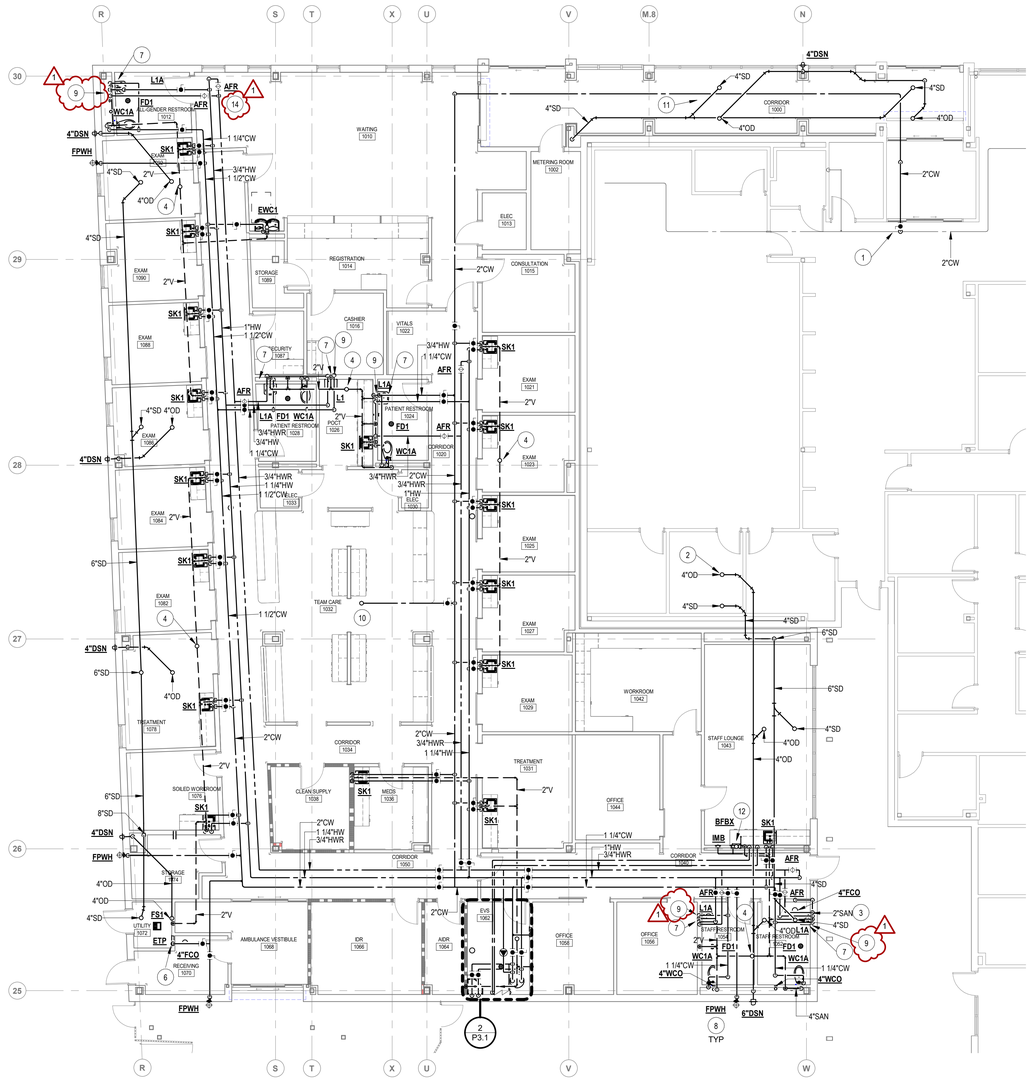
PLUMBING UNDERFLOOR PLAN

P3.0

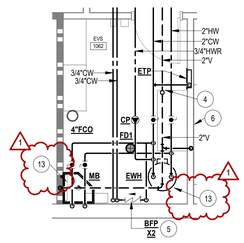
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1 PLUMBING PLAN
SCALE: 1/8" = 1'-0"



2 PLUMBING ENLARGED PLAN
SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. REFER TO SHEET P1.1 FOR GENERAL PLUMBING NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. ALL EXISTING PIPING SIZES & LOCATIONS ARE TAKEN FROM BEST AVAILABLE RECORD DOCUMENTS & SITE OBSERVATIONS. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION.

KEYNOTE LEGEND

1 CONNECT INTO EXISTING DOMESTIC COLD WATER LINE.

2 ROUTE TO NEW ROOF DRAINS SERVING EXISTING BUILDING

3 ROUTE SAN PIPING FOR SINK IN WALL TO AVOID GRADE BEAM.

4 2" VENT THROUGH ROOF.

5 PROVIDE 3/4" CW PIPING DOWN TO BACKFLOW PREVENTER STATION; WATTS 009LF; OR EQUAL. TWO 1/2" BACKFLOW PREVENTERS TO BE RACKED ON THE WALL, MINIMUM 12 INCHES AFF AND MAX 60 INCHES AFF. ONE BACKFLOW PREVENTER TO SERVE WATER DISPENSER AND ONE BACKFLOW PREVENTER TO SERVE COFFEE MACHINE. ROUTE DRAIN TO FLOOR SINK/DRAIN. BACKFLOW PREVENTERS SHALL BE LABELED TO INDICATE EQUIPMENT SERVED AND PIPING DOWNSTREAM OF BACKFLOW DEVICES SHALL BE LABELED AS "NON-POTABLE WATER".

6 3/4"CW DOWN TO ELECTRONIC TRAP PRIMER. ROUTE 1/2"CW FROM TRAP PRIMER, UNDER FLOOR, TO FLOOR DRAIN OR FLOOR SINK.

7 PROVIDE MANUFACTURER SUPPLIED BOX MOUNTED TRANSFORMER TO SERVE SENSOR OPERATED FAUCETS. PROVIDE JUNCTION BOX TO MOUNT TRANSFORMER. TRANSFORMER MAY SERVE UP TO SIX (6EA) SENSOR FAUCETS. COORDINATE WITH GC AND ELECTRICAL CONTRACTOR TO PROVIDE 120V / 50VA, POWER TO TRANSFORMER. THIS CONTRACTOR TO PROVIDE LOW VOLTAGE WIRE FROM TRANSFORMER TO FAUCET, IN RIGID CONDUIT. WIRE SHALL BE WITHIN THE WALL CAVITY AND SHALL NOT BE EXPOSED. MOUNT TRANSFORMER NO MORE THAN 10" ABOVE CEILING. PROVIDE 10" X10" ACCESS DOOR IN HARD CEILINGS. REFER TO SPECIFICATION SECTION 08 31 13 FOR ACCESS DOOR TYPE.

8 PROVIDE FREEZE PROOF WALL HYDRANT APPROX 24" A.F.F.

9 ROUTE HW LOOP DOWN IN WALL TO SERVE LAVATORY. PROVIDE MAX 18" LONG RUN-OUT FROM LOOP TO FIXTURE.

10 3/4" CW UP TO ROOF HYDRANT.

11 ROUTE STORM AND OVERFLOW PIPING HIGH AND TIGHT TO STRUCTURE TO AVOID CONFLICT WITH DUCTWORK.

12 PROVIDE ONE (1EA) BACKFLOW BOX LOCATED BELOW COUNTER HEIGHT FOR CONNECTION TO ICE MAKER. ROUTE ICE MAKER DRAIN LINE TO BACKFLOW BOX DRAIN. REFER TO ARCHITECTURAL SHEETS FOR COORDINATION OF LOCATION OF EQUIPMENT.

1 13 REF. DETAIL ON P7.2

14 AUTOMATIC FLOW REGULATOR ASSEMBLY. REFER TO DETAILS, TYPICAL.

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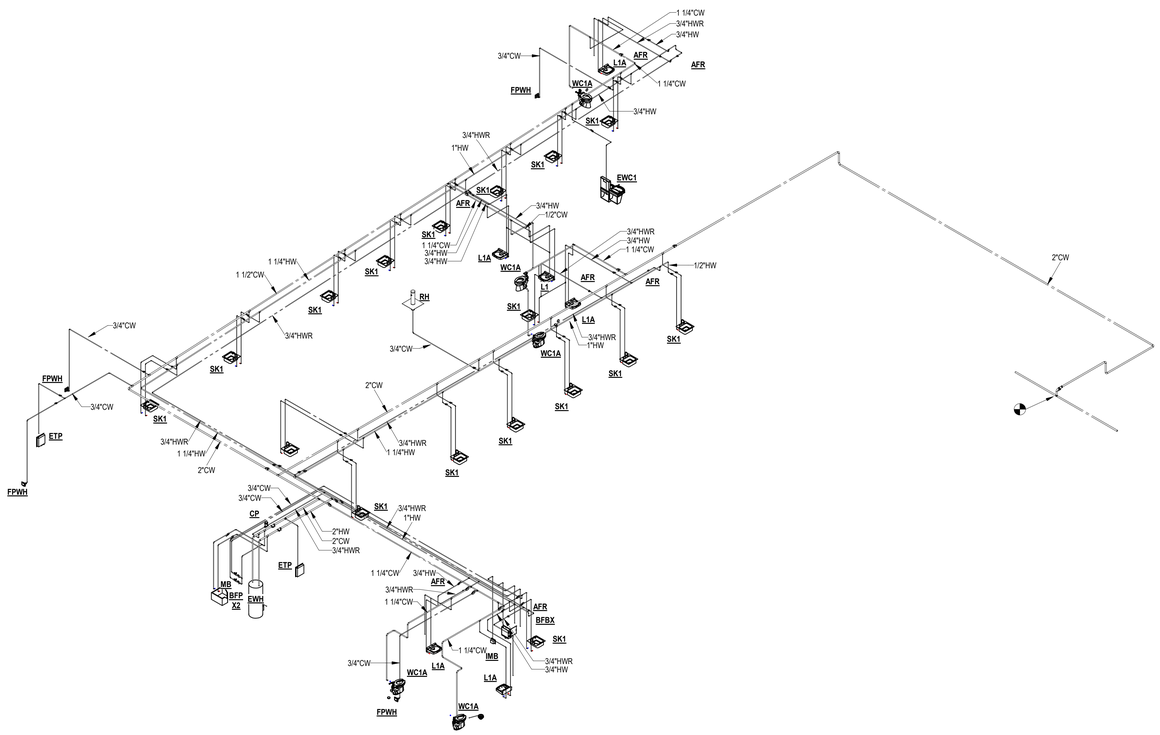
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PLUMBING PLAN
P3.1

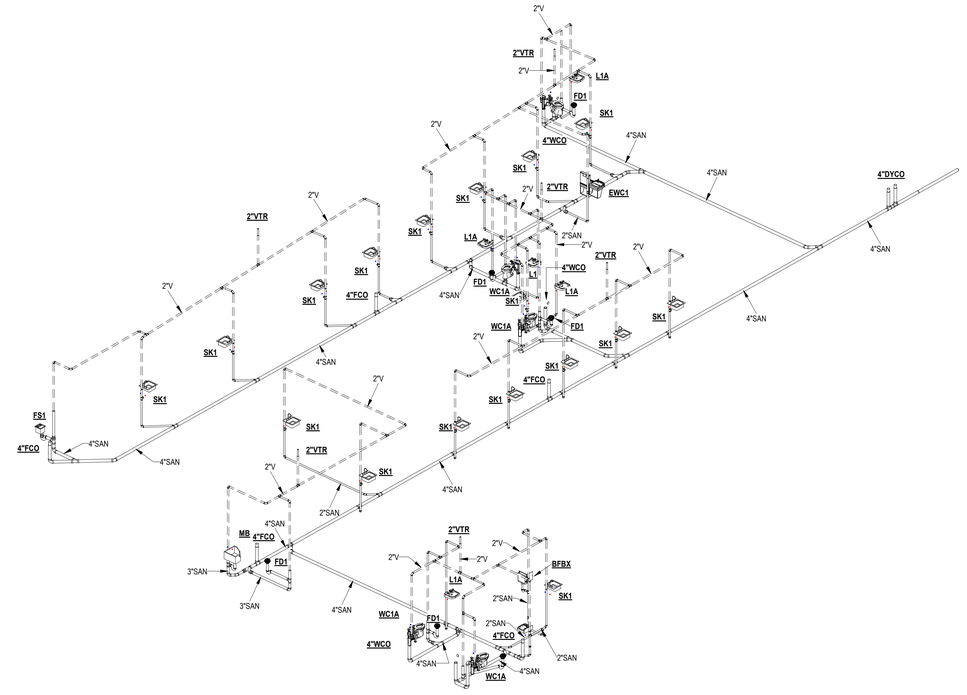
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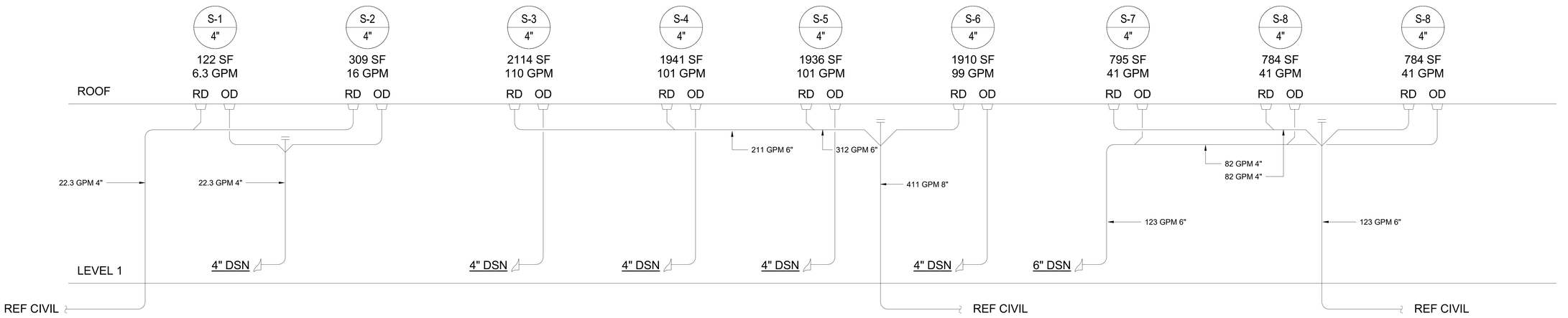
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2 DOMESTIC WATER RISER DIAGRAM
NOT TO SCALE



3 DWV RISER DIAGRAM
NOT TO SCALE



1 STORM RISER DIAGRAM
NOT TO SCALE

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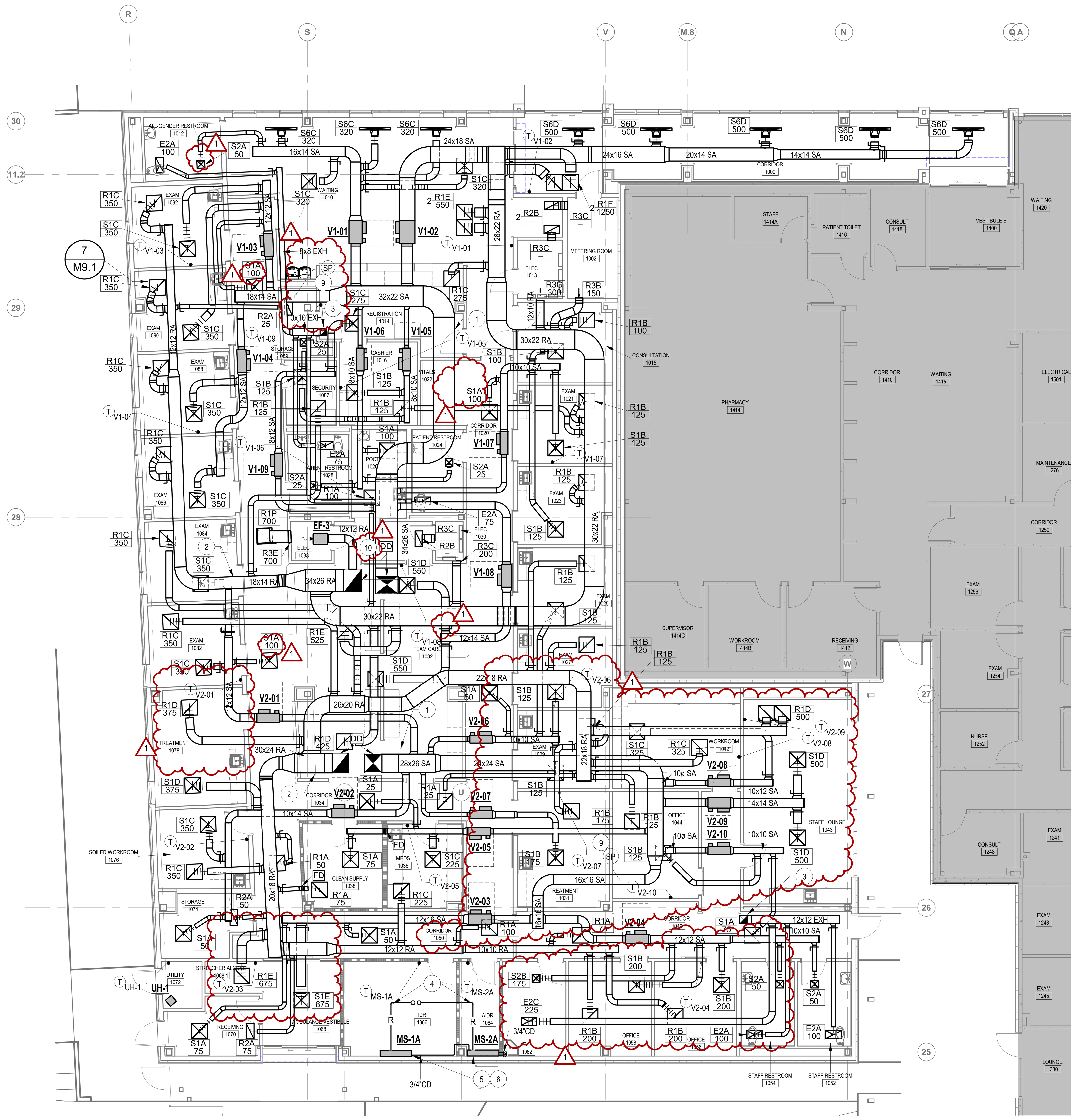
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PLUMBING RISER DIAGRAMS
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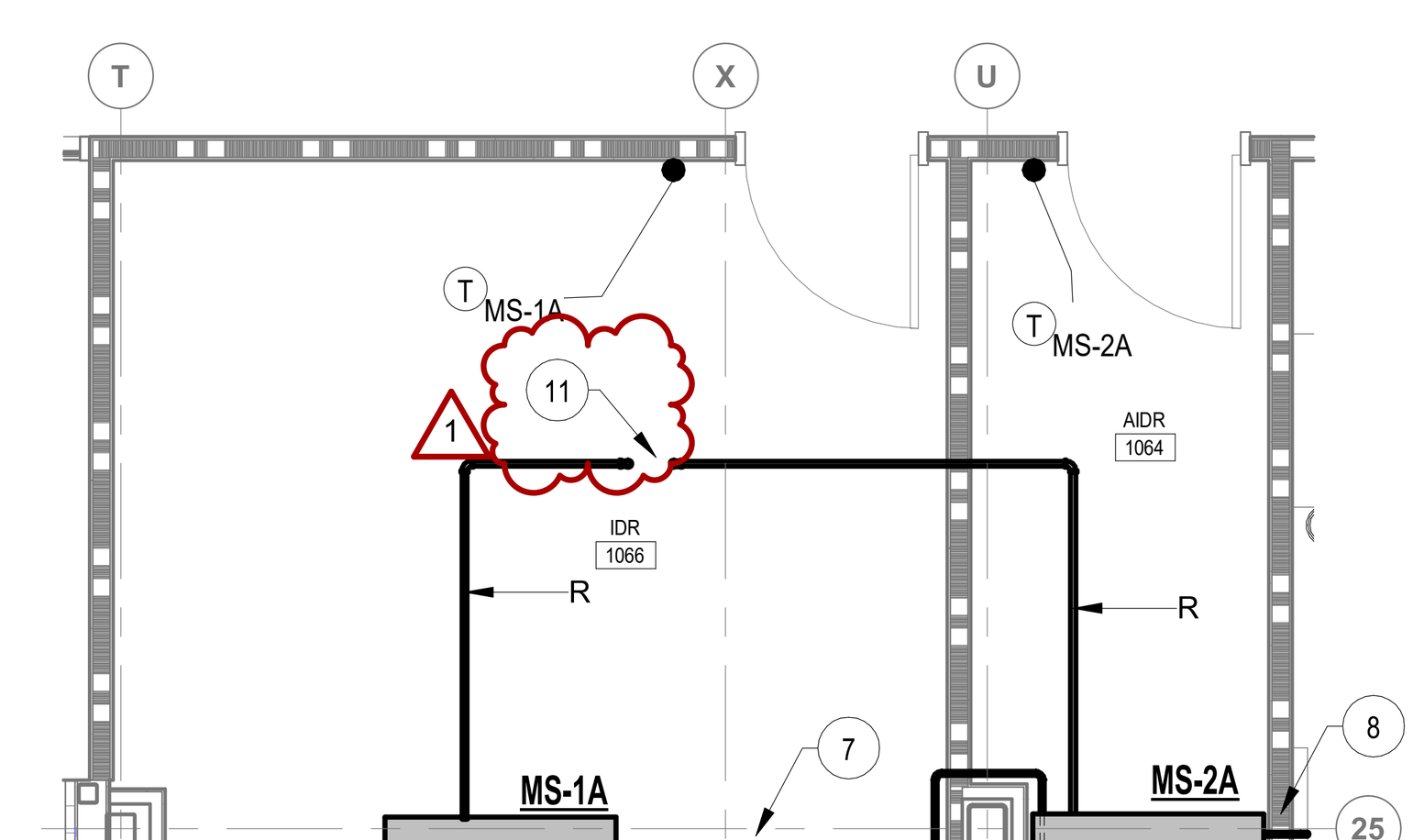
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1 MECHANICAL DUCTWORK PLAN

SCALE: 1/8" = 1'-0"



2 MECHANICAL PIPING ENLARGED PLAN - IDR & AIDR

SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. REFER TO SHEET M1.1 FOR GENERAL MECHANICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. ALL EXISTING DUCTWORK, PIPING SIZES & LOCATIONS ARE TAKEN FROM AVAILABLE RECORD DOCUMENTS & SITE OBSERVATIONS. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION.
3. WHERE WALL SENSORS ARE LOCATED NEAR LIGHT SWITCHES, GROUP ALL BACKBOXES TOGETHER IN ORDERLY FASHION WITH CONSISTENT SPACING BETWEEN. COORDINATE WALL SENSOR LOCATIONS WITH ARCHITECTURAL PLANS TO AVOID CASEWORK, WALL PANELS, ETC. DO NOT INSTALL SENSORS BEHIND DOOR SWINGS.
4. COORDINATE ALL PAINTING REQUIREMENTS FOR EXPOSED ELEMENTS WITH DIV 23 SPECIFICATIONS AND ARCHITECTURAL RCP SHEETS.

KEYNOTE LEGEND

1 MEDIUM PRESSURE GALVANIZED STEEL SUPPLY DUCT WITH 2" (R-8) DUCT WRAP.

2 RETURN DUCT WITH 2" (R-8) DUCT WRAP.

3 DUCT UP TO EXHAUST FAN ON ROOF.

4 ROUTE MINI-SPLIT REFRIGERANT PIPING (INSULATED/JACKETED AS SPECIFIED) TO INDOOR UNIT. COORDINATE ROUTING TO AVOID CONFLICTS WITH OTHER UTILITIES AND TAKE THE MOST DISCRETE ROUTE POSSIBLE.

5 MOUNT MINI-SPLIT AT ~7' 6" A.F.F. TO BOTTOM OF UNIT. COORDINATE TO MOUNT ABOVE ANY LIGHT FIXTURES IN SAME LOCATION. COORDINATE LOCATION OF UNIT TO AVOID CONFLICTS WITH OTHER UTILITIES (ESPECIALLY CABLE TRAY ROUTING OUT OF IT ROOMS).

6 ROUTE MINI-SPLIT CONDENSATE DRAIN PIPING (INSULATED/JACKETED AS SPECIFIED) ALONG WALL AND DOWN TO TERMINATE AT MOP SINK IN ADJACENT EVS ROOM.

7 PUMPED CONDENSATE DRAIN.

8 SLEEVE PIPE PENETRATIONS AT FIRE-RATED WALL AND SEAL WITH FIRE-RATED CAULK.

9 DUCT STATIC PRESSURE SENSOR. RE: CONTROLS, 1/M7.2.

10 ADDRESSABLE DUCT SMOKE DETECTOR IN SUPPLY AND RETURN DUCTS, FURNISHED AND INSTALLED BY DIV. 23. COORDINATE WITH FIRE ALARM CONTRACTOR FOR UNIT SHUTDOWN UPON DETECTION OF SMOKE,

11 PIPING UP THROUGH ROOF HOUSING.

TRUE NORTH

PLAN NORTH

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TRENT S. TOPHAM
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LICENSED PROFESSIONAL ENGINEER

01/15/2026

Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708

Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025

CONTRACT DOCUMENTS

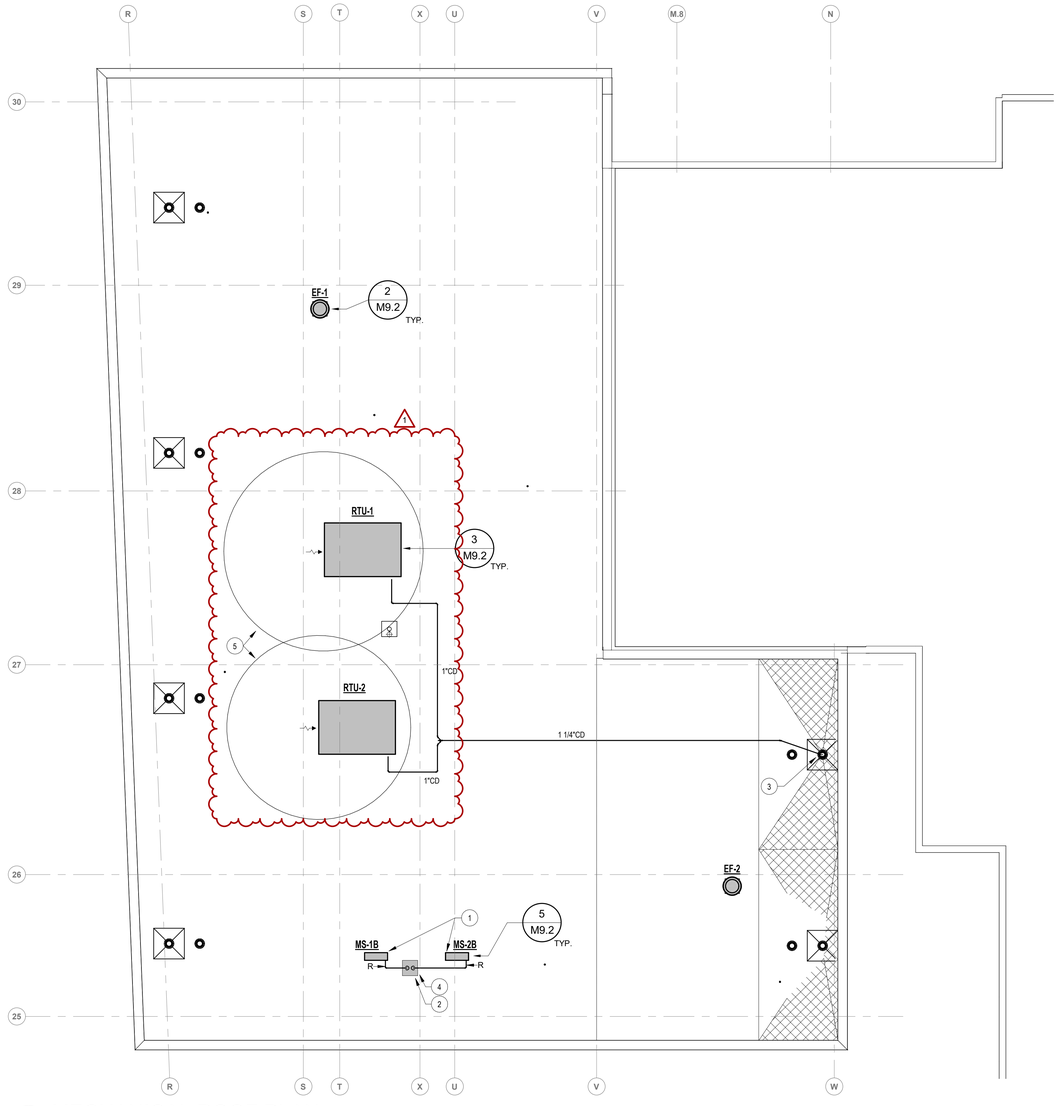
MECHANICAL DUCTWORK PLAN

M3.1

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1 MECHANICAL ROOF PLAN
SCALE: 1/8" = 1'-0"

GENERAL NOTES

1. REFER TO SHEET M1.1 FOR GENERAL MECHANICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. ALL EXISTING DUCTWORK, PIPING SIZES & LOCATIONS ARE TAKEN FROM AVAILABLE RECORD DOCUMENTS & SITE OBSERVATIONS. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION.
3. WHERE WALL SENSORS ARE LOCATED NEAR LIGHT SWITCHES, GROUP ALL BACKBOXES TOGETHER IN ORDERLY FASHION WITH CONSISTENT SPACING BETWEEN. COORDINATE WALL SENSOR LOCATIONS WITH ARCHITECTURAL PLANS TO AVOID CASEWORK, WALL PANELS, ETC. DO NOT INSTALL SENSORS BEHIND DOOR SWINGS.
4. COORDINATE ALL PAINTING REQUIREMENTS FOR EXPOSED ELEMENTS WITH DIV 23 SPECIFICATIONS AND ARCHITECTURAL RCP SHEETS.

KEYNOTE LEGEND

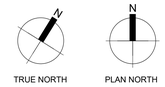
1 INSTALL NEW CONDENSING UNIT ON NEW ROOF CURB RAILS AS SPECIFIED. ROUTE NEW REFRIGERANT PIPING FROM THE CONDENSING UNIT TO THE NEW AIR HANDLING UNIT.

2 INSTALL ROOF PENETRATION HOUSING AS SPECIFIED. PROVIDE RPH VAULT MODEL OR EQUAL. COORDINATE WITH ALL TRADES TO ROUTE ALL UNIT UTILITES THROUGH ROOF PENETRATION HOUSING.

3 ROUTE CONDENSATE DRAIN TO ROOF DRAIN. RE: PLUMBING.

4 ROUTE NEW REFRIGERANT PIPING FROM THE CONDENSING UNIT TO THE NEW AIR HANDLING UNIT. REFER TO PIPE HOUSING DETAIL.

1 5 LOCATE OUTSIDE AIR INTAKE MINIMUM 10'-0" FROM GENERAL EXHAUST DISCHARGE AND PLUMBING VENTS. THE BOTTOM OF THE OUTSIDE AIR INTAKE SHALL BE MINIMUM 3'-0" ABOVE THE ROOF SURFACE.



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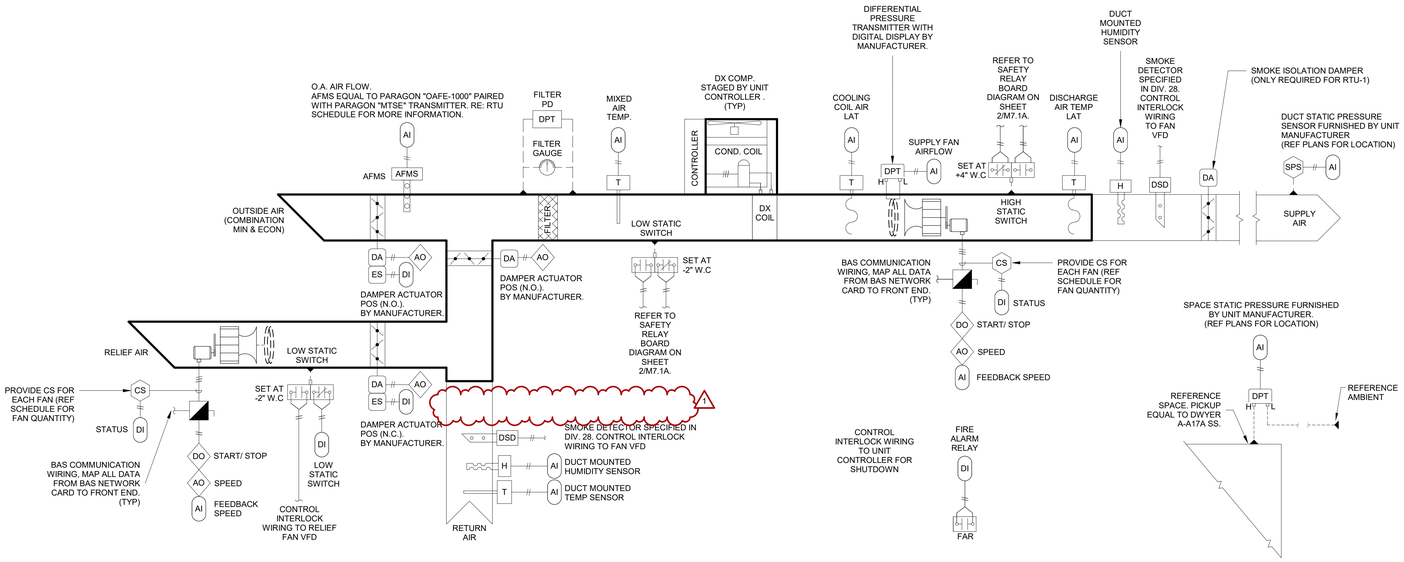
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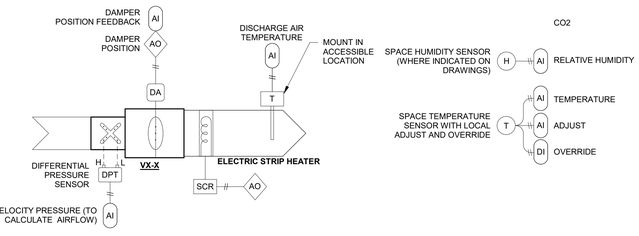
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MECHANICAL ROOF PLAN

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1 DX ROOFTOP UNIT SERVING VAV BOXES CONTROL DIAGRAM & SEQUENCE

GENERAL:

UNIT SHALL BE PROVIDED WITH MANUFACTURER'S UNIT CONTROLLER WITH BACNET MSTP INTERFACE AS SPECIFIED. MANUFACTURER SHALL PROVIDE UNIT WITH ALL SENSORS, DEVICES, ETC. TO PROVIDE UNIT CONTROLS SEQUENCE PER BELOW. CONTRACTOR SHALL COORDINATE TO WRITE ANY NECESSARY POINTS TO UNIT CONTROLLER FROM BMS; REFER TO I/O SUMMARY TABLE.

1. **OCCUPANCY SCHEDULE:**
   - **A.** OCCUPIED AND UNOCCUPIED MODE SHALL BE BASED ON TIME SCHEDULE PROVIDED BY OWNER.
   - **B.** PROVIDE OVERRIDE BUTTON GRAPHIC THAT WHEN SELECTED WHILE THIS UNIT IS IN UNOCCUPIED MODE, BRINGS THE RTU AND ASSOCIATED VAV BOXES BACK TO OCCUPIED MODE. THIS OVERRIDE BUTTON SHALL HAVE A TIME-BASED EXPIRATION TIMER (ADJUSTABLE) THAT WILL RESET THE MODE TO ITS TIME SCHEDULED MODE OF OPERATION AFTER THE DESIGNATED TIME PERIOD.
2. **OUTDOOR AIR AND RETURN AIR DAMPER CONTROL:**
   - **A.** NORMAL MODE: MODULATE EITHER THE OUTDOOR AIR (OA) DAMPER OR RETURN AIR (RA) DAMPER, ONE AT A TIME WHILE THE OTHER STAYS 100% OPEN, TO MEET OA FLOW SETPOINT. THE RA DAMPER WILL TYPICALLY BE 100% OPEN AND THE OA DAMPER WILL MODULATE TO MEET OA FLOW SETPOINT. IF BOTH THE OA DAMPER COMMAND IS 100% AND OA FLOW IS UNDER SETPOINT, KEEP OA DAMPER COMMAND AT 100% AND BEGIN MODULATING RA DAMPER TO CONTROL OA FLOW SETPOINT. IF RA DAMPER COMMAND IS 100% AND OA FLOW IS OVER SETPOINT, KEEP RA DAMPER COMMAND AT 100% AND SWITCH BACK TO MODULATING OA DAMPER TO CONTROL OA FLOW SETPOINT.
3. **OUTDOOR AIR (OA) SETPOINT DETERMINATION (NORMAL MODE):**
   - **A.** MINIMUM OA AIRFLOW SETPOINT - AS SCHEDULED ON PLANS
   - **B.** MINIMUM UNOCCUPIED OA SETPOINT - 500 CFM
4. **ECONOMIZER MODE DETERMINATION:**
   - **A.** IF THE OA TEMPERATURE IS <70F AND THE OA DEW POINT IS <55F, GO INTO THE ECONOMIZER MODE.
   - **B.** ONCE THE ECONOMIZER MODE IS DISABLED, IT SHALL NOT BE RE-ENABLED WITHIN 20 MINUTES AND VICE VERSA.
5. **SUPPLY AIR TEMPERATURE CONTROL:**
   WHEN THE SUPPLY FAN IS PROVEN ON, CONTROL THE ASSOCIATED DX CONDENSING UNIT'S CAPACITY OUTPUT TO MAINTAIN THE SUPPLY AIR TEMPERATURE SET POINT DICTATED BY THE SEQUENCE BELOW.
   - **A.** SUPPLY AIR TEMPERATURE RESET: THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET USING TRIM & RESPOND LOGIC (REFER TO SEPARATE TRIM & RESPOND LOGIC SEQUENCE ON THIS SHEET), WITH PARAMETERS PER BELOW (TO BE ADJUSTED AND CONFIRMED DURING TAB/COMMISSIONING) -

SP/0	-	56°F
SP/MIN	-	52°F
SP/MAX	-	60°F
T/D	-	10 MINUTES
T	-	15 MINUTES
I	-	2
R	-	COOLING SUPPLY AIR TEMPERATURE RESET WEIGHTED REQUESTS
SP/TRIM	-	+0.5°F
SP/RES	-	-1.0°F

6. **DEHUMIDIFICATION:** IF HUMIDITY SENSORS (LOCATED ON PLANS) MEASURE RELATIVE HUMIDITY GREATER THAN 59% THE SUPPLY AIR TEMPERATURE SHALL BE RESET TO 52°F UNTIL RELATIVE HUMIDITY IS BELOW 50%.
7. **SUPPLY AIR FAN SPEED:** SUPPLY FAN SPEED IS CONTROLLED TO MAINTAIN DUCT STATIC PRESSURE AT SETPOINT WHEN THE FAN IS PROVEN ON. LOOP OUTPUT SHALL BE MAPPED TO THE VFD SPEED FROM THE MINIMUM VFD SPEED TO 100% SPEED.
8. **STATIC PRESSURE SETPOINT RESET:** STATIC PRESSURE SETPOINT SHALL BE RESET USING TRIM & RESPOND LOGIC (REFER TO SEPARATE TRIM & RESPOND LOGIC SEQUENCE ON THIS SHEET), WITH PARAMETERS PER BELOW (TO BE ADJUSTED AND CONFIRMED DURING TAB/COMMISSIONING) -

SP/0	-	0.50 IN. W.G.
SP/MIN	-	0.10 IN. W.G.
SP/MAX	-	PER TAB REPORT
T/D	-	10 MINUTES
T	-	5 MINUTES
I	-	2
R	-	STATIC PRESSURE RESET WEIGHTED REQUESTS
SP/TRIM	-	-0.05 IN. W.G.
SP/RES	-	+0.10 IN. W.G.

9. **RELIEF AIR FAN:** THE RELIEF AIR DAMPER SHALL OPEN AND THE RELIEF AIR FAN SHALL BE ENERGIZED WHEN THE ASSOCIATED SUPPLY FANS ARE PROVEN ON AND THE SPACE STATIC PRESSURE SENSOR READS GREATER THAN 0.10 IN. W.G. FOR A PERIOD OF 3 MINUTES (ADJ). THE FAN SPEED SHALL BE MODULATED TO MAINTAIN THE SPACE PRESSURE SETPOINT OF 0.05 IN. W.G. POSITIVE (ADJ). INITIAL VALUE TO BE CONFIRMED BY TAB). FAN SHALL BE DE-ENERGIZED WHEN FAN IS AT MINIMUM SPEED AND SPACE STATIC PRESSURE SENSOR READS LESS THAN 0.05 IN. W.G. FOR A PERIOD OF 3 MINUTES (ADJ).
   RELIEF FAN SHALL MODULATE TO MAINTAIN RELIEF AIRFLOW SETPOINT BASED ON THE FOLLOWING FORMULA:RELIEF AIR FLOW SETPOINT = OAF - EAF - OFFSET. OFFSET SHALL BE DETERMINED BY TAB TO ACHIEVE 0.05 IN. W.G.
10. **ALARMS**:
    LEVEL 2 ALARM: ANY FAN FAILURE (SUPPLY/RELIEF), FAULT DETECTION, LOW MIXED AIR TEMP, HIGH/LOW SUPPLY TEMP, HIGH/LOW SUPPLY STATIC, HIGH/LOW SPACE STATIC, EPO, FILTER, CUTOUTS, OR FREEZE PROTECTION SEQUENCE ACTIVATED.
    LEVEL 3 ALARM: SPACE RELATIVE HUMIDITY SETPOINT NOT MET FOR 60 MIN (ADJ.).
    LEVEL 3 ALARM: BAS INTERFACE ALARM ON UNITARY CONTROLLER.
    LEVEL 3 ALARM: IF DAMPER END SWITCH DOES NOT MATCH POSITION.
    LEVEL 4 ALARM: THE SUPPLY FAN IS COMMANDED OFF BUT THE STATUS IS ON SHOWING "RTU-X REMOTE OVERRIDE".
    LEVEL 4 ALARM: IF OUTSIDE AIR DAMPER, RELIEF AIR DAMPER, OR RETURN AIR DAMPER COMMAND DOES NOT MATCH POSITION.

2 TRIM & RESPOND RESET SEQUENCE OF OPERATION

1. A "REQUEST" IS A CALL TO RESET A STATIC PRESSURE, DIFFERENTIAL PRESSURE, OR TEMPERATURE SETPOINT, GENERATED BY DOWNSTREAM VAV TERMINAL BOXES. THESE REQUESTS ARE SENT UPSTREAM TO THE RTU THAT SERVES THE VAV TERMINAL BOXES WHICH GENERATED THE REQUESTS.
2. FOR EACH TYPE OF TRIM & RESPONSE SETPOINT RESET, PROVIDE THE FOLLOWING SOFTWARE POINTS:
   - **A.** REQUEST.
   - **B.** IMPORTANCE MULTIPLIER (DEFAULT = 1).
     1) FOR EXAMPLE, CRITICAL ZONES (IE SERVER ROOMS, TELECOM ROOMS, IDF ROOMS, LABS) SHOULD HAVE AN IMPORTANCE MULTIPLIER OF 3, WHILE A HALLWAY OR STORAGE CLOSET MIGHT HAVE AN IMPORTANCE MULTIPLIER OF 0.
     2) THE IMPORTANCE MULTIPLIER SHOULD BE A USER ADJUSTABLE POINT.
   - **C.** WEIGHTED REQUEST. MULTIPLY THE NUMBER OF REQUESTS DETERMINED FROM THE VAV TERMINAL BOX REQUEST LOGIC BY THE IMPORTANCE MULTIPLIER TO GET THE WEIGHTED REQUEST
   - **D.** REQUEST-HOUR. EVERY 15 MINUTES, ADD 15/60 TIMES THE CURRENT NUMBER OF REQUESTS TO THIS REQUEST-HOURS ACCUMULATOR POINT.
     1) CREATE REQUEST-HOUR REPORTS THAT LIST EACH VAV TERMINAL BOX, ITS ASSOCIATED REQUEST, IMPORTANCE MULTIPLIER, WEIGHTED REQUEST, REQUEST-HOUR, AND ASSOCIATED POINTS THAT GENERATED THE REQUEST. THE REPORT SHOULD HAVE THE CAPABILITY OF SORTING BY LARGEST TO SMALLEST REQUEST-HOUR, AND EACH VAV TERMINAL BOX SHOULD BE HYPERLINKED TO ITS ASSOCIATED GRAPHIC.
     2) PROVIDE MEANS TO RESET THE REQUEST-HOUR POINT TO ZERO ON BOTH AN INDIVIDUAL AND A GLOBAL COMMAND.
3. SEND THE WEIGHTED REQUEST SUMMED TOGETHER FROM EACH VAV TERMINAL BOX TO THE RTU THAT SERVES THE VAV TERMINAL BOXES GENERATING THE REQUESTS EVERY 5 MINUTES (ADJUSTABLE). DISPLAY THE WEIGHTED REQUEST FOR EACH RESET TYPE ON THE ASSOCIATED RTU GRAPHIC.
4. FOR EACH RTU SETPOINT BEING CONTROLLED BY A TRIM & RESPONSE LOOP, DEFINE THE FOLLOWING VARIABLES. ALL VARIABLES BELOW SHALL BE ADJUSTABLE FROM A RESET GRAPHIC ACCESSIBLE FROM A HYPERLINK ON THE ASSOCIATED RTU GRAPHIC. VALUES FOR TRIM, RESPOND, TIME STEP, ETC., SHALL BE TUNED TO PROVIDE STABLE CONTROL.

VARIABLE		DEFINITION
SP/0	-	INITIAL SETPOINT
SP/MIN	-	MINIMUM SETPOINT
SP/MAX	-	MAXIMUM SETPOINT
T/D	-	DELAY TIMER
T	-	TIME STEP
I	-	NUMBER OF 'WEIGHTED REQUESTS' TO IGNORE
R	-	NUMBER OF 'WEIGHTED REQUESTS' GENERATED FROM VAV TERMINAL BOXES
SP/TRIM	-	TRIM AMOUNT
SP/RES	-	RESPOND AMOUNT (MUST BE THE OPPOSITE IN SIGN TO SP/TRIM)

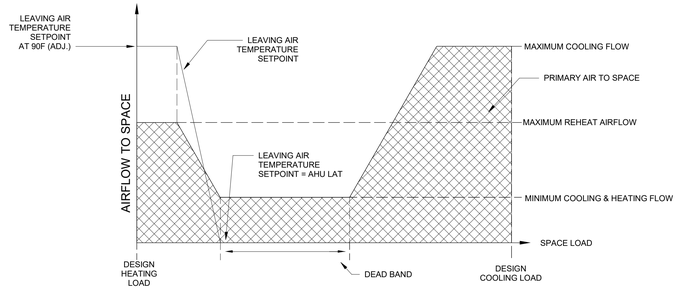
5. TRIM & RESPOND LOGIC SHALL RESET A SETPOINT WITHIN THE RANGE SP/MIN TO SP/MAX. WHEN THE ASSOCIATED DEVICE (E.G., FAN, PUMP) IS OFF, THE SETPOINT SHALL BE SP/0. THE RESET LOGIC SHALL BE ACTIVE WHILE THE ASSOCIATED DEVICE IS PROVEN ON, STARTING TD AFTER INITIAL DEVICE START COMMAND. WHEN ACTIVE, EVERY TIME STEP T, TRIM THE SETPOINT BY SPTRIM. IF THERE ARE MORE THAN I REQUESTS, RESPOND BY CHANGING THE SETPOINT BY SP/RES. IN OTHER WORDS, EVERY TIME STEP T:

   IF R<=I, NEW SETPOINT = CURRENT SETPOINT + SP/TRIM
   IF R>I, NEW SETPOINT = CURRENT SETPOINT + SP/RES

BAS INPUT/OUTPUT SUMMARY

SYSTEM/EQUIPMENT	DIGITAL INPUT (DI)	ANALOG INPUT (AI)	DIGITAL OUTPUT (DO)	ANALOG OUTPUT (AO)	DDC COMM CARD (R/W)	ALARM	NOTES
RTU-1, RTU-2							1, 2
SUPPLY FAN START/STOP			X				
SUPPLY FAN STATUS (EACH FAN TYP)	X					X	
SUPPLY FAN SPEED				X			
SUPPLY FAN FEEDBACK SPEED		X					
SUPPLY FAN VELOCITY PRESSURE (DTP)		X					
SUPPLY DUCT STATIC PRESSURE		X					
SUPPLY SMOKE DUCT DETECTOR	X						
RELIEF FAN START/STOP			X				
RELIEF FAN STATUS (EACH FAN TYP)	X					X	
RELIEF FAN SPEED				X			
RELIEF FAN FEEDBACK SPEED		X					
RELIEF FAN LOW STATIC PRESSURE SWITCH	X						
RELIEF DAMPER POSITION				X			
DISCHARGE AIR TEMP (LAT)		X					
DISCHARGE HUMIDITY		X					
COOLING COIL TEMP (LAT)		X					
MIXED AIR TEMP		X					
OUTSIDE/ECON DAMPER POS. & END SWITCH	X			X			
RETURN AIR DAMPER POSITION				X			
RETURN AIR TEMP		X					
RETURN AIR HUMIDITY		X					
SUPPLY AIR AIRFLOW					R		
RETURN AIR AIRFLOW					R		
UNIT STATE/ STATUS					R		
DEHUMIDIFICATION STATUS					R		
HEATING STATUS					R		
ECONOMIZER STATUS					R		
COOLING CAPACITY					R		
HEATING CAPACITY					R		
ECONOMIZER CAPACITY (0-100%)					R		
EMERGENCY OVERRIDE (ON/OFF)					W		
OCCUPANCY STATUS					R/W		
DUCT STATIC PRESSURE					R		
DUCT STATIC PRESSURE SETPOINT					W		
COOLING COIL LAT SETPOINT					W		
UNIT DISCHARGE TEMP. SETPOINT					W		
OUTSIDE AIRFLOW SETPOINT					W		
SPACE RELATIVE HUMIDITY					W		
SPACE RELATIVE HUMIDITY SETPOINT					W		
OUTDOOR AIR TEMPERATURE					W		
SPACE TEMPERATURE					W		
OUTSIDE AIR TEMPERATURE		X					3
OUTSIDE AIR RELATIVE HUMIDITY		X					3
FIRE ALARM RELAY	X						

NOTES:
1. DDC COMM CARD POINTS ARE MARKED "R" FOR READ AND "W" FOR WRITE FROM PERSPECTIVE OF BMS.
2. ALL ALARM POINTS FROM UNIT CONTROLLER SHALL BE PULLED THROUGH BACNET INTERFACE.
3. PROVIDE ONE COMMON SENSOR FOR BMS ON NORTH-FACING WALL ON NEW ADDITION.



3 VAV TERMINAL UNIT CONTROL SEQUENCE - SINGLE DUCT WITH REHEAT (ASHRAE GUIDELINE 36-2018)

SEQUENCE OF OPERATION

SPACE TEMPERATURE SENSOR:
THE SPACE TEMPERATURE SENSOR SHALL ALLOW OCCUPANT ADJUSTMENT OF THE SPACE TEMPERATURE SET POINT. THE OCCUPANT-SELECTED SPACE TEMPERATURE SET POINT SHALL BE ADJUSTABLE FROM 70°F TO 75°F. THE EFFECTIVE COOLING SET POINT SHALL BE THE OCCUPANT-SELECTED SET POINT +2.5°F (ADJ), AND THE EFFECTIVE HEATING SET POINT SHALL BE -2.5°F (ADJ) BELOW THE OCCUPANT-SELECTED SET POINT.

SPACE TEMPERATURE CONTROL:
THE TERMINAL UNIT CONTROLLER SHALL MODULATE THE DAMPER FROM THE SCHEDULED MAXIMUM PRIMARY FLOW RATE TO THE SCHEDULED MINIMUM PRIMARY FLOW RATE TO MAINTAIN THE SPACE TEMPERATURE AT THE EFFECTIVE COOLING SET POINT.

WHEN THE SPACE TEMPERATURE FALLS BELOW THE EFFECTIVE HEATING SET POINT, THE DAMPER SHALL BE MODULATED FROM MINIMUM TO HEATING MAXIMUM AND THE DISCHARGE AIR TEMPERATURE SETPOINT SHALL BE RESET UP TO THE DAT HEATING MAXIMUM, IN UNISON, TO MAINTAIN THE SPACE TEMPERATURE AT THE EFFECTIVE HEATING SETPOINT. THE ELECTRIC HEAT SCR CONTROLLER SHALL BE MODULATED TO MEET THE LEAVING AIR SETPOINT.

OCCUPIED / UNOCCUPIED MODE:
ZONE OCCUPANCY MODE SHALL BE DETERMINED BY THE OWNER DEFINED SCHEDULE. WHEN THE ZONE IS IN UNOCCUPIED MODE, THE TERMINAL UNIT SHALL ALLOW THE SPACE TEMPERATURE SETPOINT BE SETUP OR SETBACK TO THE UNOCCUPIED SETPOINTS OF 85°F (COOLING) AND 55°F (HEATING). IF ANY VAV ZONE FALLS OUTSIDE THE SETUP SETBACK SETPOINTS THEN THE VAV BOX SHALL SEND A SIGNAL TO TEMPORARILY OCCUPY THE ASSOCIATED AHU UNTIL THE SPACE TEMPERATURE CAN BE SATISFIED. IF A ZONE IS IN NIGHT SETBACK OR NIGHT SETUP MODE, ALL ASSOCIATED ZONES FOR THE AIR HANDLER SHALL ENABLE THE SAME MODE.

AN OCCUPANCY OVERRIDE SHALL BE PROVIDED AT THE SPACE SENSOR.

SCHEDULES:
OCCUPANCY SCHEDULES SHALL BE ADJUSTABLE FROM THE OPERATOR'S WORKSTATION. OCCUPANCY SCHEDULES SHALL PROVIDE A MINIMUM OF FOUR EVENTS EACH DAY. SCHEDULES MUST HAVE A MINIMUM OF 3 WEEKLY TYPE AND 8 TEMPORARY SCHEDULES. THE CONTROLS CONTRACTOR SHALL COORDINATE WITH THE OWNER TO INITIALLY PROGRAM THE OCCUPANCY SCHEDULE FOR EACH ZONE.

OCCUPANCY SCHEDULE GROUPS SHALL BE CREATED TO FACILITATE SCHEDULING CHANGES. THE CONTROLS CONTRACTOR SHALL COORDINATE WITH THE OWNER TO ASSIGN ZONES TO THE RELEVANT SCHEDULING GROUP. INITIALLY EACH ZONE MAP AREA (E.G. 'AREA A') SHALL BE CONSIDERED A GROUP. THE CONTROLS CONTRACTOR SHALL PROVIDE SCHEDULE EDITING TRAINING TO THE OWNER.

ADJUSTMENTS
ALL SET POINTS AND OUTPUTS SHALL BE ADJUSTABLE THROUGH THE BMS WORKSTATION.

ZONE GROUPS
TERMINAL UNITS SHALL BE GROUPED INTO ZONE GROUPS BASED ON BUILDING AREA AND/OR FLOOR (TO BE CONFIRMED BY OWNER). EACH ZONE GROUP SHALL HAVE INDEPENDENT SCHEDULES.

ALARMS
LEVEL 2 ALARM - IF ANY SPACE TEMPERATURE IS ABOVE THE COOLING SETPOINT OR BELOW THE HEATING SETPOINT BY MORE THAN 5 DEGREES FOR 5 MINUTES.

1 VAV CONTROL SERVING A VESTIBULE:
- COOLING SETPOINT SHALL BE SET TO 85 DEGREES FAHRENHEIT MINIMUM.
- HEATING SETPOINT SHALL BE SET TO 60 DEGREES FAHRENHEIT MAXIMUM.
- WHEN THE OUTDOOR AIR TEMPERATURE IS GREATER THAN 45 DEGREES FAHRENHEIT THE HEATING SHALL BE DISABLED.

BAS INPUT/OUTPUT SUMMARY

SYSTEM/EQUIPMENT	DIGITAL INPUT (DI)	ANALOG INPUT (AI)	DIGITAL OUTPUT (DO)	ANALOG OUTPUT (AO)	CALC-ULATED	DDC COMM CARD	NOTES
TYPICAL VAV BOX							1
VELOCITY PRESSURE (FROM DPT)		X					
AIRFLOW					X		
DAMPER POSITION & FEEDBACK		X		X			
ELECTRIC HEAT SCR CONTROL				X			
SPACE TEMPERATURE		X					
ADJUST		X					
OVERRIDE	X						
DISCHARGE AIR TEMPERATURE		X					

NOTES:
1. ALL POINTS SHALL BE WRITABLE FROM THE BMS WORKSTATION.

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COOLING ONLY MINI-SPLIT SYSTEM SCHEDULE

MARK (INDOOR UNIT / CONDENSING UNIT)	MS-1A / MS-1B	MS-2A / MS-2B
AREA SERVED	IDR	AIDR
INDOOR EVAPORATOR UNIT		
UNIT TYPE	DUCTLESS WALL MOUNT	DUCTLESS WALL MOUNT
EA DB/WB °F	80.0 / 67.0	80.0 / 67.0
NET TOTAL CAP BTUH	24,000	12,000
NET SENS. CAP. BTUH		
TOTAL CFM	800	400
TOTAL ESP IN. WG	-	-
V / PH / CYC	FED FROM OUTDOOR UNIT	FED FROM OUTDOOR UNIT
WEIGHT LBS.	70	70
OUTDOOR CONDENSING UNIT		
AMBIENT TEMP. °F	95	95
GROSS TOTAL CAP BTUH	24,000	12,000
V / PH / CYC	208 / 1 / 60	208 / 1 / 60
MCA / MOCP	23.0 / 37.0	12.5 / 28.0
WEIGHT LBS.	160	160
SYSTEM		
REFRIGERANT TYPE	R-454B	R-454B
ENERGY EFFICIENCY (SEER2)	20.1	20.1
MODEL FAN COIL UNIT / CONDENSING UNIT	PEAD-A24AA8 / PUY-A24NHA7	PEAD-A12AA8 / PUY-A12NHA7
MANUFACTURER	MITSUBISHI	MITSUBISHI
NOTES	ALL	ALL

NOTES:
1. PROVIDE WITH LOW AMBIENT HEAD PRESSURE CONTROL FOR UNIT OPERATION DOWN TO 20 DEGREES F.
2. PROVIDE ROOF MOUNTED CONDENSER ROOF CURB AS SPECIFIED AND SHOWN IN DETAILS.
3. PROVIDE WITH HARD WIRED CONTROLLER, REMOTE CONTROLLER IS NOT ACCEPTABLE.
4. INDOOR UNIT POWERED THROUGH CONDENSING UNIT.
5. FURNISH LITTLE GIANT EC-1-DV (OR EQUIVALENT) CONDENSATE PUMP RATED FOR 1.8 GPH @ 5' OF HEAD.
6. ELECTRICAL CONTRACTOR TO FURNISH AND INSTALL DISCONNECT. REFERENCE ELECTRICAL PLANS.
7. PROVIDE HAIL GUARDS.
8. PROVIDE WITH FACTORY INSTALLED LEAK DETECTION SYSTEM PER UL 60335-2-40 WITH BACNET POINTS.

AIR DEVICE SCHEDULE

REFER TO SHEET M1.1 FOR DIAGRAM INDICATING AIR DEVICE TAG DESCRIPTION.

NOTE: FOR ALL AIR DEVICES INSTALLED IN GYPSUM CEILINGS, PROVIDE PLASTER FRAME.

MARK	NECK SIZE	FACE SIZE	DESCRIPTION	MODEL	REMARKS
S1A	6"Φ	24"x24"	CEILING SUPPLY DIFFUSER	PRICE 'ASCD'	3 CONE SUPPLY DIFFUSER; ALUMINUM CONSTRUCTION; WHITE FINISH; FRAME FOR LAY-IN CEILING; PROVIDE FACTORY INSTALLED, R-6, FOIL-BACKED INSULATION BLANKET.
S1B	8"Φ	24"x24"			
S1C	10"Φ	24"x24"			
S1D	12"Φ	24"x24"			
S1E	14"Φ	24"x24"			
S2A	6"Φ	12"x12"	CEILING SUPPLY DIFFUSER	PRICE 'ASCD'	3 CONE SUPPLY DIFFUSER; ALUMINUM CONSTRUCTION; WHITE FINISH; FRAME FOR LAY-IN CEILING; PROVIDE FACTORY INSTALLED, R-6, FOIL-BACKED INSULATION BLANKET.
S2B	8"Φ	12"x12"			
S3A	6"Φ	24"x24"	CEILING SUPPLY DIFFUSER	PRICE 'ASPD'	SQUARE PLAQUE-FACED SUPPLY DIFFUSER; ALUMINUM CONSTRUCTION; WHITE FINISH; FRAME FOR LAY-IN CEILING; PROVIDE FACTORY INSTALLED, R-6, FOIL-BACKED INSULATION BLANKET.
S3B	8"Φ	24"x24"			
S3C	10"Φ	24"x24"			
S3D	12"Φ	24"x24"			
S3E	14"Φ	24"x24"			
S4A	8" x 6"	8" x 6"	SIDEWALL SUPPLY GRILLE	PRICE '620'	DOUBLE DEFLECTION; 3/4" BLADE SPACING; ALUMINUM CONSTRUCTION; BORDER TYPE 'F', WITH CONCEALED MOUNTING
S4B	12" x 6"	12" x 6"			
S4C	12" x 8"	12" x 8"			
S6A	6"Φ	48"L	CEILING SUPPLY SLOT DIFFUSER	PRICE 'SDS75'	3/4" SLOT WIDTH; 2 SLOTS; PROVIDE WITH INSULATED PLENUM EQUAL TO PRICE MODEL 'SDB' TYPE 14 WITH FIBER FREE FOAM INSULATION; CONCEALED SURFACE MOUNT WITH TYPE 2 BORDER; COLOR AND FINISH TO BE CHOSEN BY ARCHITECT.
S6B	8"Φ	48"L			
S6C	10"Φ	48"L			
R1A	6"Φ	24"x24"	CEILING RETURN GRILLE	PRICE '80'	1/2"x 1/2"x1/2" ALUMINUM CORE; FRAME FOR LAY-IN CEILING; PROVIDE NARROW FRAME OPTION; PROVIDE ROUND DUCT ADAPTER FOR ALL DEVICES OF THIS TYPE EXCEPT 'R1P.' FOR ALL TYPE 'R1P' DEVICES, PROVIDE PLENUM RETURN GRILLE COVER EQUAL TO PRICE MODEL 'RAC' TO BLOCK LIGHT AND SOUND.
R1B	8"Φ	24"x24"			
R1C	10"Φ	24"x24"			
R1D	12"Φ	24"x24"			
R1E	14"Φ	24"x24"			
R1F	16"Φ	24"x24"			
R2A	6"Φ	12"x24"	CEILING RETURN GRILLE	PRICE '80'	1/2"x 1/2"x1/2" ALUMINUM CORE; FRAME FOR LAY-IN CEILING; PROVIDE NARROW FRAME OPTION; PROVIDE ROUND DUCT ADAPTER FOR ALL DEVICES OF THIS TYPE EXCEPT 'R2P.' FOR ALL TYPE 'R2P' DEVICES, PROVIDE PLENUM RETURN GRILLE COVER EQUAL TO PRICE MODEL 'RAC' TO BLOCK LIGHT AND SOUND.
R2B	8"Φ	12"x24"			
R2C	10"Φ	12"x24"			
R3A	8" x 6"	8" x 6"	SIDEWALL RETURN GRILLE	PRICE '635'	45° DEFLECTION; 1/2" BLADE SPACING WITH HORIZONTAL BLADES; ALUMINUM CONSTRUCTION; SURFACE MOUNTING; BORDER TYPE 'F', WITH COUNTERSUNK SCREW MOUNTING; WHITE FINISH;
R3B	12" x 6"	12" x 6"			
R3C	12" x 10"	12" x 10"			
R3D	12" x 12"	12" x 12"			
R3E	18" x 12"	18" x 12"			
R5A	6"Φ	48"L	CEILING RETURN SLOT DIFFUSER	PRICE 'SDR75'	3/4" SLOT WIDTH; 2 SLOTS; PROVIDE WITH INSULATED PLENUM EQUAL TO PRICE MODEL 'SDB' TYPE 14 WITH FIBER FREE FOAM INSULATION; CONCEALED SURFACE MOUNT WITH TYPE 2 BORDER; COLOR AND FINISH TO BE CHOSEN BY ARCHITECT.
R5B	8"Φ	48"L			
R5C	10"Φ	48"L			
E1A	6"Φ	24"x24"	CEILING EXHAUST GRILLE	PRICE '80'	1/2"x 1/2"x1/2" ALUMINUM CORE; FRAME FOR LAY-IN CEILING; PROVIDE NARROW FRAME OPTION; PROVIDE ROUND DUCT ADAPTER.
E1B	8"Φ	24"x24"			
E1C	10"Φ	24"x24"			
E1D	12"Φ	24"x24"			
E2A	6"Φ	12"x24"	CEILING EXHAUST GRILLE	PRICE '80'	1/2"x 1/2"x1/2" ALUMINUM CORE; FRAME FOR LAY-IN CEILING; PROVIDE NARROW FRAME OPTION; PROVIDE ROUND DUCT ADAPTER.
E2B	8"Φ	12"x24"			
E2C	10"Φ	12"x24"			
E3A	8" x 6"	8" x 6"	SIDEWALL EXHAUST GRILLE	PRICE '635'	45° DEFLECTION; 1/2" BLADE SPACING WITH HORIZONTAL BLADES; ALUMINUM CONSTRUCTION; SURFACE MOUNTING; BORDER TYPE 'F', WITH COUNTERSUNK SCREW MOUNTING; WHITE FINISH;
E3B	12" x 6"	12" x 6"			
E3C	12" x 10"	12" x 10"			

ROOFTOP A/C UNIT SCHEDULE

MARK		RTU-1	RTU-2
TYPE		Multi-Zone VAV	Multi-Zone VAV
TONNAGE		20 TON	15 TON
TOTAL MIN./MAX CFM		7,750	6,550
O.A. MIN./MAX. CFM		900	860
DX COIL	MIN. TOTAL NET CAP. MBH	198.3	156.0
	MIN. SENS.NET CAP. MBH	173.9	125.1
	E.A.T. (DB/WB °F)	78.0 / 64.3	79.4 / 65.2
	L.A.T. (DB/WB °F)	54.7 / 53.54	54.27 / 53.87
	STAGES	Modulating	Modulating
COMP.	NO. OF COMPRESSORS	2	1
	R.L.A. EACH	26.0 / 15.5	26.9
	V / PH / HZ	480 / 3 / 60	480 / 3 / 60
CONDENSER	NO. OF FANS	2	2
	FAN HP EACH	1	1
	AMB. AIR TEMP. (DB °F)	105	105
	V / PH / HZ	480 / 3 / 60	480 / 3 / 60
	F.L.A.	1.3	2.3
EVAP. FAN	DRIVE	Direct	Direct
	NO. OF FANS	2	2
	E.S.P. (IN. W.C.)	2"	2"
	MOTOR HP	6	6
	OPERATING BHP	4.267	3.042
	V / PH / HZ	480 / 3 / 60	480 / 3 / 60
	F.L.A.	4.6	4.6
RETURN FAN	DRIVE	Direct	Direct
	E.S.P. (IN. W.C.)	0.5"	0.5"
	MOTOR HP		
	OPERATING BHP		
	V / PH / HZ	480 / 3 / 60	480 / 3 / 60
	F.L.A.		
ELEC. DATA	V / PH / HZ	480 / 3 / 60	480 / 3 / 60
	M.C.A.	64	51
	M.O.C.P.	80	70
UNIT DATA	REFRIGERANT	R-454B	R-454B
	REFRIGERANT CHARGE (LBS.)	15.4	12.8
	MIN. IEER	16.0	16.0
	FILTERS (PRE / FINAL)	2" MERV 8 / 13	MERV 8 / 13
	UNIT WEIGHT (LBS.)	2700	2600
	MODEL NO.	TZK240A4S00	TZK180A4S00
	MANUFACTURER	TRANE	TRANE
	NOTES	ALL	ALL

NOTES:
1. EFFICIENCIES ARE AT A.H.R.I. CONDITIONS.
2. PROVIDE WITH 24" HIGH ROOF CURB (SLOPED TO MATCH ROOF).
3. PROVIDE WITH WEATHERPROOF OA INTAKE HOOD WITH AN OA MOTORIZED DAMPER.
4. PROVIDE WITH HAIL GUARDS.
5. PROVIDE WITH HINGED ACCESS PANELS.
6. PROVIDE WITH LOW AMBIENT CONTROL.
7. PROVIDE WITH INTEGRAL DISCONNECT.
8. SINGLE POINT POWER CONNECTION.
9. PROVIDE WITH VARIABLE SPEED SUPPLY FAN FOR MULTIZONE CONFIGERATION
10. PROVIDE PARAGON "OAFE-2000" AIRFLOW MEASURING STATION. INSTALL INSIDE UNIT AT OUTSIDE AIR INTAKE BETWEEN THE UNIT WALL AND THE OA DAMPER. PROVIIDE PARAGON MTSE TRANSMITTER. MOUNT INSIDE UNIT CONTROLS COMPARTMENT.
11. PROVIDE WITH FACTORY INSTALLED LEAK DETECTION SYSTEM PER UL 60335-2-40 WITH BACNET POINTS.
12. PROVIDE WITH FACTORY INSTALLED MICROPROCESSOR UNIT CONTROLLER WITH BACNET COMMUNICATION INTERFACE.
13. PROVIDE UNPOWERED CONVENIENCE RECEPTACLE.

FAN SCHEDULE

MARK	EF-1	EF-2	EF-3
FAN TYPE	DOWNBLAST	DOWNBLAST	INLINE
DRIVE TYPE	DIRECT (ECM)	DIRECT (ECM)	DIRECT (ECM)
SERVICE	GENERAL EXH.	GENERAL EXH.	VENTILATION
DESIGN FLOW (CFM)	250	425	700
MAX FLOW (CFM)	300	525	700
MIN. FLOW (CFM)	N/A	N/A	N/A
DESIGN EXT. S.P. (IN WG.)	0.65	0.75	0.25
MAX EXT. S.P. (IN WG.)	0.94	1.14	N/A
DESIGN FAN RPM	1585	1399	1096
MAX FAN RPM	1725	1725	1750
FAN B.H.P.	0.09	0.12	
MOTOR H.P.	1/6	1/4	123 W
FLA	2.8	4.8	3.53
MOCP (A)	15	15	15
INLET SOUND POWER, LW (dBA)	60	56	0.9 SONES
V / PH / CYC	120 / 1 / 60	120 / 1 / 60	120 / 1 / 60
WEIGHT (LBS)	43	54	39
LOCATION	ROOF	ROOF	ELEC ROOM
MOTOR ENCLOSURE TYPE	TEFC	TEFC	
MOTOR CONTROL TYPE	RELAY	RELAY	THERMOSTAT
INTERLOCK	N/A	N/A	N/A
MODEL	G-095-VG	G-099-VG	CSP-A700-VG
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK
NOTES	1-5	1-5	1,2,4-6

NOTES:
1. PROVIDE WITH BACKDRAFT DAMPER AS SPECIFIED.
2. PROVIDE WITH DISCONNECT SWITCH AS SPECIFIED.
3. PROVIDE WITH ROOF CURB AS SPECIFIED.
4. PROVIDE WITH SOLID STATE CONTROLLER FOR MANUAL SPEED ADJUSTMENT COMPATIBLE WITH EC MOTOR.
5. PROVIDE WITH INSULATED HOUSING.
6. THERMOSTAT CONTROL.

VAV TERMINAL SCHEDULE - RTU-1

MARK	PRICE MODEL	UNIT SIZE	MAX COOLING (CFM)	MIN COOLING & HEATING (CFM)	INLET SP (IN.WG)	DOWNSTREAM SP (IN.WG)	MAX DISCHARGE NC	MAX RADIATED NC	REHEAT (CFM)	EAT °F	LAT °F	CAPACITY (KW)	STEPS / CONTROL	POWER V/PH
V1-01	SDV5	14	1600	480	0.75	0.25	--	--	800	55.0	90.0	8.9	SCRV	480-3
V1-02	SDV5	16	2500	750	0.75	0.25	--	--	1250	55.0	90.0	13.8	SCRV	480-3
V1-03	SDV5	10	750	250	0.75	0.25	--	--	375	55.0	90.0	4.2	SCRV	277-1
V1-04	SDV5	10	700	250	0.75	0.25	--	--	350	55.0	90.0	3.9	SCRV	277-1
V1-05	SDV5	6	250	90	0.75	0.25	--	--	125	55.0	90.0	1.4	SCRV	277-1
V1-06	SDV5	6	150	90	0.75	0.25	--	--	75	55.0	90.0	0.8	SCRV	277-1
V1-07	SDV5	8	400	150	0.75	0.25	--	--	200	55.0	90.0	2.2	SCRV	277-1
V1-08	SDV5	12	1100	350	0.75	0.25	--	--	550	55.0	90.0	6.1	SCRV	480-3
V1-09	SDV5	8	300	150	0.75	0.25	--	--	150	55.0	90.0	1.7	SCRV	277-1

NOTES:
1 SELECTIONS BASED UPON PRICE AS BASIS OF DESIGN MANUFACTURER.
2 SOUND POWER LEVELS AND NC'S ARE BASED ON TESTS CONDUCTED IN ACCORDANCE WITH AHRI STANDARD 880-2011. BLANKS (--) INDICATE A SOUND POWER LEVEL OF NC UNDER 20 AS DEFINED BY AHRI 880-2011.
3 ROOM NC LEVELS SHOWN INCLUDE ATTENUATION FACTORS OBTAINED FROM AHRI STANDARD 885-2011 FOR SPECIFIED LINER MATERIAL.
4 PROVIDE STEP-DOWN TRANSFORMER WITH EACH TERMINAL UNIT TO PROVIDE 120V CONTROLS POWER.

VAV TERMINAL SCHEDULE - RTU-2

MARK	PRICE MODEL	UNIT SIZE	MAX COOLING (CFM)	MIN COOLING & HEATING (CFM)	INLET SP (IN.WG)	DOWNSTREAM SP (IN.WG)	MAX DISCHARGE NC	MAX RADIATED NC	REHEAT (CFM)	EAT °F	LAT °F	CAPACITY (KW)	STEPS / CONTROL	POWER V/PH
V2-01	SDV5	10	750	250	0.75	0.25	--	--	375	55.0	90.0	4.2	SCRV	277-1
V2-02	SDV5	10	775	250	0.75	0.25	--	--	390	55.0	90.0	4.3	SCRV	277-1
V2-03	SDV5	12	1000	350	0.75	0.25	--	--	500	55.0	90.0	5.5	SCRV	480-3
V2-04	SDV5	10	675	250	0.75	0.25	--	--	340	55.0	90.0	3.8	SCRV	277-1
V2-05	SDV5	8	325	150	0.75	0.25	--	--	165	55.0	90.0	1.8	SCRV	277-1
V2-06	SDV5	8	425	150	0.75	0.25	--	--	215	55.0	90.0	2.4	SCRV	277-1
V2-07	SDV5	6	175	90	0.75	0.25	--	--	90	55.0	90.0	1.0	SCRV	277-1
V2-08	SDV5	8	325	150	0.75	0.25	--	--	165	55.0	90.0	1.8	SCRV	277-1
V2-09	SDV5	12	1000	350	0.75	0.25	--	--	500	55.0	90.0	5.5	SCRV	480-3
V2-10	SDV5	6	250	90	0.75	0.25	--	--	100	55.0	90.0	1.1	SCRV	277-1

NOTES:
1 SELECTIONS BASED UPON PRICE AS BASIS OF DESIGN MANUFACTURER.
2 SOUND POWER LEVELS AND NC'S ARE BASED ON TESTS CONDUCTED IN ACCORDANCE WITH AHRI STANDARD 880-2011. BLANKS (--) INDICATE A SOUND POWER LEVEL OF NC UNDER 20 AS DEFINED BY AHRI 880-2011.
3 ROOM NC LEVELS SHOWN INCLUDE ATTENUATION FACTORS OBTAINED FROM AHRI STANDARD 885-2011 FOR SPECIFIED LINER MATERIAL.
4 PROVIDE STEP-DOWN TRANSFORMER WITH EACH TERMINAL UNIT TO PROVIDE 120V CONTROLS POWER.

ELECTRIC UNIT HEATER SCHEDULE

MARK	UH-1
AREA SERVED	UTILITY ROOM
TYPE	UNIT HEATER
MOUNTING TYPE	WALL-MOUNT
CAPACITY (BTUH)	17,060
WATTS	3750
V / PH / HZ	208 / 1 / 60
MODEL	EGW
MFR. REF.	REZNOR
NOTES	ALL

NOTES:
1. PROVIDE WALL-MOUNTED THERMOSTAT WHERE SHOWN ON PLANS.

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HARRIS HEALTH
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1620 KEENE STREET, HOUSTON, TX, 77009



01/15/2026
Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708
Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025

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MECHANICAL SCHEDULES

M8.1

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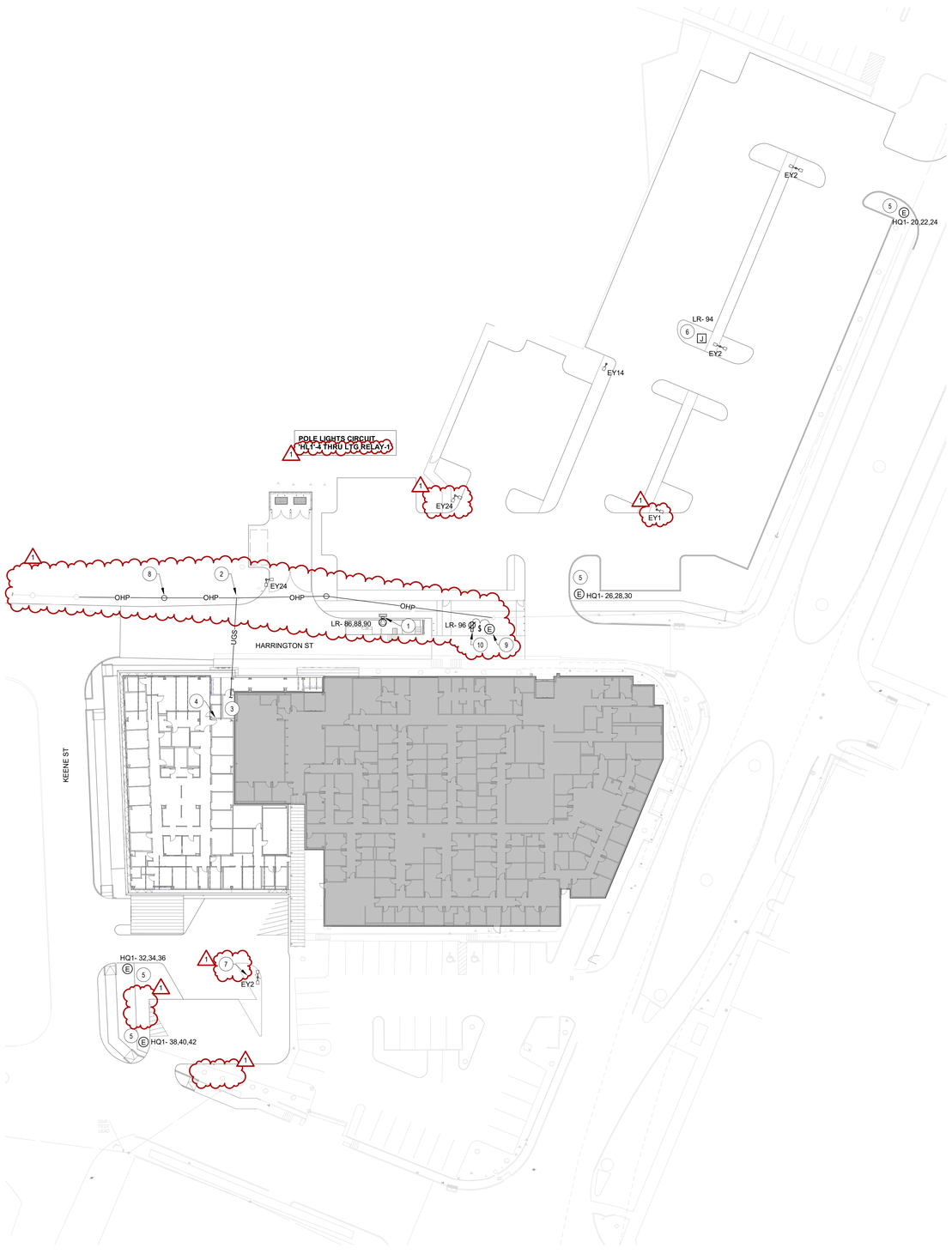
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1 ELECTRICAL SITE PLAN
SCALE: 1" = 30'-0"

GENERAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL ELECTRICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. THIS SHEET GENERALLY DEPICTS EQUIPMENT AND DEVICES FOR FLOOR LEVEL TO APPROXIMATELY 48" AFF. SEE LIGHTING/CEILING SHEETS FOR ADDITIONAL DEVICES MOUNTED ABOVE THIS LEVEL.

KEYNOTE LEGEND

1. 250V/100A/3P/100AF NEMA 3R FUSIBLE DISCONNECT WITH 100A SHORE POWER FEMALE CONNECTOR/RECEPTACLE. 4#1, #6GND, 1-1/2"C
2. EXISTING UTILITY POLES TO REMAIN.
3. SEE POWER PLAN AND RISER DIAGRAM FOR CONTINUATION TO METERING ROOM.
4. RELOCATED IRRIGATION METER. ROUTE 3"C. TO SITE, REF: LANDSCAPE.
5. CONNECT TO MOTORIZED GATE.
6. CONNECT TO EMERGENCY PHONE STANCHION, REF: SECURITY. 4#1, #6GND, 1-1/2"C
7. LIGHT POLE TO AVOID CONFLICT WITH UNDERGROUND DETENTION, REF: CIVIL.
8. NEW UTILITY POLES (BY CPE).
9. MONUMENT SIGN. ROUTE CIRCUIT THROUGH LIGHTING RELAY CIRCUIT 4 FOR ON/OFF CONTROL. DISCONNECT SWITCH TO BE AFFIXED TO THE SIGN.
10. PROVIDE SIGNAGE WITH WP SERVICE RECEPTACLE. EXTEND CIRCUIT FROM SIGNAGE CIRCUIT, AHEAD OF THE DISCONNECT FOR THE RECEPTACLE TO REMAIN IN SERVICE.

LEGEND

EXISTING TO REMAIN
NEW WORK

TRUE NORTH

PLAN NORTH

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Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

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ELECTRICAL SITE PLAN

E1.3

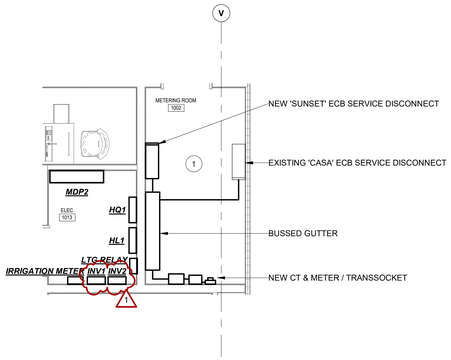
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1 ELECTRICAL POWER PLAN
SCALE: 1/8" = 1'-0"



2 ENLARGED ELECTRICAL & METERING RM
SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL ELECTRICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. THIS SHEET GENERALLY DEPICTS EQUIPMENT AND DEVICES FOR FLOOR LEVEL TO APPROXIMATELY 48" AFF. SEE LIGHTING/CEILING SHEETS FOR ADDITIONAL DEVICES MOUNTED ABOVE THIS LEVEL.

KEYNOTE LEGEND

1 REFERENCE ELECTRICAL RISER DIAGRAM FOR DETAILS.

2 REFERENCE T-SERIES SHEETS FOR RECEPTACLE LOCATIONS AT RACK.

3 RECEPTACLES LOCATED IN THIS ROOMS TO BE TAMPER RESISTANT TYPE.

LEGEND

EXISTING TO REMAIN
NEW WORK

TRUE NORTH

PLAN NORTH

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Jeremy L. Zorn
99218
LICENSED PROFESSIONAL ENGINEER
01/16/2026

Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708

Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

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ELECTRICAL POWER PLAN

E3.1

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1 ELECTRICAL POWER PLAN - EQUIPMENT
SCALE: 1/8" = 1'-0"

GENERAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL ELECTRICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. THIS SHEET GENERALLY DEPICTS EQUIPMENT AND DEVICES FOR FLOOR LEVEL TO APPROXIMATELY 48" AFF. SEE LIGHTING/CEILING SHEETS FOR ADDITIONAL DEVICES MOUNTED ABOVE THIS LEVEL.

KEYNOTE LEGEND

1 CONNECT TO MOTORIZED SHADE. ROUTE TO CONTROLLER AT REGISTRATION.

2 MOTORIZED WINDOW SHADES CONTROLLERS FOR WAITING RM AND ENTRY CORRIDOR.

3 CONNECT TO MOTORIZED COILING DOOR AND ASSOCIATED RAISE/LOWER CONTROLS.

4 CONNECT TO AUTOMATIC DOORS.

5 CONNECT TO ACCESS CONTROL PANEL, REF: SECURITY.

6 CONNECT TO SENSOR FAUCET, REF: PLUMBING.

7 CONNECT TO OVERHEAD LIGHT. EXTEND FROM 120V CIRCUIT SERVING THE ROOM'S RECEPTACLES.

8 EXTEND WIRING FROM ROOFTOP UNIT TO INDOOR UNIT.

9 CONNECT TO TRAP PRIMER. EXTEND FROM 120V CIRCUIT SERVING THE ROOM'S RECEPTACLES.

10 PROVIDE 120V SHARED CIRCUIT TO SERVE ALL VAV CONTROLS, REF: MECHANICAL. (TYPICAL)

LEGEND

EXISTING TO REMAIN
NEW WORK

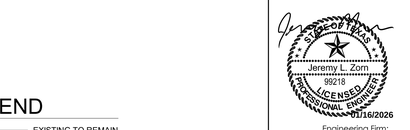
TRUE NORTH

PLAN NORTH

O'CONNELL ROBERTSON
Austin
San Antonio
Houston
811 Barton Springs Road, Suite 900, Austin, Texas 78704 p.: 512.478.7284 f.: 512.478.7441
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HARRIS HEALTH
SCP ACS SUNSET HEIGHTS URGENT CARE
1620 KEENE STREET, HOUSTON, TX, 77009



Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708

Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025

CONTRACT DOCUMENTS

ELECTRICAL POWER PLAN - EQUIPMENT

E3.2

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1 LIGHTING PLAN
SCALE: 1/8" = 1'-0"

GENERAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL ELECTRICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.
2. THIS SHEET GENERALLY DEPICTS EQUIPMENT AND DEVICES FROM APPROXIMATELY 48" AFF TO CEILING LEVEL, INCLUDING LIGHTING, SWITCHING, AND SOME CEILING MOUNTED AND WALL MOUNTED DEVICES NECESSARY FOR COORDINATION WITH CEILING MOUNTED DEVICES - e.g. FIRE ALARM VISUAL DEVICES.

KEYNOTE LEGEND

1 EXISTING LIGHT FIXTURE TO REMAIN IN PLACE UNDISTURBED.

2 NEW LOCATION OF RELOCATED EMERGENCY LIGHT FIXTURE. CONTRACTOR SHALL EXTEND CONDUIT AND WIRING FOR LIGHTING AND TEST SWITCH TO NEW LOCATION.

3 EXISTING EMERGENCY FIXTURE TO REMAIN IN PLACE, UNDISTURBED.

4 CONNECT TO AUTOMATIC DOORS.

5 CIRCUIT SWITCHED EMERGENCY LIGHT FIXTURES TO EMERGENCY LIGHTING CIRCUIT AS INDICATED. TYPICAL.

6 REFER TO LIGHT FIXTURE SCHEDULE FOR EMERGENCY CIRCUIT INVERTER CONNECTION INFORMATION.

LEGEND

EXISTING TO REMAIN
NEW WORK

TRUE NORTH

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STATE OF TEXAS
Jeremy L. Zorn
99218
LICENSED PROFESSIONAL ENGINEER
01/16/2026

Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708

Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025

CONTRACT DOCUMENTS

LIGHTING PLAN

E4.1

1/16/2026 9:14:19 AM

Autodesk Docs://Harris Health - Sunset Heights Clinic/2321.06_24_HHS - Sunset Heights UC_MEP_Central.rvt

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1/16/2026 9:14:29 AM

Autodesk Docs://Harris Health - Sunset Heights Clinic/2321.06_24_HHS - Sunset Heights UC_MEP_Central.rvt

GENERAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL ELECTRICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.

KEYNOTE LEGEND

1 PRE-ACTION SYSTEM, REF: FIRE PROTECTION.



1 SPECIAL SYSTEMS PLAN
SCALE: 1/8" = 1'-0"

LEGEND

EXISTING TO REMAIN
NEW WORK

TRUE NORTH

PLAN NORTH

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LICENSED
PROFESSIONAL ENGINEER
01/16/2026

Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708

Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

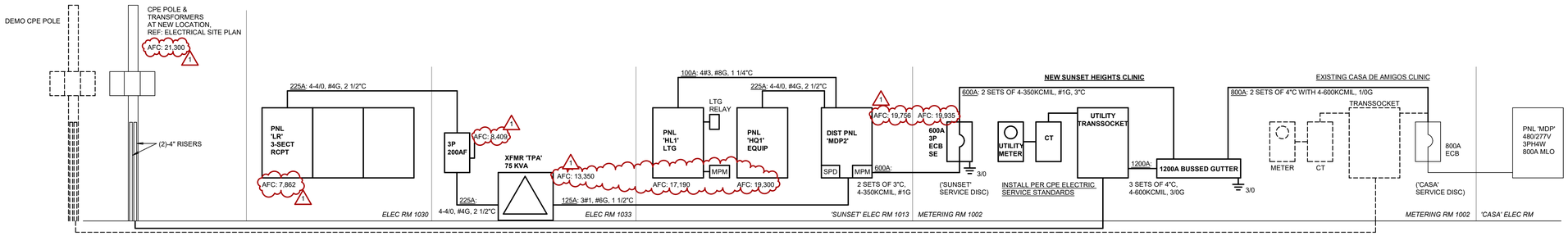
12/19/2025

CONTRACT DOCUMENTS

SPECIAL SYSTEMS PLAN

E5.1

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1 RISER DIAGRAM
NOT TO SCALE

GENERAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL ELECTRICAL NOTES THAT SHALL APPLY TO ALL SHEETS IN THIS SET UNLESS NOTED OTHERWISE IN THE KEYED NOTES.

LEGEND

- TO BE REMOVED
- EXISTING TO REMAIN
- NEW WORK

Distribution Panel: MDP2

Location: ELEC RM 1013 | **Volts:** 480/277 Wye | **A.I.C. Rating:** 35 K
Supply From: | **Phases:** 3 | **Mains Type:** MLO
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 600 A
Enclosure: NEMA1 | **Panel Feed...**

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	PANEL HQ1	3	225.00 A	166820 VA	
2	PANEL HL1	3	100.00 A	6483 VA	
3	75 KVA XFMR TR (PANEL LR)	3	125.00 A	106603 VA	
4					
5					
6	SPD	3	30.00 A	0 VA	
Notes:	MPM - MULTIPOINT METER			279806 VA	
				336.55 A	

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	15000 VA	100.00%	15000 VA		
HVAC	152493 VA	100.00%	152493 VA	**Total Conn. Load:**	279806 VA
Heating	3750 VA	100.00%	3750 VA	**Total Est. Demand:**	242686 VA
Lighting	6299 VA	125.00%	7874 VA	**Total Conn.:**	336.55 A
Lighting - Exterior	300 VA	125.00%	375 VA	**Total Est. Demand:**	291.91 A
Motor	7520 VA	104.79%	7880 VA		
Other	1684 VA	100.00%	1684 VA		
Power	4500 VA	100.00%	4500 VA		
Receptacle	88260 VA	55.67%	49130 VA		

Branch Panel: HQ1

Location: | **Volts:** 480/277 Wye | **A.I.C. Rating:** 22 K
Supply From: MDP2 | **Phases:** 3 | **Mains Type:** MLO
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 225.00 A
Enclosure: NEMA1 | **Panel Feed...**

NOTE	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	NOTE
	1				2983 VA	14189 VA								2	
	3	V1-01	20 A	3			2983 VA	14189 VA			3	80 A	RTU-1 (AFC: 7,834)	4	
	5								2983 VA	14189...				6	
	7				4617 VA	11307 VA								8	
	9	V1-02	25 A	3			4617 VA	11307 VA			3	70 A	RTU-2 (AFC: 6,607)	10	
	11								4617 VA	11307...				12	
	13	V1-03	20 A	1	4250 VA	5000 VA								14	
	15	V1-04	20 A	1			3950 VA	5000 VA			3	30 A	EWH	16	
	17	V1-05, V1-06, V1-09	20 A	1					4050 VA	5000 VA				18	
	19	V1-07	20 A	1	2250 VA	480 VA								20	
	21						141 VA	480 VA			3	20 A	MOTORIZED GATE NORTH	22	
	23	V1-08	20 A	3					141 VA	480 VA				24	
	25				141 VA	480 VA								26	
	27	V2-01	20 A	1			4250 VA	480 VA			3	20 A	MOTORIZED GATE CENTRAL	28	
	29	V2-02	20 A	1					4350 VA	480 VA				30	
	31				1850 VA	480 VA								32	
	33	V2-03	20 A	3			1850 VA	480 VA			3	20 A	MOTORIZED GATE SOUTH1	34	
	35								1850 VA	480 VA				36	
	37	V2-04	20 A	1	3850 VA	480 VA								38	
	39	V2-05	20 A	1			1850 VA	480 VA			3	20 A	MOTORIZED GATE SOUTH2	40	
	41	V2-06, V2-07	20 A	1					3500 VA	480 VA				42	
	43	V2-08, V2-10	20 A	1	3000 VA									44	
	45						1833 VA							46	
	47	V2-09	20 A	3					1833 VA					48	
	49				1833 VA									50	
	51													52	
	53													54	
	55													56	
	57													58	
	59													60	
			Total Load:		57190 VA		53890 VA		55740 VA						
			Total Amps:		207.49 A		194.55 A		202.26 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	15000 VA	100.00%	15000 VA		
HVAC	145636 VA	100.00%	145636 VA	**Total Conn. Load:**	166820 VA
Motor	6184 VA	105.82%	6544 VA	**Total Est. Demand:**	167180 VA
				Total Conn.:	200.65 A
				Total Est. Demand:	201.09 A

Notes:

Branch Panel: HL1

Location: | **Volts:** 480/277 Wye | **A.I.C. Rating:** 22 K
Supply From: MDP2 | **Phases:** 3 | **Mains Type:** MLO
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 100.00 A
Enclosure: NEMA1 | **Panel Feed...**

NOTE	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	NOTE
	1	INDOOR LIGHTING	20 A	1	700 VA	1306 VA					1	20 A	BUILDING EXTERIOR LIGHTING	2	
	3	INDOOR LIGHTING	20 A	1			951 VA	1812 VA			1	20 A	SITE EXTERIOR LIGHTING	4	
	5	INDOOR LIGHTING	20 A	1					865 VA	0 VA	1	20 A	RELAY PANEL	6	
	7	INDOOR LIGHTING	20 A	1	147 VA	164 VA					1	20 A	EXTERIOR EMERGENCY LIGHTING	8	
	9	EMERGENCY LIGHTING	20 A	1			538 VA	0 VA			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0 VA	0 VA	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0 VA	0 VA					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0 VA	0 VA			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0 VA	0 VA	1	20 A	SPARE	18	
	19	SPACE ONLY	--	1	--	0 VA								20	
	21	SPACE ONLY	--	1			--	0 VA			3	30 A	SPD	22	
	23	SPACE ONLY	--	1					--	0 VA				24	
			Total Load:		2317 VA		3301 VA		865 VA						
			Total Amps:		9.17 A		12.73 A		3.12 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	6299 VA	125.00%	7874 VA		
Other	184 VA	100.00%	184 VA	**Total Conn. Load:**	6483 VA
				Total Est. Demand:	8058 VA
				Total Conn.:	7.80 A
				Total Est. Demand:	9.69 A

Notes:
HONEYWELL E-MON MULTI-MON BRANCH CIRCUIT RS485 IP SMART METER OR EQUAL. CONNECT METER LEADS TO EACH BREAKER FOR METERING.

Branch Panel: LR

Location: | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10 K
Supply From: TPA | **Phases:** 3 | **Mains Type:** SELECT ONLY 1 CONFIG
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 225.00 A
Enclosure: NEMA1 | **Panel Feed...**

NOTE	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	NOTE
	1	RCPT - CORR, VEST, METERING	20 A	1	540 VA	900 VA					1	20 A	RCPT - RECEPTION	2	
	3	RCPT - WAITING, RR	20 A	1			1080 VA	720 VA			1	20 A	RCPT - RECEPTION	4	
	5	RCPT - CORRIDOR	20 A	1					540 VA	720 VA	1	20 A	RCPT - RECEPTION, CORR	6	
G	7	RCPT - DRINKING FOUNTAIN	20 A	1	180 VA	1260 VA					1	20 A	RCPT - SECURITY	8	
	9	RCPT - EXAM	20 A	1			900 VA	1260 VA			1	20 A	RCPT - CASHIER	10	
	11	RCPT - EXAM	20 A	1					900 VA	720 VA	1	20 A	RCPT - VITALS	12	
	13	RCPT - EXAM	20 A	1	900 VA	360 VA					1	20 A	RCPT - RR, POCT	14	
	15	RCPT - EXAM	20 A	1			900 VA	360 VA			1	20 A	RCPT - POCT	16	
	17	RCPT - EXAM	20 A	1					900 VA	180 VA	1	20 A	RCPT - POCT FRIDGE	18	
	19	RCPT - EXAM	20 A	1	900 VA	180 VA					1	20 A	RCPT - POCT FREEZER	20	
	21	RCPT - TREATMENT	20 A	1			720 VA	660 VA			1	20 A	RCPT - TEAM CARE	22	
	23	RCPT - TREATMENT	20 A	1					900 VA	1080 VA	1	20 A	RCPT - TEAM CARE...	24	
	25	RCPT - CONSULTATION	20 A	1	900 VA	1080 VA					1	20 A	RCPT - TEAM CARE...	26	
	27	RCPT - EXAM	20 A	1			900 VA	1080 VA			1	20 A	RCPT - TEAM CARE...	28	
	29	RCPT - EXAM	20 A	1					900 VA	1080 VA	1	20 A	RCPT - TEAM CARE...	30	
	31	RCPT - EXAM	20 A	1	900 VA	720 VA					1	20 A	RCPT - TEAM CARE	32	
	33	RCPT - EXAM	20 A	1			900 VA	720 VA			1	20 A	RCPT - TEAM CARE	34	
	35	RCPT - EXAM	20 A	1					900 VA	480 VA	1	20 A	RCPT - TEAM CARE	36	
	37	RCPT - TREATMENT	20 A	1	720 VA	600 VA					1	20 A	RCPT - WAITING DISPLAYS	38	
	39	RCPT - TREATMENT	20 A	1			900 VA	180 VA			1	20 A	SENSOR FAUCETS - PATIENT RR	40	
	41	RCPT - PATIENT RR, ELEC	20 A	1					720 VA	540 VA	1	20 A	SENSOR FAUCETS - POCT	42	
			Total Load:		36345 VA		36258 VA		34001 VA						
			Total Amps:		305.76 A		305.04 A		283.34 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	6857 VA	100.00%	6857 VA		
Heating	3750 VA	100.00%	3750 VA	**Total Conn. Load:**	106503 VA
Lighting - Exterior	300 VA	125.00%	375 VA	**Total Est. Demand:**	67592 VA
Motor	1336 VA	110.78%	1480 VA	**Total Conn.:**	295.62 A
Other	1500 VA	100.00%	1500 VA	**Total Est. Demand:**	187.62 A
Power	4500 VA	100.00%	4500 VA		
Receptacle	88260 VA	55.67%	49130 VA		

Notes:
G - GFCI BREAKER

Branch Panel: LR

Location: | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10 K
Supply From: LR | **Phases:** 3 | **Mains Type:** FEED THROUGH LUGS
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 100.00 A
Enclosure: NEMA1 | **Panel Feed...**

NOTE	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	NOTE
	43	RCPT - CORRIDOR (BREAKROOM)	20 A	1	720 VA	1914 VA					2	30 A	MS-1B / MS-1A	44	
	45	RCPT - OFFICE	20 A	1			900 VA	1914 VA						46	
	47	RCPT - WORKROOM	20 A	1					900 VA	1040 VA	2	20 A	MS-2B / MS-1B	48	
	49	RCPT - WORKROOM	20 A	1	1080 VA	1040 VA								50	
	51	RCPT - WORKROOM	20 A	1			900 VA	540 VA			1	20 A	RCPT - ROOF	52	
	53	RCPT - BREAKROOM APPLIANCE	20 A	1					180 VA	336 VA	1	15 A	EF-1	54	
	55	RCPT - BREAKROOM APPLIANCE	20 A	1	180 VA	576 VA					1	15 A	EF-2	56	
	57	RCPT - BREAKROOM APPLIANCE	20 A	1			180 VA	424 VA			1	15 A	EF-3	58	
	59	RCPT - BREAKROOM APPLIANCE	20 A	1					180 VA	1875 VA	2	25 A	UH-1	60	
	61	RCPT - BREAKROOM APPLIANCE	20 A	1	180 VA	1875 VA								62	
	63	RCPT - BREAKROOM	20 A	1			1200 VA	720 VA			1	20 A	RCPT - MEDS	64	
	65	RCPT - EVS, CORR	20 A	1					540 VA	180 VA	1	20 A	RCPT - MEDS FRIDGE	66	
	67	SENSOR FAUCETS - STAFF RR	20 A	1	360 VA	180 VA					1	20 A	RCPT - MEDS FRIDGE	68	
	69	RCPT - AMBULANCE	20 A	1			720 VA	180 VA			1	20 A	RCPT - MEDS FRIDGE	70	
	71	RCPT - SOILED WORKROOM	20 A	1					720 VA	950 VA	1	20 A	VAV CONTROLS	72	
	73	RCPT - CORRIDOR (MEDS)	20 A	1	540 VA	0 VA					1	20 A	SPARE	74	
	75	RCPT - CLEAN SUPPLY	20 A	1			360 VA	0 VA			1	20 A	SPARE	76	
	77	RCPT - FIRE, STOR, REC, AMB VEST	20 A	1					1080 VA	0 VA	1	20 A	SPARE	78	
	79	RCPT - STAFF RR	20 A	1	720 VA	0 VA					1	20 A	SPARE	80	
	81	RCPT - OFFICE	20 A	1			900 VA	0 VA			1	20 A	SPARE	82	
	83	RCPT - OFFICE	20 A	1					900 VA	0 VA	1	20 A	SPARE	84	
			Total Load:		26205 VA		24978 VA		23441 VA						
			Total Amps:		220.34 A		210.12 A		195.34 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	6857 VA	100.00%	6857 VA		
Heating	3750 VA	100.00%	3750 VA	**Total Conn. Load:**	74523 VA
Lighting - Exterior	300 VA	125.00%	375 VA	**Total Est. Demand:**	50462 VA
Motor	1336 VA	110.78%	1480 VA	**Total Conn.:**	206.86 A
Other	300 VA	100.00%	300 VA	**Total Est. Demand:**	140.07 A
Power	3420 VA	100.00%	3420 VA		
Receptacle	58560 VA	58.54%	34280 VA		

Notes:

Branch Panel: LR

Location: | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10 K
Supply From: LR | **Phases:** 3 | **Mains Type:** FEED THROUGH LUGS
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 225.00 A
Enclosure: NEMA1 | **Panel Feed...**

NOTE	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	NOTE
	85	RCPT - AIDR	20 A	1	180 VA	10000 VA								86	
	87	RCPT - AIDR VIDEO	20 A	1			180 VA	10000 VA			3	100 A	RCPT - MAMMO CLINIC CHARGER	88	
	89	RCPT - AIDR	20 A	1					180 VA	10000...				90	
	91	RCPT - IDR L6-30R	30 A	2	1500 VA	360 VA					1	20 A	COILING & AUTO DOOR	92	
	93						1500 VA	180 VA			1	20 A	SITE - EM PHONE STANCHION	94	
	95	RCPT - IDR L6-30R	30 A	2					1500 VA	300 VA	1	20 A	Lighting - Exterior	96	
	97				1500 VA	0 VA					1	20 A	SPARE	98	
	99	RCPT - IDR L6-30R	30 A	2			1500 VA	0 VA			1	20 A	SPARE	100	
	101								1500 VA	0 VA	1	20 A	SPARE	102	
	103	RCPT - IDR L6-30R	30 A	2	1500 VA	0 VA					1	20 A	SPARE	104	
	105						1500 VA	0 VA			1	20 A	SPARE	106	
	107	RCPT - IDR RACK	20 A	1					360 VA	0 VA	1	20 A	SPARE	108	
	109	RCPT - IDR RACK	20 A	1	360 VA	0 VA					1	20 A	SPARE	110	
	111	RCPT - IDR RACK	20 A	1			360 VA	0 VA			1	20 A	SPARE	112	
	113	RCPT - IDR PA	20 A	1					180 VA	0 VA	1	20 A	SPARE	114	
	115	RCPT - AIDR INTRUSION	20 A	1	540 VA	0 VA					1	20 A	SPARE	116	
	117	AIDR - ACCESS CONTROLS	20 A	1			280 VA	0 VA			1	20 A	SPARE	118	
	119	FACP	20 A	1					180 VA	0 VA	1	20 A	SPARE	120	
	121	MOTORIZED WINDOW SHADES	20 A	1	900 VA	0 VA					1	20 A	SPARE	122	
	123	MOTORIZED WINDOW SHADES	20 A	1			540 VA	0 VA			1	20 A	SPARE	124	
	125	COILING & AUTO DOOR	20 A	1					360 VA	0 VA	1	20 A	SPARE	126	
			Total Load:		16840 VA		16040 VA		14560 VA						
			Total Amps:		142.23 A		135.56 A		121.33 A						

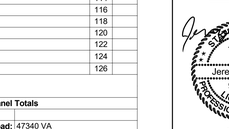
Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting - Exterior	300 VA	125.00%	375 VA		
Power	2700 VA	100.00%	2700 VA	**Total Conn. Load:**	47340 VA
Receptacle	44340 VA	61.28%	27170 VA	**Total Est. Demand:**	30245 VA
				Total Conn.:	131.40 A
				Total Est. Demand:	83.95 A

Notes:

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HARRIS HEALTH SCP ACS SUNSET HEIGHTS URGENT CARE

1620 KEENE STREET, HOUSTON, TX. 77009



Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708
Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025

CONTRACT DOCUMENTS

ELECTRICAL RISER DIAGRAM AND PANEL SCHEDULES

E7.1

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LIGHTING FIXTURE SCHEDULE

NOTES:
1. LISTED MANUFACTURER IS THE BASIS OF DESIGN WITH THE LISTED ALTERNATIVE MANUFACTURER AS AN APPROVED EQUAL.
2. VOLTAGE TO BE UNIVERSAL 120-277V FOR ALL FIXTURES U.N.O.
3. CEILING TYPE INDICATED IN ARCHITECTURAL DRAWINGS WILL TAKE PRECEDENCE OVER MOUNTING OPTION INDICATED IN PART NUMBER.
4. REFER TO ARCHITECTURAL DRAWINGS FOR INFORMATION REGARDING CEILING TILES. PROVIDE MOUNTING HARDWARE, FLANGES, AS REQUIRED.
5. COLORS NOT SPECIFIED SHALL BE CHOSEN BY THE ARCHITECT.
6. LENGTH OF CONTINUOUS RUN FIXTURES SHALL BE PER PLAN. PROVIDE ACCESSORIES AS REQUIRED FOR MULTI-SECTION CONNECTIONS.
7. FIXTURES INDICATED FOR EMERGENCY EGRESS SHALL HAVE BATTERY BACKUP.
8. FIXTURES WITH INDEPENDENT LED LAMPS TO BE RATED CRI >= 80 WITH L70 OF 24,000 HOURS.

TAG	MODEL	LUMENS	COLOR TEMPERATURE	MANUFACTURER	CATALOG NO.	ALTERNATE	WATTAGE	VOLTAGE	MOUNTING	NOTES
INTERIOR										
CV	COVE LIGHT	2256 lm	4000 K	SSL	MC-48-4K-CRI80-120	FORUM	20 W	MVOLT	RECESSED	CONFIIRM LENGTH IN FIELD
D6	6" RECESSED DOWNLIGHT	1000 lm	4000 K	HALO	HC6100010-HM60525840-61MDH	LIGHTOLIER	10 W	MVOLT	RECESSED	
D6E	6" RECESSED DOWNLIGHT WITH INTEGRAL BATTERY & TEST BUTTON	1000 lm	4000 K	HALO	HC610D010IEM7-HM605258040-61MDHIEM	LIGHTOLIER	10 W	MVOLT	RECESSED	
F	18' CONTINUOUS LINEAR WALL WASH	8730 lm	4000 K	NEORAY	S122DR-S485D840-GYP-18F0-1-UDD-A-W	INTERLUX	86 W	MVOLT	RECESSED	CONFIRM LENGTH IN FIELD
GA	VOLUMETRIC 2'X2'	3272 lm	4000 K	METALUX	22CZ2-32-UNV-L840-CD1-U	DAYBRITE	24 W	MVOLT	RECESSED	
GB	VOLUMETRIC 2'X4'	4091 lm	4000 K	METALUX	24CZ2-40-UNV-L840-CD1-U	DAYBRITE	30 W	MVOLT	RECESSED	
GBE	VOLUMETRIC 2'X4' W/ EM. BATTERY	4091 lm	4000 K	METALUX	24CZ2-40-UNV-L840-CD1-EL14W-U	DAYBRITE	30 W	MVOLT	RECESSED	
GC	VOLUMETRIC 2'X4'	5454 lm	4000 K	METALUX	24CZ2-55-UNV-L840-CD1-U	DAYBRITE	41 W	MVOLT	RECESSED	
GED	SEALED VOLUMETRIC 2'X4' W/ BOTTOM LENS	5385 lm	4000 K	FAILSAFE	24FCZ2-55VHE-UNV-L840-CA08-CD1-U	DAYBRITE	36 W	MVOLT	RECESSED	
LR1	76' CONTINUOUS RECESSED LINEAR PERIMETER W/ (4) EMERGENCY SECTIONS	26600 lm	4000 K	NEORAY	S124DRP-S350D840-ETG-76F0-1B1x4-UDD-C-W	PINNACLE	228 W	MVOLT	RECESSED	CONFIM LENGTH IN FIELD
LR2	97' CONTINUOUS RECESSED LINEAR PERIMETER W/ (5) EMERGENCY SECTIONS	33950 lm	4000 K	NEORAY	S124DRP-S350D840-ETG-97F0-1B1x5-UDD-C-W	PINNACLE	291 W	MVOLT	RECESSED	CONFIM LENGTH IN FIELD
LR3	4' LINEAR RECESSED	1440 lm	4000 K	NEORAY	S124DR-S350D840-GYP-4F0-1-UDD-F-W	PINNACLE	12 W	MVOLT	RECESSED	
R	SUSPENDED DIRECT-INDIRECT RING	5600 lm	4000 K	ALW	MR1.5-D5-SS-LOW/80/4K-V01-LENS-LOW/80/4K-V01-LENS-SW-UNV-N-N	ALLURE	184 W	MVOLT	SUSPENDED	
SK4E	4' SUSPENDED STRIP LIGHT	5210 lm	4000 K	METALUX	4SLSTP4040DD-UNV / EBPLED7W / AYC-CHAIN/SET	DAYBRITE	39 W	MVOLT	SUSPENDED	
SK4E2	4' SURFACE STRIP LIGHT	5210 lm	4000 K	METALUX	4SLSTP4040DD-UNV / EBPLED7W	DAYBRITE	39 W	MVOLT	SURFACE	
SK8E	8' SUSPENDED STRIP LIGHT	9304 lm	4000 K	METALUX	8SLSTP8040DD-UN / EBPLED7W / AYC-CHAIN/SET	DAYBRITE	76 W	MVOLT	SUSPENDED	
UA	4' UNDERCABINET FIXTURE	3828 lm	4000 K	FAIL-SAFE	UCL-4-LD4-40-A12125-RSW-AM	KENALL	49 W	MVOLT	UNDERCABINET	
UC	2' UNDERCABINET FIXTURE	1484 lm	4000 K	FAIL-SAFE	UCL-2-LD4-40-A12125-RSW-AM	KENALL	17 W	MVOLT	UNDERCABINET	
X1	EXIT SIGN SINGLE-SIDED LIGHT	0 lm	0 K	SURE-LITES	APX7RG	EMERGLITE	3 W	MVOLT	SEE DRAWING	
EXTERIOR										
EY1	WIDE SYMMETRIC-THROW LIGHT POLE - 1 HEAD	20332 lm	4000 K	LUMARK KW	PRV-PA2B-740-U-5WQ-SA-BZ / SSP20-5.0-11-BRZ-DM10-BC	GARDCO/KW	151 W	MVOLT	POLE	
EY2	WIDE SYMMETRIC-THROW LIGHT POLE - 2 HEADS	20332 lm	4000 K	LUMARK KW	(2)PRV-PA2B-740-U-5WQ-SA-BZ / SSP20-5.0-11-BRZ-DM2180-BC	GARDCO/KW	302 W	MVOLT	POLE	
EY14	WIDE FORWARD THROW LIGHT POLE - 1 HEAD	14072 lm	4000 K	LUMARK KW	PRV-PA2B-740-U-T4W-SA-BZ-HSS / SSP20-5.0-11-BRZ-DM10-BC	GARDCO/KW	151 W	MVOLT	POLE	
EY24	WIDE FORWARD THROW LIGHT POLE - 2 HEADS	14072 lm	4000 K	LUMARK KW	(2)PRV-PA2B-740-U-T4W-SA-BZ-HSS / SSP20-5.0-11-BRZ-DM2090-BC	GARDCO/KW	302 W	MVOLT	POLE	
INV1	55VA EMERGENCY LIGHTING MICRO INVERTER			EVENLITE	EMS-55-LC-V3-S-RT		0 W	120/277	WALL	CONNECT TO SR FIXTURE AT MAIN ENTRY
INV2	250VA EMERGENCY LIGHTING MINI INVERTER			EVENLITE	PW11-25-LC-RT ELCD		0 W	120/277	WALL	CONNECT TO SR/SC FIXTURES AT REAR ENTRY & CANOPY, CONFIRM PWR. CONFIG.
SR8E	8' IP66 RECESSED PERIMETER LINEAR WITH EMERGENCY	2800 lm	4000 K	NEORAY	DTR3DRP-SR8F0-035DS940-FLL-1EUEFDD-FINISH-FES	AXIS	41 W	MVOLT	RECESSED PERIMETER	CONNECT TO INVERTER (INV1), FEED POWER ONE END
SR48	48' IP66 RECESSED PERIMETER LINEAR	16800 lm	4000 K	NEORAY	DTR3DRP-SR48F0-035DS940-FLL-1DUEFDD-FINISH-FES	AXIS	245 W	MVOLT	RECESSED PERIMETER	CONFIRM LENGTH IN FIELD, FEED POWER ONE END.
SR88E	88' IP66 RECESSED PERIMETER LINEAR WITH EMERGENCY	30800 lm	4000 K	NEORAY	DTR3DRP-SR88F0-035DS940-FLL-1EUEFDD-FINISH-FES	AXIS	449 W	MVOLT	RECESSED PERIMETER	CONFIRM LENGTH IN FIELD, COORDINATE EMERGENCY LOCATION W/ PLANS, FEED POWER EACH END, CONNECT 'E' SECTION TO INVERTER (INV2).
SR120E	120' IP66 RECESSED PERIMETER LINEAR WITH EMERGENCY	42000 lm	4000 K	NEORAY	DTR3DRP-SR120F0-035DS940-FLL-1EUEFDD-FINISH-FES	AXIS	612 W	MVOLT	RECESSED PERIMETER	CONFIRM LENGTH IN FIELD, COORDINATE EMERGENCY LOCATION W/ PLANS, FEED POWER EACH END, CONNECT 'E' SECTION TO INVERTER (INV2).
SRC8E	8' IP66 RECESSED LINEAR WITH EMERGENCY	2800 lm	4000 K	NEORAY	DTR3DR-SR8F0-035DS940-FLL-1EUEFDD-FINISH-FES	AXIS	41 W	MVOLT	RECESSED	CONNECT TO INVERTER (INV2), FEED POWER ONE END

EQUIPMENT CONNECTION SCHEDULE

GENERAL NOTES:
A. STARTERS ARE MAGNETIC, FULL VOLTAGE, NON-REVERSING U.N.O.
B. CONTROLLERS SHOWN AS FURNISHED WITH EQUIPMENT ARE INTEGRAL WITH EQUIPMENT UNLESS OTHERWISE NOTED.
C. MINIMUM SHORT CIRCUIT INTERRUPTING & WITHSTAND RATINGS FOR ALL CONTROLLERS ON THE PROJECT SHALL MEET OR EXCEED THE SHORT CIRCUIT CURRENT AVAILABLE AT THE UPSTREAM SUPPLY CIRCUIT'S OVERCURRENT PROTECTIVE DEVICE.
D. WHERE BRANCH CIRCUIT BREAKER IS SHOWN AS BEING UTILIZED AS CONTROLLER DISCONNECTING MEANS, PROVIDE THE BREAKER WITH PERMANENTLY INSTALLED HANDLE LOCKOFF/PROVISIONS.
E. NON-COMBINATION CONTROLLERS SHALL BE LOCATED BY PANELBOARD SERVING THE LOAD....

REFERENCED NOTES:
1. REFER TO MECHANICAL SCHEDULES FOR NUMBER OF FANS PER UNIT.
2. ADDITIONAL 120V CIRCUIT REQUIRED FOR CONVENIENCE RECEPTACLE.

EQUIPMENT INFORMATION		ELECTRICAL INFORMATION					DISCONNECT & CONTROLLER INFORMATION			
EQUIPMENT TAG	DESCRIPTION	VOLTAGE	PHASE	PANEL	CIRCUIT #	WIRING	DISCONNECT	CONTROL	ENCLOSURE	NOTES
CONTROLS	VAV CONTROLS	120 V	3	LR	72	#12, #12N, #12G, 3/4"C	-	-	NEMA 3R	
EF-1	EXHAUST FAN	120 V	1	LR	54	#12, #12N, #12G, 3/4"C	INTEGRAL TO EQUIP	RELAY	NEMA 3R	
EF-2	EXHAUST FAN	120 V	1	LR	56	#12, #12N, #12G, 3/4"C	INTEGRAL TO EQUIP	RELAY	NEMA 3R	
EF-3	EXHAUST FAN	120 V	1	LR	58	#12, #12N, #12G, 3/4"C	INTEGRAL TO EQUIP	RELAY	NEMA 1	
EWH	ELECTRIC WATER HEATER	480 V	3	HQ1	14,16,18	3#10, #10G, 3/4"C	30A/3P/NF		NEMA 3R	
MG1	MOTORIZED GATE	480 V	3	HQ1	32,34,36	3#10, #10G, 1"C	INTEGRAL TO EQUIP			
MG2	MOTORIZED GATE	480 V	3	HQ1	26,28,30	3#12, #12G, 1"C	INTEGRAL TO EQUIP			
MG3	MOTORIZED GATE	480 V	3	HQ1	38,40,42	3#12, #12G, 1"C	INTEGRAL TO EQUIP			
MG4	MOTORIZED GATE	480 V	3	HQ1	20,22,24	3#12, #12G, 1"C	INTEGRAL TO EQUIP			
MS-1A	MINISPLIT INDOOR UNIT	208 V	1	LR	44,46	2#12, #12G, 3/4"C	30A/2P/NF		NEMA 1	
MS-1B	MINISPLIT OUTDOOR UNIT	208 V	1	LR	44,46	2#12, #12G, 3/4"C	30A/2P/NF		NEMA 3R	
MS-2A	MINISPLIT INDOOR UNIT	208 V	1	LR	48,50	2#12, #12G, 3/4"C	30A/2P/NF		NEMA 1	
MS-2B	MINISPLIT OUTDOOR UNIT	208 V	1	LR	48,50	2#12, #12G, 3/4"C	30A/2P/NF		NEMA 3R	
RTU-1	ROOF TOP UNIT	480 V	3	HQ1	2,4,6	3#4, #8G, 1 1/4"C	INTEGRAL TO UNIT		NEMA 3R	1,2
RTU-2	ROOF TOP UNIT	480 V	3	HQ1	8,10,12	3#4, #8G, 1 1/4"C	INTEGRAL TO UNIT		NEMA 3R	1,2
SIGN	MONUMENT SIGN	120 V	3	LR	96	3#8, #10G, 1"C	MOTOR RATED SWITCH		NEMA 3R	
UH-1	UNIT HEATER	208 V	1	LR	60,62	3#12, #12G, 3/4"C	30A/2P/NF	LINE STAT	NEMA 1	
V1-01	VAV BOX	480 V	3	HQ1	1,3,5	3#12, #12G, 3/4"C	30A/3P/NF		NEMA 1	
V1-02	VAV BOX	480 V	3	HQ1	7,9,11	3#10, #10G, 3/4"C	30A/3P/NF		NEMA 1	
V1-03	VAV BOX	277 V	1	HQ1	13	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V1-04	VAV BOX	277 V	1	HQ1	15	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V1-05	VAV BOX	277 V	1	HQ1	17	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V1-06	VAV BOX	277 V	1	HQ1	17	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V1-07	VAV BOX	277 V	1	HQ1	19	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V1-08	VAV BOX	480 V	3	HQ1	21,23,25	3#12, #12G, 3/4"C	30A/3P/NF		NEMA 1	
V1-09	VAV BOX	277 V	1	HQ1	17	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-01	VAV BOX	277 V	1	HQ1	27	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-02	VAV BOX	277 V	1	HQ1	29	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-03	VAV BOX	480 V	3	HQ1	31,33,35	3#12, #12G, 3/4"C	30A/3P/NF		NEMA 1	
V2-04	VAV BOX	277 V	1	HQ1	37	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-05	VAV BOX	277 V	1	HQ1	39	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-06	VAV BOX	277 V	1	HQ1	41	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-07	VAV BOX	277 V	1	HQ1	41	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-08	VAV BOX	277 V	1	HQ1	43	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	
V2-09	VAV BOX	480 V	3	HQ1	45,47,49	3#12, #12G, 3/4"C	30A/3P/NF		NEMA 1	
V2-10	VAV BOX	277 V	1	HQ1	43	#12, #12N, #12G, 3/4"C	MOTOR RATED SWITCH		NEMA 1	

LIGHTING CONTROLS MATRIX SCHEDULE

	SPACE DESCRIPTION						CONTROL TYPE						
	TIME-SWITCH CONTROLS WITH OVERRIDE SWITCHES (C405.2.2.1)	MANUAL OFF (C405.2.2.3)	AUTOMATIC OFF (C405.2.1.1.1)	VACANCY SENSOR MODE - MANUAL-ON (C405.2.1.1.2)	OCCUPANCY SENSOR MODE AUTOMATIC-ON (C405.2.1.1.2)	DIMMING LIGHT REDUCTION CONTROLS (C405.2.2.2 OR OWNER PREFERENCE)	EMERGENCY ALWAYS-ON - NIGHT LIGHTS NOT CONTROLLED	EMERGENCY SWITCH - UL 924	DAYLIGHT SENSORS - WHERE ZONES ARE INDICATED (C405.2.3.1/2)	PHOTOSENSORS ON/OFF	MOTION SENSOR DIMMING	RELAY SYSTEM / LIGHTING CONTACTOR	MANUAL - ONLINE - VOLTAGE
EXAM ROOMS		X	X	X		X							
TREATMENT ROOMS		X	X	X		X							
ENCLOSED OFFICES		X	X	X				X					
TEAM CARE		X	X		X		X						
MAIN CORRIDOR/LOBBY	X						X					X	
STORAGE		X	X	X				X					
RESTROOMS		X	X		X			X					
BREAK ROOM		X	X	X									
WORKROOMS		X	X					X					
MDF/IDF ROOMS		X	X		X			X					
EXTERIOR LIGHTING										X	X	X	

NOTES
1. ELECTRICAL PLANS ARE DIAGRAMMATIC, CONTRACTOR SHALL INCLUDE PRICING FOR ALL COMPONENTS AND CABLING REQUIRED FOR SYSTEM
2. FLOOR PLANS SHOWING CONTROL WIRING AND COMPONENTS SHALL BE INCLUDED WITH LGHTING SUBMITTALS.
3. CONTRACTOR SHALL VERIFY ROUGH-IN REQUIREMENTS WITH CONTROLS SUPPLIER PRIOR TO BEGINNING INSTALLATION.
4. EXTERIOR EMERGENCY BATTERY BACKUP TO ENERGIZE UPON LOSS OF NORMAL POWER AND TO BE CONTROLLED BY RELAY SYSTEM OTHERWISE.

LIGHTING RELAY SCHEDULE

#	CIRCUIT	CONTROL CHANNEL	DESCRIPTION
1	HL1-4	PARKING	NORTH AND SOUTH PARKING LOT POLES
2	HL1-2	EXTERIOR	CANOPY
3	HL1-8	EXTERIOR	CANOPY EMERGENCY
4	LR-96	SIGNAGE	MONUMENT SIGN
5			<SPARE>

NOTES:

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STATE OF TEXAS
Jeremy L. Zorn
99218
LICENSED
PROFESSIONAL ENGINEER
01/16/2026

Engineering Firm:
O'CONNELL ROBERTSON
Firm Registration No. F-2708

Revisions:

NO.	DESCRIPTION	DATE
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12/19/2025

CONTRACT DOCUMENTS

ELECTRICAL EQUIPMENT AND LIGHTING SCHEDULES

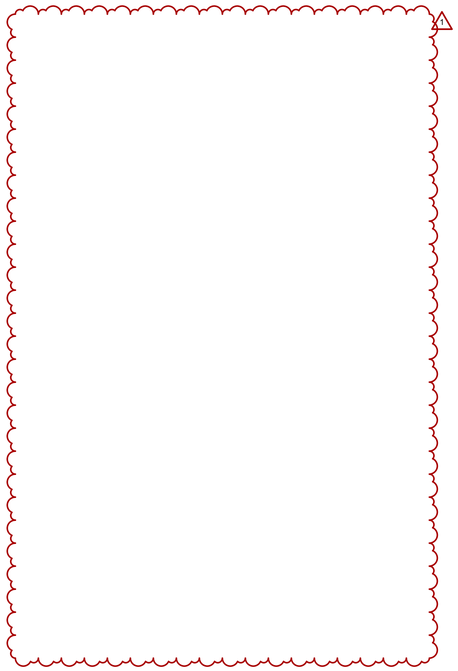
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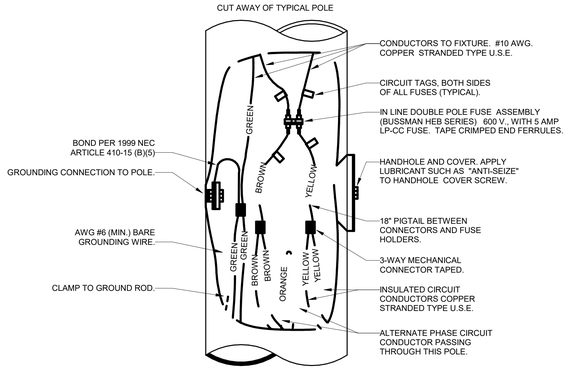
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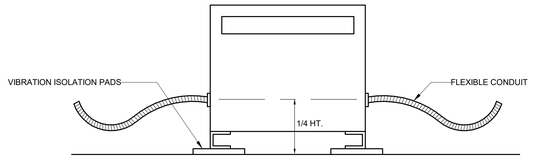




NOTE:

1. ALTERNATE PHASES TO EACH FIXTURE (EXAMPLE. AB, BC, AC, AB, ETC.)

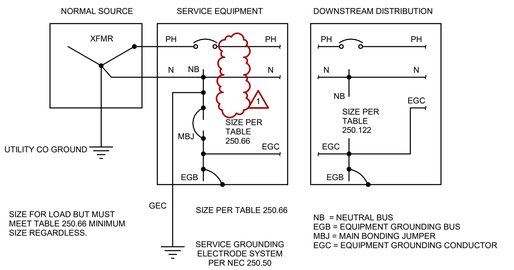
2 POLE CONNECTION DETAIL
NOT TO SCALE



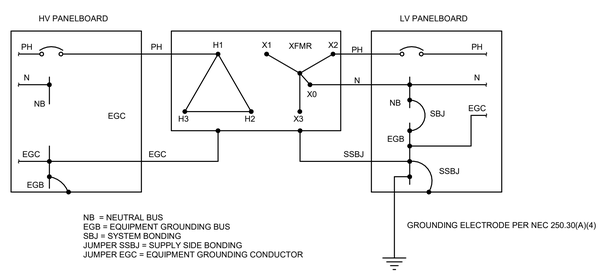
NOTE:

CONDUIT ENTRY MUST BE IN LOWER 1/4
HEIGHT OF TRANSFORMER (NOT THRU BOTTOM)

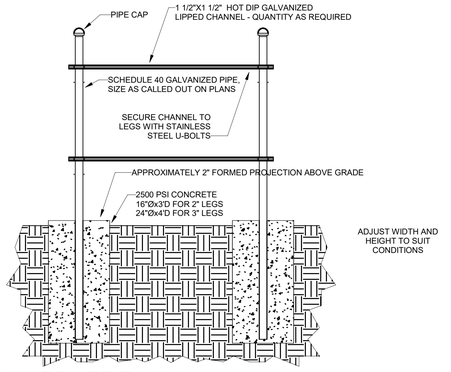
3 FLOOR MOUNTED TRANSFORMER DETAIL
NOT TO SCALE



4 GROUNDING SERVICE AND DISTRIBUTION
NOT TO SCALE



5 GROUNDING DRY TYPE XFMRS
NOT TO SCALE



6 SUPPORT RACK
NOT TO SCALE

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1 T2.1 TECHNOLOGY OVERALL FLOOR PLAN
3/16" = 1'-0"

GENERAL NOTES

1. THE TECHNOLOGY REGION / WIRING BOUNDARIES ARE IDENTIFIED ON THE OVERALL SHEETS ONLY AND NOT ON THE ENLARGED SHEETS. CONTRACTOR SHALL REFER TO THE OVERALL SHEETS FOR ALL TECHNOLOGY REGIONS / WIRING BOUNDARIES.
2. ALL CONDUIT PATHWAYS, ROUGH-INS, BACKBOXES, FLOOR BOXES, CONDUIT SLEEVES, ETC. INDICATED ON THE TECHNOLOGY DRAWINGS ARE TO BE PROVIDED AND INSTALLED BY DIVISION 26.
3. ALL POWER INDICATED ON THE TECHNOLOGY DRAWINGS IS TO BE PROVIDED AND INSTALLED BY DIVISION 26.
4. CONTRACTOR SHALL RESTORE ALL PENETRATIONS PROVIDED THROUGH FIRE RATED WALLS/STRUCTURES FOR TECHNOLOGY CABLING BACK TO THE ORIGINAL RATING.
5. CONTRACTOR SHALL RESTORE ALL PENETRATIONS PROVIDED THROUGH NON-RATED WALLS/STRUCTURES FOR TECHNOLOGY CABLING FOR SOUND TO REDUCE NOISE TRAVELING THROUGH PENETRATIONS.
6. TECHNOLOGY CABLING SHALL BE ROUTED IN SEPARATE PATHWAYS IN J-HOOKS, CONDUITS, CONDUIT SLEEVES, CORES, ETC. THROUGHOUT THE ENTIRE PATHWAY. DIFFERENT MEDIA TYPES (DATA, VIDEO, SECURITY, ETC.) SHALL NOT SHARE THE SAME J-HOOK, CONDUIT, CONDUIT SLEEVE, CORE, ETC.
7. UNLESS NOTED OTHERWISE, ALL CONDUITS FOR TECHNOLOGY DEVICES SHALL ROUTE FROM THE DEVICE LOCATION AND TERMINATE ABOVE AN ACCESSIBLE CEILING (AN OPEN CEILING OR CLOUD TYPE CEILING IS NOT CONSIDERED AN ACCESSIBLE CEILING) IN THE SAME ROOM WHERE THE DEVICE IS LOCATED. IF THE ROOM WHERE THE DEVICE IS LOCATED DOES NOT HAVE AN ACCESSIBLE CEILING, THE CONDUIT SHALL ROUTE TO THE NEAREST ACCESSIBLE CEILING OFF A MAIN CORRIDOR. CONDUIT PATHWAY SHALL TAKE THE SHORTEST ROUTE TO THE APPLICABLE MDF / IDF ROOM TO MINIMIZE THE CABLE LENGTH ENSURING CABLE LENGTH DOES NOT EXCEED 275 FEET.
8. UNLESS NOTED OTHERWISE ALL CONDUITS SHALL BE HOMERUN FROM THE DEVICE LOCATION AND NO DAISY CHAINING OF DEVICES / ROUGH-INS SHALL BE ALLOWED.
9. CONDUIT SEGMENTS SHALL BE NO MORE THAN 100-FEET IN LENGTH WITH NO MORE THAN THE EQUIVALENT OF (2) 90 DEGREE BENDS BETWEEN PULLING POINTS.
10. CONDUITS SHALL MAINTAIN A BEND RADIUS OF 6 TIMES THE DIAMETER OF THE CONDUIT FOR CONDUITS 2-INCHES OR SMALLER AND 10 TIMES THE DIAMETER OF THE CONDUIT FOR CONDUITS GREATER THAN 2-INCHES.
11. ALL CONDUITS SHALL HAVE A PULL STRING INSTALLED FOR PULLING OF CABLE. CLEARLY LABEL AS "PULL STRING" INDICATING OPPOSITE END LOCATION.
12. ALL SPARE CONDUITS OR CONDUITS FILLED WITH LESS THAN THE MAXIMUM ALLOWED FILL RATIO SHALL HAVE A PULL STRING INSTALLED AND LEFT FOR FUTURE PULLING OF CABLE. CLEARLY LABEL AS "PULL STRING" INDICATING OPPOSITE END LOCATION.
13. EQUIPMENT NOT RELATED TO THE SUPPORT OF THE TELECOMMUNICATIONS ROOM (E.G., PIPING, DUCTWORK, PNEUMATIC TUBING) SHALL NOT BE INSTALLED IN, PASS THROUGH, OR ENTER THE TELECOMMUNICATIONS ROOM
14. ALL CONDUITS FOR TECHNOLOGY DEVICES SHALL ROUTE FROM THE DEVICE LOCATION AND TERMINATE ABOVE A LAY- IN TYPE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED. IF THE ROOM WHERE THE DEVICE IS LOCATED DOES NOT HAVE A LAY-IN TYPE CEILING TO PREVENT THE CABLES FROM BEING EXPOSED, THE CONDUIT SHALL ROUTE TO THE NEAREST LAY-IN TYPE CEILING OFF A MAIN CORRIDOR OR THE NEAREST MDF/IDF. THE CONDUIT PATHWAY SHALL TAKE THE SHORTEST ROUTE TO THE MAIN CORRIDOR OR THE NEAREST MDF/IDF TO MINIMIZE THE CABLE LENGTH ENSURING THE CABLE LENGTH DOES NOT EXCEED 275 FEET. CONDUIT, CONNECTIONS, J-BOXES, SUSPENSION, ANCHORAGES, AND OTHER CONDUIT COMPONENTS EXPOSED TO VIEW IN PUBLIC SPACES SHALL BE ROUTED AND INSTALLED CAREFULLY TO MINIMIZE VISUAL IMPACT AND SHALL BE FULLY PAINTED TO MATCH UNLESS NOTED OTHERWISE.
15. CONTRACTOR SHALL COORDINATE ALL CABLE TRAY ROUTING AND ELEVATIONS WITH MECHANICAL, ELECTRICAL, AND PLUMBING SYSTEMS USING THE LATEST MODEL AND REFLECTED CEILING COORDINATION DRAWINGS. MAINTAIN MINIMUM CLEARANCES IN ACCORDANCE WITH TIA-569-D STANDARDS, INCLUDING 12 INCHES VERTICAL AND 6 INCHES HORIZONTAL SEPARATION FROM ADJACENT DUCTS, CONDUITS, AND PIPING. CABLE TRAYS SHALL BE LEVEL, SECURELY SUPPORTED FROM THE BUILDING STRUCTURE, AND INSTALLED TO PROVIDE ACCESS FOR INSTALLATION AND FUTURE MAINTENANCE ABOVE ACCESSIBLE CEILINGS. DO NOT ROUTE TRAYS ABOVE LARGE DUCTS, STRUCTURAL MEMBERS, OR OBSTRUCTIONS. LOW-VOLTAGE PATHWAYS SHALL NOT SHARE SUPPORTS OR ROUTING WITH POWER, PLUMBING, OR MECHANICAL SYSTEMS.

KEYED NOTES

1. (1) 2-INCH EMT CONDUIT SLEEVE ABOVE ACCESSIBLE CEILING WITH NYLON BUSHING ON EACH END AND SECURED TO WALL. CONDUIT SLEEVE SHALL BE USED FOR LOW VOLTAGE TECHNOLOGY CABLE ONLY. (BY DIV 26)
2. (2) 2-INCH EMT CONDUIT SLEEVES ABOVE ACCESSIBLE CEILING WITH NYLON BUSHING ON EACH END AND SECURED TO WALL. CONDUIT SLEEVES SHALL BE USED FOR LOW VOLTAGE TECHNOLOGY CABLE ONLY. (BY DIV 26)
3. (2) 4-INCH EMT CONDUIT SLEEVES ABOVE ACCESSIBLE CEILING WITH NYLON BUSHING ON EACH END AND SECURED TO WALL. CONDUIT SLEEVES SHALL BE USED FOR LOW VOLTAGE TECHNOLOGY CABLE ONLY. (BY DIV 26)
4. (4) 4-INCH EMT CONDUIT SLEEVES ABOVE ACCESSIBLE CEILING WITH NYLON BUSHINGS ON EACH END AND SECURED TO WALL. CONDUIT SLEEVES SHALL BE USED FOR LOW VOLTAGE TECHNOLOGY CABLE ONLY. (BY DIV 26)
5. (2) 4-INCH EZ PATH SLEEVES ABOVE ACCESSIBLE CEILING WITH NYLON BUSHING ON EACH END AND SECURED TO WALL. CONDUIT SLEEVES SHALL BE USED FOR LOW VOLTAGE TECHNOLOGY CABLE ONLY. (BY DIV 26)
6. (4) 4-INCH EZ PATH SLEEVES ABOVE ACCESSIBLE CEILING WITH NYLON BUSHINGS ON EACH END AND SECURED TO WALL. CONDUIT SLEEVES SHALL BE USED FOR LOW VOLTAGE TECHNOLOGY CABLE ONLY. (BY DIV 26)
7. 12-INCH-WIDE X 4-INCH HIGH WIRE BASKET TYPE CABLE TRAY ABOVE ACCESSIBLE CEILING AND SUSPENDED FROM THE STRUCTURE USING A TRAPEZE SUPPORT CONFIGURATION. (BY DIV 26)
8. 24-INCH-WIDE X 4-INCH HIGH WIRE BASKET TYPE CABLE TRAY ABOVE ACCESSIBLE CEILING AND SUSPENDED FROM THE STRUCTURE USING A TRAPEZE SUPPORT CONFIGURATION. (BY DIV 26)

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1	ADD 01	01/16/26

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Project No. 2321.06 & 25-3SCP00178
100% CONTRACT DOCUMENTS

TECHNOLOGY OVERALL FLOOR PLAN
T2.1

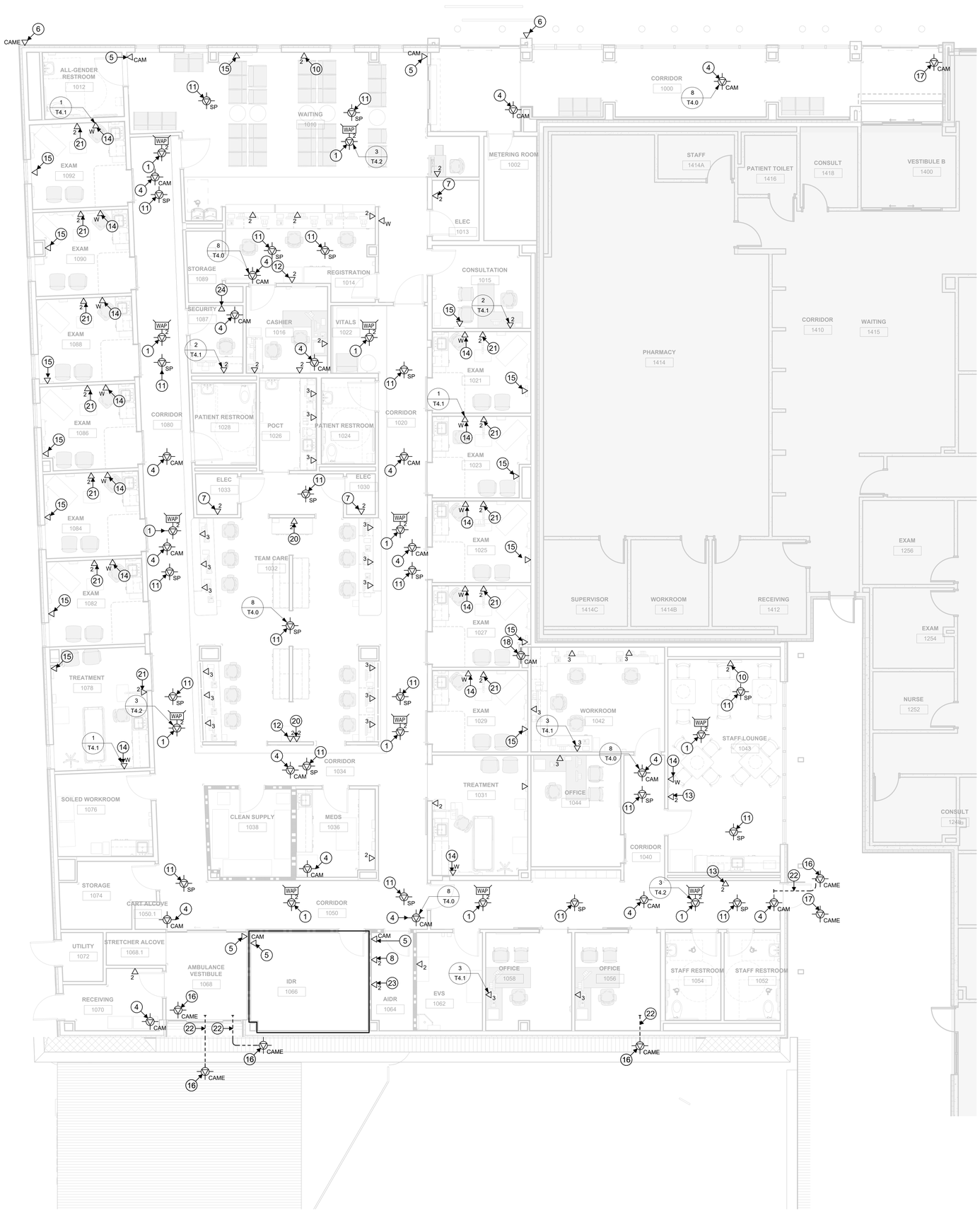
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1 TECHNOLOGY FLOOR PLAN
T2.2 3/16" = 1'-0"

GENERAL NOTES

1. THE TECHNOLOGY REGION / WIRING BOUNDARIES ARE IDENTIFIED ON THE OVERALL SHEETS ONLY AND NOT ON THE ENLARGED SHEETS. CONTRACTOR SHALL REFER TO THE OVERALL SHEETS FOR ALL TECHNOLOGY REGIONS / WIRING BOUNDARIES.
2. ALL CONDUIT PATHWAYS, ROUGH-INS, BACKBOXES, FLOOR BOXES, CONDUIT SLEEVES, ETC. INDICATED ON THE TECHNOLOGY DRAWINGS ARE TO BE PROVIDED AND INSTALLED BY DIVISION 26.
3. ALL POWER INDICATED ON THE TECHNOLOGY DRAWINGS IS TO BE PROVIDED AND INSTALLED BY DIVISION 26.
4. CONTRACTOR SHALL RESTORE ALL PENETRATIONS PROVIDED THROUGH FIRE RATED WALLS/STRUCTURES FOR TECHNOLOGY CABLING BACK TO THE ORIGINAL RATING.
5. CONTRACTOR SHALL RESTORE ALL PENETRATIONS PROVIDED THROUGH NON-RATED WALLS/STRUCTURES FOR TECHNOLOGY CABLING FOR SOUND TO REDUCE NOISE TRAVELING THROUGH PENETRATIONS.
6. TECHNOLOGY CABLING SHALL BE ROUTED IN SEPARATE PATHWAYS IN J-HOOKS, CONDUITS, CONDUIT SLEEVES, CORES, ETC. THROUGHOUT THE ENTIRE PATHWAY. DIFFERENT MEDIA TYPES (DATA, VIDEO, SECURITY, ETC.) SHALL NOT SHARE THE SAME J-HOOK, CONDUIT, CONDUIT SLEEVE, CORE, ETC.
7. UNLESS NOTED OTHERWISE, ALL CONDUITS FOR TECHNOLOGY DEVICES SHALL ROUTE FROM THE DEVICE LOCATION AND TERMINATE ABOVE AN ACCESSIBLE CEILING (AN OPEN CEILING OR CLOUD TYPE CEILING IS NOT CONSIDERED AN ACCESSIBLE CEILING) IN THE SAME ROOM WHERE THE DEVICE IS LOCATED. IF THE ROOM WHERE THE DEVICE IS LOCATED DOES NOT HAVE AN ACCESSIBLE CEILING, THE CONDUIT SHALL ROUTE TO THE NEAREST ACCESSIBLE CEILING OFF A MAIN CORRIDOR. CONDUIT PATHWAY SHALL TAKE THE SHORTEST ROUTE TO THE APPLICABLE MDF / IDF ROOM TO MINIMIZE THE CABLE LENGTH ENSURING CABLE LENGTH DOES NOT EXCEED 275 FEET.
8. UNLESS NOTED OTHERWISE ALL CONDUITS SHALL BE HOMERUN FROM THE DEVICE LOCATION AND NO DAISY CHAINING OF DEVICES / ROUGH-INS SHALL BE ALLOWED.
9. CONDUIT SEGMENTS SHALL BE NO MORE THAN 100-FEET IN LENGTH WITH NO MORE THAN THE EQUIVALENT OF (2) 90 DEGREE BENDS BETWEEN PULLING POINTS.
10. CONDUITS SHALL MAINTAIN A BEND RADIUS OF 6 TIMES THE DIAMETER OF THE CONDUIT FOR CONDUITS 2-INCHES OR SMALLER AND 10 TIMES THE DIAMETER OF THE CONDUIT FOR CONDUITS GREATER THAN 2-INCHES.
11. ALL CONDUITS SHALL HAVE A PULL STRING INSTALLED FOR PULLING OF CABLE. CLEARLY LABEL AS "PULL STRING" INDICATING OPPOSITE END LOCATION.
12. ALL SPARE CONDUITS OR CONDUITS FILLED WITH LESS THAN THE MAXIMUM ALLOWED FILL RATIO SHALL HAVE A PULL STRING INSTALLED AND LEFT FOR FUTURE PULLING OF CABLE. CLEARLY LABEL AS "PULL STRING" INDICATING OPPOSITE END LOCATION.
13. EQUIPMENT NOT RELATED TO THE SUPPORT OF THE TELECOMMUNICATIONS ROOM (E.G., PIPING, DUCTWORK, PNEUMATIC TUBING) SHALL NOT BE INSTALLED IN, PASS THROUGH, OR ENTER THE TELECOMMUNICATIONS ROOM
14. ALL CONDUITS FOR TECHNOLOGY DEVICES SHALL ROUTE FROM THE DEVICE LOCATION AND TERMINATE ABOVE A LAY- IN TYPE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED. IF THE ROOM WHERE THE DEVICE IS LOCATED DOES NOT HAVE A LAY-IN TYPE CEILING TO PREVENT THE CABLES FROM BEING EXPOSED, THE CONDUIT SHALL ROUTE TO THE NEAREST LAY-IN TYPE CEILING OFF A MAIN CORRIDOR OR THE NEAREST MDF/IDF. THE CONDUIT PATHWAY SHALL TAKE THE SHORTEST ROUTE TO THE MAIN CORRIDOR OR THE NEAREST MDF/IDF TO MINIMIZE THE CABLE LENGTH ENSURING THE CABLE LENGTH DOES NOT EXCEED 275 FEET. CONDUIT, CONNECTIONS, J-BOXES, SUSPENSION, ANCHORAGES, AND OTHER CONDUIT COMPONENTS EXPOSED TO VIEW IN PUBLIC SPACES SHALL BE ROUTED AND INSTALLED CAREFULLY TO MINIMIZE VISUAL IMPACT AND SHALL BE FULLY PAINTED TO MATCH UNLESS NOTED OTHERWISE.

KEYED NOTES

1. DATA CABLE WITH 20-FEET OF SLACK NEATLY COILED AND STORED ON J-HOOK ABOVE ACCESSIBLE CEILING FOR CEILING MOUNTED WIRELESS ACCESS POINT. CABLING CONTRACTOR SHALL PLACE A GREEN ADHESIVE DOT ON THE CEILING GRID DIRECTLY BELOW THE OUTLET LOCATION FOR FUTURE IDENTIFICATION OF THE OUTLET LOCATION. DATA DROP SHALL BE PROVIDED AND INSTALLED BY DIVISION 27.
2. DATA CABLE WITH 20-FEET OF SLACK NEATLY COILED AND STORED ON J-HOOK ABOVE ACCESSIBLE CEILING FOR INTERIOR WALL MOUNTED WIRELESS ACCESS POINT. CABLING CONTRACTOR SHALL PLACE A GREEN ADHESIVE DOT ON THE CEILING GRID DIRECTLY BELOW THE OUTLET LOCATION FOR FUTURE IDENTIFICATION OF THE OUTLET LOCATION. DATA DROP SHALL BE PROVIDED AND INSTALLED BY DIVISION 27.
3. DATA CABLE WITH 20-FEET OF SLACK NEATLY COILED AND STORED ON J-HOOK ABOVE ACCESSIBLE CEILING FOR EXTERIOR WALL MOUNTED WIRELESS ACCESS POINT. CABLING CONTRACTOR SHALL PLACE A GREEN ADHESIVE DOT ON THE CEILING GRID DIRECTLY BELOW THE OUTLET LOCATION FOR FUTURE IDENTIFICATION OF THE OUTLET LOCATION. DATA DROP SHALL BE PROVIDED AND INSTALLED BY DIVISION 27.
4. DATA CABLE WITH 20-FEET OF SLACK NEATLY COILED AND STORED ON J-HOOK ABOVE ACCESSIBLE CEILING FOR INTERIOR CEILING MOUNTED VIDEO SURVEILLANCE CAMERA.CABLING CONTRACTOR SHALL PLACE A BLUE ADHESIVE DOT ON THE CEILING GRID DIRECTLY BELOW THE OUTLET LOCATION FOR FUTURE IDENTIFICATION OF THE OUTLET LOCATION. DATA DROP SHALL BE PROVIDED AND INSTALLED BY DIVISION 27.
5. DATA CABLE WITH 20-FEET OF SLACK NEATLY COILED AND STORED ON J-HOOK ABOVE ACCESSIBLE CEILING FOR INTERIOR WALL MOUNTED VIDEO SURVEILLANCE CAMERA. CABLING CONTRACTOR SHALL PLACE A BLUE ADHESIVE DOT ON THE CEILING GRID DIRECTLY BELOW THE OUTLET LOCATION FOR FUTURE IDENTIFICATION OF THE OUTLET LOCATION. DATA DROP SHALL BE PROVIDED AND INSTALLED BY DIVISION 27.
6. DATA CABLE WITH 20-FEET OF SLACK NEATLY COILED AND STORED ON J-HOOK ABOVE ACCESSIBLE CEILING FOR EXTERIOR WALL MOUNTED VIDEO SURVEILLANCE CAMERA.CABLING CONTRACTOR SHALL PLACE A BLUE ADHESIVE DOT ON THE CEILING GRID DIRECTLY BELOW THE OUTLET LOCATION FOR FUTURE IDENTIFICATION OF THE OUTLET LOCATION. DATA DROP SHALL BE PROVIDED AND INSTALLED BY DIVISION 27.
7. DATA CABLE FOR MECHANICAL / ELECTRICAL CONTROLS. REFER TO MECHANICAL / ELECTRICAL DRAWINGS FOR EXACT LOCATION AND CONDUIT ROUGH-IN REQUIREMENTS.
8. DATA CABLES FOR SECURITY PANEL. COORDINATE EXACT LOCATION FOR CONDUIT ROUGH-IN AND TERMINATION REQUIREMENTS WITH THE SECURITY CONTRACTOR PRIOR TO INSTALLATION.
9. DATA CABLE FOR FIRE ALARM PANEL. REFER TO FIRE ALARM DRAWINGS FOR EXACT LOCATION AND CONDUIT ROUGH-IN REQUIREMENTS.
10. (1) DATA CABLE AND (1) RG6 COAXIAL CABLE FOR STANDARD TV WITH OFF-AIR ANTENNA (OFCI). PROVIDE 20-FEET OF SLACK FOR THE DATA CABLE, NEATLY COILED AND STORED ON A J-HOOK ABOVE ACCESSIBLE CEILING. REFER TO AUDIO/VISUAL DRAWINGS FOR EXACT DEVICE LOCATION AND CONDUIT ROUGH-IN REQUIREMENTS.
11. DATA CABLE FOR PUBLIC ADDRESS SPEAKERS (PA). REFER TO PA DRAWINGS FOR EXACT LOCATION AND CONDUIT ROUGH-IN REQUIREMENTS. (BY DIV. 27)
12. DATA CABLE FOR OWNER PROVIDED / OWNER INSTALLED PRINTER.
13. DATA CABLE FOR OWNER PROVIDED / OWNER INSTALLED UKG TIME CLOCK.
14. DATA CABLE FOR WALL MOUNTED PHONE.
15. DATA CABLE FOR PATIENT EDUCATION BOARD.
16. DATA CABLE WITH 20-FEET OF SLACK NEATLY COILED AND STORED ON J-HOOK ABOVE ACCESSIBLE CEILING FOR CANOPY-MOUNTED EXTERIOR VIDEO SURVEILLANCE CAMERA. CABLING SHALL BE ROUTED THROUGH A 1" CONDUIT FROM THE ACCESSIBLE CEILING SPACE TO THE CANOPY STRUCTURE. ALL CONDUIT PENETRATIONS TO EXTERIOR SHALL BE PROPERLY SEALED AND WEATHERPROOFED. DATA DROP SHALL BE PROVIDED AND INSTALLED BY DIVISION 27. REFER TO SECURITY DRAWINGS FOR EXACT LOCATION AND CONDUIT ROUGH-IN REQUIREMENTS.
17. EXISTING DATA CABLE AND CAMERA TO REMAIN. CABLING CONTRACTOR SHALL VERIFY TERMINATION AND LABELING. TEST EXISTING CABLE TO ENSURE FUNCTIONALITY, AND PROTECT ALL EXISTING CABLING AND DEVICES DURING CONSTRUCTION. REFER TO SECURITY DRAWINGS FOR CAMERA LOCATIONS.
18. DATA CABLE FOR VIDEO SURVEILLANCE CAMERA TO BE REMOVED / RELOCATED. EXISTING DATA CABLE AND CAMERA TO BE REMOVED OR RELOCATED AS INDICATED. CABLING CONTRACTOR SHALL COORDINATE WITH SECURITY CONTRACTOR AND OWNER FOR FINAL LOCATION OR DECOMMISSIONING REQUIREMENTS. ALL ABANDONED CABLING SHALL BE REMOVED BACK TO THE NEAREST ACCESSIBLE POINT AND PATCHED PER DIVISION 26 REQUIREMENTS. REFER TO SECURITY DRAWINGS FOR CAMERA LOCATIONS.
19. NOT USED
20. DATA CABLE FOR PATIENT MONITOR (OFOI).
21. DATA CABLES FOR WALL-MOUNTED WORKSTATION IN EXAM AND TREATMENT ROOMS. COORDINATE OUTLET LOCATION AND MOUNTING HEIGHT AT APPROXIMATELY 6'-0" A.F.F. WITH OWNER PRIOR TO INSTALLATION.
22. APPROXIMATE ROUTE THE CONDUIT SHALL TAKE TO GET TO A DROP TILE TYPE CEILING. THE CONDUIT SHALL BE RAN IN THE MOST DIRECT MANNER POSSIBLE. PROVIDE JUNCTION BOXES AS REQUIRED. (BY DIV 26)
23. DATA CABLES FOR VMS SERVER. COORDINATE EXACT LOCATION FOR CONDUIT ROUGH-IN AND TERMINATION REQUIREMENTS WITH THE SECURITY CONTRACTOR PRIOR TO INSTALLATION.
24. DATA CABLE FOR FIRE ALARM CONTROL PANEL (FACP). COORDINATE EXACT LOCATION FOR CONDUIT ROUGH-IN AND TERMINATION REQUIREMENTS WITH THE FIRE ALARM CONTRACTOR PRIOR TO INSTALLATION.

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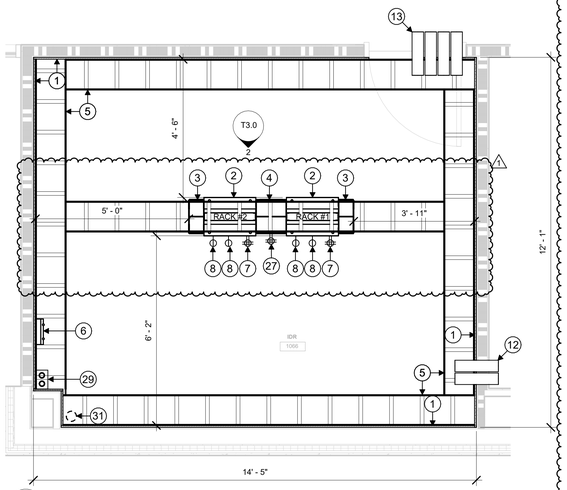
Revisions:

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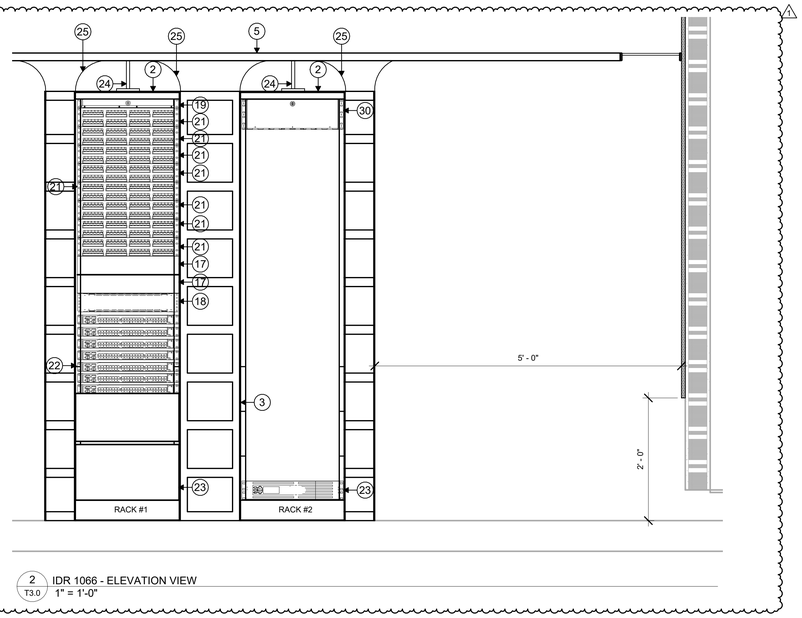
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100% CONTRACT DOCUMENTS

TECHNOLOGY FLOOR PLAN
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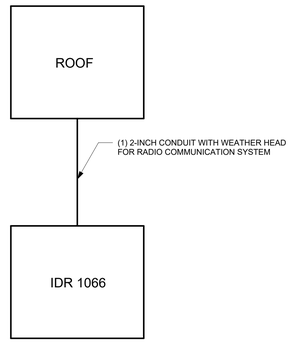
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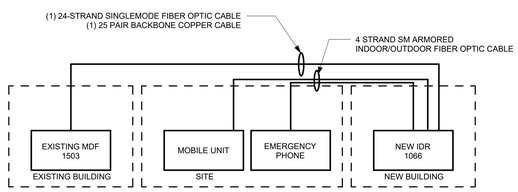
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1/2" = 1'-0"



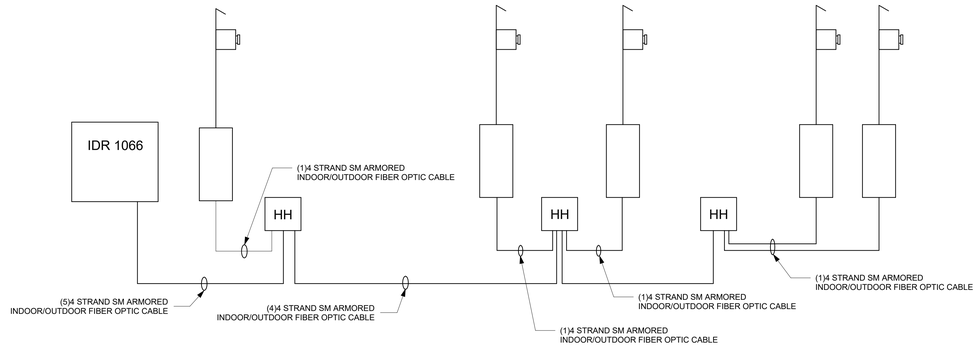
2 T3.0 IDR 1066 - ELEVATION VIEW
1" = 1'-0"



4 T3.0 TECHNOLOGY CONDUIT RISER DIAGRAM
N.T.S.



3 T3.0 COPPER/FIBER BACKBONE RISER DIAGRAM
N.T.S.



5 T3.0 CAMERA AT POLE TECHNOLOGY RISER DIAGRAM
N.T.S.

GENERAL NOTES

1. IN THE EVENT THE CONTRACTOR PROVIDES AND INSTALLS 2-POST EQUIPMENT RACKS IN THE MDF/IDF ROOMS, THE DIVISION 27 CONTRACTOR SHALL COORDINATE WITH THE OWNER TO DETERMINE IF THE OWNER NEEDS ADDITIONAL EQUIPMENT RACK SUPPORT SUCH AS RAILS OR DEEP SHELVING TO SUPPORT FUTURE OWNER PROVIDED/OWNER INSTALLED UPS SYSTEM EQUIPMENT.
2. CONTRACTOR SHALL CONFIRM PATCH PANEL COUNTS WITH CABLE QUANTITIES PRIOR TO BIDDING.
3. EQUIPMENT NOT RELATED TO THE SUPPORT OF THE TELECOMMUNICATIONS ROOM (E.G., PIPING, DUCTWORK, PNEUMATIC TUBING) SHALL NOT BE INSTALLED IN, PASS THROUGH, OR ENTER THE TELECOMMUNICATIONS ROOM.
4. A VERTICAL SECTION OF LADDER RACK SHALL BE ATTACHED TO THE WALLBOARD TO MANAGE BACKBONE CABLES, SERVICE PROVIDER CABLES, OR CABLES AS THEY TRANSITION FROM THE ENTRANCE CONDUITS TO OVERHEAD LADDER RACK.

KEYED NOTES

1. 4-FEET X 8-FEET X ¾-INCH A-C GRADE, VOID FREE, FIRE RATED PLYWOOD INSTALLED VERTICALLY STARTING AT 24-INCHES ABOVE FINISHED FLOOR ON ALL PERIMETER WALLS. PAINT WITH (2) COATS OF FIRE-RETARDANT PAINT. (BY GC)
2. 19-INCH X 84-INCH EQUIPMENT RACK. (BY DIV. 27)
3. 6-INCH VERTICAL WIRE MANAGERS. (BY DIV. 27)
4. 12-INCH VERTICAL WIRE MANAGERS. (BY DIV. 27)
5. 12-INCH LADDER RACK MOUNTED AT 87-INCHES ABOVE FINISHED FLOOR. LADDER RACK SHALL BE SUPPORTED PER MANUFACTURER AND INDUSTRY STANDARDS. (BY DIV. 27)
6. GROUND BUS BAR MOUNTED AT 84-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
7. DEDICATED 20 AMP CIRCUIT WITH SIMPLEX NEMA 5-20R RECEPTACLE MOUNTED TO LADDER RACK AT REAR SIDE OF EQUIPMENT RACKS. (BY DIV. 26)
8. DEDICATED 30 AMP CIRCUIT WITH NEMA L6-30R TWIST LOCK RECEPTACLE MOUNTED TO LADDER RACK AT REAR SIDE OF EQUIPMENT RACKS. (BY DIV. 26)
9. 20 AMP CIRCUIT WITH DUPLEX NEMA 5-20R RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR. MAXIMUM OF (6) PER CIRCUIT. (BY DIV.26)
10. DEDICATED 20 AMP CIRCUIT HARDWIRED TO ACCESS CONTROL SECURITY PANEL. (BY DIV. 26)
11. DEDICATED 20 AMP CIRCUIT HARDWIRED TO INTRUSION DETECTION SECURITY PANEL. (BY DIV. 26)
12. (2) 4-INCH EZ PATH SLEEVES ABOVE ACCESSIBLE CEILING WITH NYLON BUSHINGS ON EACH END AND SECURED TO WALL. SLEEVES SHALL BE USED FOR HORIZONTAL DATA/VOICE/SECURITY CABLE ONLY. (BY DIV. 26)
13. (4) 4-INCH EZ PATH SLEEVES ABOVE ACCESSIBLE CEILING WITH NYLON BUSHINGS ON EACH END AND SECURED TO WALL. SLEEVES SHALL BE USED FOR HORIZONTAL DATA/VOICE/SECURITY CABLE ONLY. (BY DIV. 26)
14. 48-INCHES WIDE X 84-INCHES HIGH RESERVED FOR SECURITY PANEL (BY DIV. 27/28).
15. 48-INCHES WIDE X 84-INCHES HIGH RESERVED FOR PAGING SYSTEM (BY DIV. 27/28).
16. 28-INCHES WIDE X 28-INCHES HIGH RESERVED FOR NURSE CALL TERMINAL CABINET (BY OTHERS).
17. RACK MOUNTED POWER DISTRIBUTION UNIT (BY OTHERS)
18. 2RU HORIZONTAL WIRE MANAGER. (BY DIV 27)
19. 1RU RACK MOUNTED FIBER OPTIC ENCLOSURE. (BY DIV. 27)
20. 2RU 24 PORT CATEGORY 6A RACK MOUNTED PATCH PANEL FOR DATA CABLES. (BY DIV. 27)
21. 2RU 48 PORT CATEGORY 6A RACK MOUNTED PATCH PANEL FOR DATA CABLES. (BY DIV. 27)
22. RACK MOUNTED SWITCH. (BY OTHERS)
23. RACK MOUNTED UPS SYSTEM. (BY OTHERS)
24. LADDER RACK STAND OFF BRACKETS (BY DIV 27)
25. LADDER RACK RADIUS DROPS. (BY DIV 27)
26. LADDER ANGLED CORNER BRACKET. (BY DIV 27)
27. DEDICATED QUADRUPLEX 120V RECEPTACLE ON EMERGENCY POWER, MOUNTED TO LADDER RACK ABOVE CENTER OF EQUIPMENT RACK ROW. (BY DIV. 26)
28. (2) 4-INCH CONCRETE ENCASED SCHEDULE 80 PVC CONDUIT BURIED 36-INCHES BELOW FROM NEW IDF TO THE NEW HANDHOLE LOCATIONS SERVING SOUTH PARKING LOT DEVICES. THE CONTRACTOR SHALL PROVIDE PULL STRING INSIDE EACH CONDUIT. THE CONTRACTOR SHALL PROVIDE NYLON BUSHINGS AND PROTECTIVE CAPS ON EACH END OF THE CONDUIT. (BY DIV. 26).
29. (2) 2-INCH CONCRETE ENCASED SCHEDULE 80 PVC CONDUIT BURIED 36-INCHES BELOW FROM NEW IDF TO THE NEW HANDHOLE LOCATIONS SERVING SOUTH PARKING LOT DEVICES. THE CONTRACTOR SHALL PROVIDE PULL STRING INSIDE EACH CONDUIT. THE CONTRACTOR SHALL PROVIDE NYLON BUSHINGS AND PROTECTIVE CAPS ON EACH END OF THE CONDUIT. (BY DIV. 26).
30. 3RU RACK MOUNTED RESERVED FOR PUBLIC ADDRESS SYSTEM. (BY DIV. 27)
31. (1) 2-INCH CONDUIT SLEEVE RESERVED FOR RADIO COMMUNICATION SYSTEM ANTENNA.

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REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
Anthony Vistein
BICSI ID # 203153
EXPIRES 12-31-26
Anthony Vistein
RCDD
12/19/2025

Revisions:

NO.	DESCRIPTION	DATE
1	ADD 01	01/16/26

12/19/2025
Project No. 2321.06 & 25-3SCP00178
100% CONTRACT DOCUMENTS

TECHNOLOGY ENLARGED VIEWS
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SECTION 00 31 32 - GEOTECHNICAL DATA

PART 1 GENERAL

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. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. A geotechnical investigation report for Project, prepared by Terracon, dated March 6, 2025, is available for viewing as appended to this Document.
   1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
   2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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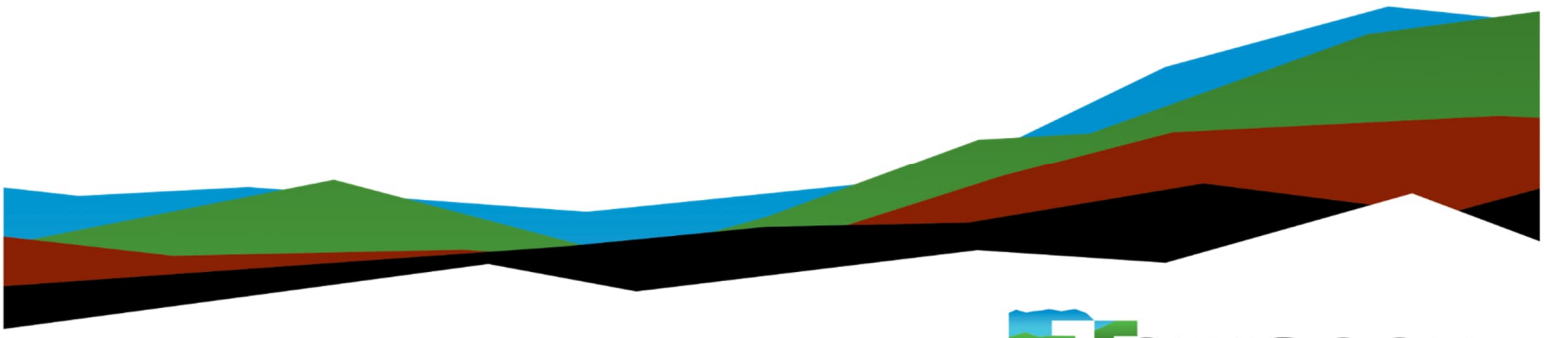
Harris Health – Sunset Heights

Geotechnical Engineering Report

March 6, 2025 | Terracon Project No. 92245604

Prepared for:

Harris Health System
4800 Fournace Place, Suite 5E
Bellaire, Texas 77401



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March 6, 2025

Harris Health System
4800 Fournace Place, Suite 5E
Bellaire, Texas 77401

Attn: Mr. Mark Stewart

Re: Geotechnical Engineering Report
Harris Health – Sunset Heights
1615 North Main Street
Houston, Texas
Terracon Project No. 92245604

Dear Mr. Stewart:

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the project referenced above in Houston, Texas. We trust that this report is responsive to your project needs.

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

Sincerely,

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

Miguel Ortiz-Cahun, Ph.D., E.I.T.
Staff Geotechnical Engineer

Yongwan Kwon, P.E.
Group Manager

Kierstyn M. Burrell, P.E.
Geotechnical Services Manager

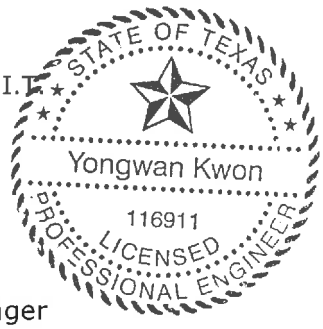


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Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Note: This report was originally delivered in a web-based format. Blue Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

Refer to each individual Attachment for a listing of contents.

Introduction

Terracon Consultants, Inc. (Terracon) is pleased to submit our Geotechnical Engineering report for the proposed construction of a single-story building within the existing Casa de Amigos Clinic facility located at 1615 North Main Street in Houston, Texas. This project was authorized by Ms. Paige McInnis of Harris Health System through issuance of a Purchase order (PO) No. 10000-0002319494, dated January 9, 2025. This project was performed in general accordance with Terracon Proposal No. P92245604, dated December 12, 2024 and with the First Amendment to Agreement for Architectural and Interior Design Services No. HCHD-843-01, dated March 23, 2023.

The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Boring logs with field and laboratory data;
- Description of subsurface conditions;
- Groundwater levels observed during drilling;
- Site and boring location plans;
- Demolition considerations;
- Site and subgrade preparation;
- Foundation design and construction;
- Seismic site class (based on IBC 2021); and
- Pavement design guidelines.

The geotechnical engineering Scope of Services for this project included the advancement of three test borings to a depth of approximately 20 feet below existing grade.

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

Site Conditions

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

Item	Description
Project Location	The project is within the existing Casa de Amigos Clinic facility located at 1615 North Main Street in Houston, Texas. See Site Location.

Item	Description
Existing Improvements[1]	The site was occupied by the existing Casa de Amigos Clinic facility and a single-story building at the southeastern portion of the site. In addition, based on historical photographs, the site was previously occupied by a single-story building at the southwestern portion of the site and demolished between 2010 and 2011. Demolition as it pertains to the foundation elements is unknown at this time. We understand that the existing building at the southwestern portion of the site is planned to be demolished and completely removed as part of the proposed construction.
Current Ground Cover	Grass, weeds, and scattered trees.
Existing Topography	Relatively level.

Project Description

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

Item	Description
Proposed Improvements[1]	The project includes the construction of a single-story building addition with a footprint of about 7,000 square feet and associated pavement areas.
Building Construction[1]	Brick-frame construction with either a grade-supported slab or structurally suspended floor slab.
Finished Floor Elevation	Within approximately one to two feet above existing grade and to match the finished floor elevation of the existing building.
Maximum Loads	▪ Column loads: 75 to 100 kips ▪ Floor slab pressure: 125 pounds per square foot (psf)
Planned Foundation Systems[1]	Either shallow spread/strip footings or drilled-and-underreamed footings.
Pavements	We assume both rigid (concrete) and flexible (asphalt) pavement sections are being considered.

Item	Description
Anticipated Traffic	Consists primarily of passenger vehicles in the parking areas and passenger vehicles combined with garbage trucks and large multi-axle delivery trucks from time-to-time in driveway areas.

1. Based on the information provided by the client.

A site plan showing the layout and footprint of the proposed building addition and pavements was not available at this time. Once this information becomes available, Terracon should be provided with a copy to evaluate the appropriateness of our recommendations.

Geotechnical Characterization

Geology

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

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

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

Geomodel

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

the Exploration and Laboratory Results and the GeoModel can be found in the Figures attachment of this report.

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

Model Layer	Layer Name	General Description
1	Fill: Sandy Lean Clay and Lean Clay	light gray, gray, and tan, with ferrous stains and sand seams
2	Fat Clay	gray and tan, medium stiff to hard, with ferrous nodules and sand pockets
3	Sandy Lean Clay	light gray and tan, stiff to very stiff, with sand pockets and seams, and ferrous stains
4	Clayey Sand and Silty Sand	light gray and tan, medium dense, with clay pockets

Groundwater Conditions

Borings B-1 through B-3 were advanced using dry drilling techniques to their termination depths (about 20 feet) in an effort to evaluate groundwater conditions at the time of our field program. Groundwater was not observed at borings B-1 through B-3 during or upon completion of drilling.

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

Geotechnical Overview

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

- **Fill soils were observed at the ground surface at borings B-1 through B-3 and extended to a depth of about 2 feet. Fill soils may be present at varying depths and at other locations not explored during our field program. Support of the foundation elements, slabs, flatworks, and pavements on or above fill soils is discussed in this report. However, even with the recommended construction testing services, an inherent risk exists for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill.**

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

- **Demolition of the existing building, remnants of the foundation elements (if any) from the previous building, utilities, etc. will be performed to facilitate the construction of the proposed building planned at this site. Special care should be exercised to demolish and remove the existing structure, foundations elements, pavements, utilities, and any buried structure to minimize disturbance of the subgrade and potential detrimental effects on construction of the proposed development at this site. Recommendations of demolition and removal of existing foundations, utilities, etc. are provided in the Demolition Considerations section of this report.**

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

- **For a grade-supported-slab, a minimum 48-inch thick select fill building pad should be placed under the proposed building to provide uniform support to the floor slab and reduce the estimated Potential Vertical Rise (PVR) of the subgrade to approximately one inch or less.**

- **As an alternate option, a structurally suspended floor slab system may be utilized at this site in lieu of a grade-supported floor slab. We recommend that a minimum 8-inch void space be provided beneath the floor slab and grade beams and that the drilled-and-underreamed footings be designed to carry the floor loads.**

- Rigid pavement sections vary from 5.0 to 7.0 inches of reinforced concrete with chemically treated subgrade.
- Flexible pavement sections vary from 2.0 to 2.5 inches of asphaltic concrete over 8.0 to 10.0 inches of base material with chemically treated subgrade.

This summary should be used in conjunction with the entire report for design purposes. Details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled General Comments should be read for an understanding of the report limitations.

Earthwork

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

Site Preparation

Construction areas should be stripped of vegetation, topsoil, trees, and other debris/unsuitable surface material. Roots of trees to be removed within the construction areas should be grubbed to full depths. Care should be taken to replace or recompact all soil removed or loosened by the removal of tree roots and stumps as recommended in subsequent paragraphs. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

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

Proofrolling in the building area is not required if a structurally suspend and supported floor slab system is utilized for the proposed building.

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

Fill Material Types

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

Fill Type[1]	USCS Classification	Acceptable Location for Placement
Select Fill Soils	CL and/or SC (10≤PI≤20)	Must be used to construct the select fill building pad under the floor slab and for all grade adjustments within the building areas.
On-site Soils	Varies	The on-site soils, including undocumented fill material, appear suitable for use as fill within the pavement areas, provided they are free of organics and debris.

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

Fill Compaction Requirements

Item	Description
Fill Lift Thickness	The fill soils should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches.

Item	Description
Compaction Requirements	■ The select fill and on-site soils placed below 4 feet below final grade should be compacted to at least 100 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The select fill and on-site soils placed within 4 feet below final grade should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The select fill soils should be moisture adjusted to within 2 percent of the optimum moisture content. ■ The on-site clay soils should be moisture conditioned to between optimum and +4 percent of the optimum moisture content.

If a structurally suspended and supported floor slab is desired for the proposed building addition, clean on-site soils may be used for grade adjustments under the floor slab. The on-site soils should be compacted to at least 90 to 92 percent of the Standard Effort (ASTM D698) maximum dry density to aid in earth-forming of grade beams, etc. for the structurally suspended floor slab. For pavement areas and soils beneath a grade-supported floor slab, the recommendations in the table above should be followed.

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

Utility Trench Backfill

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

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction. Water permitted to pond next to the building can result in distress in the building. These greater movements can result in unacceptable differential floor slab

movements, cracked slabs and walls, and roof leaks. Building slab and foundation performances described in this report are based on effective drainage for the life of the structures and cannot be relied upon if effective drainage is not maintained.

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

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

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

Wet Weather/Soft Subgrade Considerations

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

Demolition Considerations

Demolition of the existing building, and remnants of the foundation elements (if any) from the previous building, utilities, etc. will be performed to facilitate the construction of the proposed building planned at this site. Special care should be exercised to demolish and/or remove any existing foundations, pavements, utilities, and buried structures to help

reduce the disturbance of the subgrade and potential detrimental effects on construction of the proposed development at this site.

Geophysical methods can be employed on site to help locate and identify foundations, other buried structures, and utilities. This information can be compared to the proposed plans for the site to help avoid conflicts, as well as identify buried structures/utilities not previously known to exist on site. Terracon should be contacted for additional services if geophysical methods are desired to be utilized to aid in the demolition and re-development of the site.

We anticipate that the existing building is supported on shallow footings or grade beams and/or drilled-and-underreamed footings. Shallow footings and grade beams should be removed and the excavation backfilled with properly placed and compacted select fill. If drilled footings are observed, we recommend that the shaft should be broken off at an elevation about 24 to 36 inches below the bottom of the proposed grade beam depth. The remainder of the drilled footing should be left in place. Remnants of the foundation elements to remain should be surveyed. The existing foundations should be superimposed on the proposed development plans to evaluate the potential for obstructions with the new construction. If drilled footings are planned to be excavated and completely removed, Terracon should be contacted for additional recommendations. Complete removal of drilled footings will require significant earthwork activities to backfill the resulting excavations in such a manner as to make the site suitable for new construction.

All utilities and associated bedding material that are planned to be abandoned should be completely removed from within the proposed building areas. As an alternate to complete removal, the existing utilities may be abandoned in-place if they do not interfere with the planned development. If the utilities are abandoned in-place, they should be properly pressure grouted to completely fill the utility.

The excavations resulting from the utilities or other buried structures should be backfilled in accordance with the recommendations provided in the **Fill Compaction Requirements** section. If situations are encountered where compaction of fill would not be efficient because of the size or location of an excavation, the use of cement stabilized sand or flowable fill may be considered as a suitable alternative to select fill. The compressive strength of the cement stabilized sand or flowable fill utilized should be between 50 and 100 pounds per square inch (psi).

Although not observed during our field activities, the potential exists that other types of buried structures (wells, cisterns, etc.) could exist on this site. These buried structures will need to be addressed on an individual basis if encountered during construction.

Foundation Systems

Based on our conversations with the client, we understand that the proposed building addition is planned to be supported using a foundation system consisting of either shallow spread/strip footings or drilled-and-underreamed footings. Based on the subsurface conditions observed during our field and laboratory programs, these type of foundation systems may be utilized to support the proposed building planned at this site, provided the subgrade is properly prepared as described in this report. Recommendations for these types of foundation systems are provided in the following sections, along with other geotechnical considerations for this project.

Design Recommendations – Drilled-and-Underreamed Footings

Item	Description
Minimum Embedment Depth [1]	10 feet below existing grade (grade at the time of our field program)
Allowable Bearing Pressures [2]	Net dead plus sustained live load – 4,800 psf Net total load – 7,200 psf
Maximum Underream-to-Shaft Diameter Ratio	3:1
Minimum Underream-to-Shaft Diameter Ratio [3]	2:1
Estimated Uplift Pressure Due to Post-Construction Heave of the Clay Soils [4]	1,000 psf
Minimum Percentage of Steel [5]	0.5 percent
Approximate Post-Construction Settlement [6]	one inch or less
Estimated Differential Settlement [7]	Approximately ½ of post-construction settlement
Allowable Passive Pressure [8]	1,000 psf
Uplift Resistance [9]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should extend through the fill soils and bear within the native undisturbed clay soils.
2. Whichever condition yields a larger bearing area.
3. This minimum underream-to-shaft diameter ratio should result in a large enough diameter of the underream to overcome uplift forces on the footing without causing local soil failure to the overlying soils.

Item	Description

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

Construction Considerations – Drilled-and-Underreamed Footings

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

Based on our groundwater observations (refer to **Groundwater Conditions**), groundwater is not expected to be a major concern during construction at the recommended bearing depth. However, depending on climatic conditions, groundwater levels may vary from the levels observed during our field program. Water must not be allowed to accumulate in the bottom of the footing excavations. The contractor should be prepared to remove water from the drilled footings, if necessary. To reduce the potential for water seepage into the footing excavation and to minimize disturbance to the bearing area, we recommend that

concrete and steel be placed as soon as possible after footing excavations are completed. Preferably, footing excavations should be backfilled with concrete within about 2 to 4 hours of completion of the drilling and in no case should an excavation be left open overnight. The concrete placed in the excavations should have a 6-inch slump with a plus or minus one inch tolerance. The bottom of each footing excavation should be free of all loose materials and/or water, and the bearing surface should be evaluated immediately prior to placing concrete.

Additionally, the subgrade soils tend to become very silty/sandy below a depth of about 13 feet below existing grade at borings B-1 through B-3. If underreams were attempted below the recommended bearing depth, they would likely become unstable. In addition, significant groundwater seepage could occur. Thus, we recommend the footing depths not be lowered below the recommended bearing depth without discussion and consideration of the consequences. The contractor should not auger the shaft deeper than the recommended bearing depth under any circumstances without contacting us.

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

Grade Beams – Drilled-and-Underreamed Footings

Grade-Supported Floor Slab System

Grade beams associated with the drilled-and-underreamed footings and a grade-supported floor slab should be designed to span between the footings without subgrade support. We understand the grade beams are planned to be constructed without a void space. However, due to the underlying clay soils, nominal upward movement of the grade beams may occur during moisture variations of the subgrade.

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

Structurally Suspended Floor Slab System

As stated previously, we understand that a structurally suspended and supported floor slab system is being considered for this project. For a structurally suspended floor slab system at this site, we recommend a minimum 8-inch void space be provided beneath the grade beams.

Design Recommendations – Shallow Spread/Strip Footings

We do not recommend a foundation system consisting of shallow spread/strip footings be utilized if a structurally suspended and supported slab is utilized.

Item	Description
Minimum Embedment Depth [1]	4 feet below existing grade (grade at the time of our field program)
Allowable Bearing Pressures (Individual Footings) [2]	Net dead plus sustained live load – 3,000 psf Net total load – 4,500 psf
Allowable Bearing Pressure (Strip Footing) [3]	Net dead plus sustained live load – 2,500 psf Net total load – 3,800 psf
Approximate Post-Construction Settlement [4]	Approximately one inch
Estimated Post-Construction Differential Settlement [5]	Approximately ½ of post-construction settlement
Allowable Passive Pressure [6]	750 psf
Allowable Frictional Resistance [7]	250 psf
Uplift Resistance [8]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should extend through the fill soils and bear upon the native undisturbed clay soils.
2. Whichever condition yields a larger bearing area.
3. Defined as a footing at least twice as long as it is wide.
4. This estimated post-construction settlement of the shallow footings is without considering the effect of stress distribution from adjacent foundations and assuming proper construction practices are followed. A clear distance between footings (new and existing) of one footing size of the larger of the two footings should not produce overlapping stress distributions and would essentially behave as independent foundations.
5. The post-construction differential settlements may result from variances in subsurface conditions, loading conditions, and construction procedures. The settlement response of the footings will be more dependent upon the quality of construction than upon the response of the subgrade to the foundation loads.
6. The passive pressure along the exterior face of the footings should be neglected within the upper 4 feet due to surface effects and the presence of fill and expansive soils unless pavement is provided

Item	Description

up to the edge of the structures. For interior footings, the allowable passive pressure may be used for the entire depth of the footing.

7. To be utilized on the base of the footings.
8. Structural uplift loads on the shallow footings may be resisted by the weight of the foundation plus the weight of any soil directly above the foundation. The ultimate uplift capacity of shallow footings should be reduced by an appropriate factor of safety to compute allowable uplift capacity.

Construction Considerations – Shallow Spread/Strip Footings

Excavations for shallow footings should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the foundation excavations should be completed with a smooth-mouthed bucket or by hand labor. The excavations should be neatly excavated and properly formed. Debris in the bottom of the excavation should be removed prior to steel placement. Based on the groundwater observations obtained during our field program (refer to Groundwater Conditions), significant groundwater seepage is not anticipated for shallow footings at the recommended bearing depth. However, water should not be allowed to accumulate at the bottom of the foundation excavations. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that concrete and steel be placed as soon as possible after the excavations are completed. Excavations should not be left open overnight. The bearing surface of the shallow footings should be evaluated immediately prior to placing concrete or a seal slab.

A thin seal slab of lean concrete (approximately 2 to 4 inches thick) should be placed at the bottom of the footing excavation to protect the bearing surface of the footings from disturbance and/or infiltration of ground/surface water if the footing cannot be poured within the same day of excavation.

Connection of Building Addition to Existing Building

Based on the information provided to us, we understand that the new building addition is planned to be built immediately adjacent and connected to the existing building. Due to the independence of the existing and proposed foundations systems, differential movements may occur between the foundation systems. The magnitude of the differential movement will be primarily dependent upon the stability of the moisture content of the near-surface soils, the quality of foundation construction and subgrade preparation utilized for the building addition, and the performance of the foundation system of the existing structure. Therefore, any members or connections of the new building addition which are common to the adjacent existing structure should be designed such that they are tolerant to differential movements whenever possible.

Foundation Construction Monitoring

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

Floor Slab

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

Grade-Supported Floor Slab System Associated with Shallow Spread/Strip Footings or Drilled-and-Underreamed Footings

The near surface soils observed at this site generally exhibit a medium to high expansion potential. These soils can subject the interior floor slab of the building to significant movements (due to shrinking and swelling) with fluctuations in their moisture content. This movement potential is influenced primarily by the properties of the subgrade soils, as well as the moisture content of the subgrade at the time of construction, overburden pressures, and the stability of the moisture contents throughout the life of the building. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of up to approximately 2½ inches. Therefore, we highly recommend that the near-surface soils be prepared as stated below to reduce the potential for slab movement associated with volumetric changes of the near-surface clay soils due to moisture variations to a more acceptable level. The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structure after construction.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the grade-supported floor slab. The corresponding decrease in the potential soil movements is primarily a function of the fill pad thickness and the moisture levels of the underlying clay subgrade. While the indicated preparations do not eliminate the potential

for soil movement, the magnitude of such movements should be reduced to more acceptable levels. To provide uniform support to the floor slab and to reduce the estimated PVR to approximately one inch or less, we recommend that a minimum 48 inches of properly placed and compacted select fill material be constructed immediately beneath the floor slab. The select fill pad should extend a minimum of 5 feet beyond the edge of the building area. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the structure.

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

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

Structurally Suspended Floor Slab System Associated with Drilled-and-Underreamed Footings

As stated previously, we understand that a structurally suspended and supported floor slab system in being considered for this project. Due to the presence of high plasticity clay soils observed at this site, the most effective means of reducing the effects of floor slab movements resulting from volume changes of the soils would be to structurally suspend the floor slab above grade. For a structurally suspended floor slab system at this site, we recommend a minimum 8-inch void space be provided beneath the floor slab and grade beams and that the drilled-and-underreamed footing foundation system be designed to carry the additional loads.

We also recommend that measures be taken to reduce the possibility of water accumulation in the void space areas below the floor slab and grade beams. In addition, proper ventilation should be provided to minimize the possibility that a high humidity environment could develop in the void space areas.

Proper construction of void space and soils retainers is very important. If a cardboard carton system is used on this project, we recommend that the carton form supplier provide, during initial concrete operations, a representative to instruct the work force on the proper installation methods for both the form and the concrete.

Furthermore, we recommend that at ingress/egress areas (entrances, exits, emergency exits, etc.) around the perimeter of the proposed building the structurally suspended slab be extended at least 5 to 10 feet away from the building to help prevent slab movements from affecting the opening and closing of doors. Flatwork areas located immediately adjacent to the structurally suspended slab may be affected by differential movements between the structural slab and on-site soils. To reduce the potential for differential movement in these areas, we recommend constructing a select fill pad beneath areas considered sensitive to movement. Recommendations to reduce the estimated PVR in these areas are located in the **Grade-Supported Floor Slab System Associated with Shallow Spread/Strip Footings or Drilled-and-Underreamed Footings** section of this report.

Pavements

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

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

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

Pavement Area	Traffic Design Index [1]	Description
Driveways and Truck Traffic Areas (Medium Duty)	DI-3	Medium traffic (Including not over 300 heavily loaded two axle trucks plus lightly loaded trucks with three or more axles and no more than 30 heavily loaded trucks with more than three axles per day.) (EAL = 21-75)

1. Based on NSSGA traffic design indices.
2. Equivalent daily 18-kip single-axle load applications.

The top 6 inches of the finished subgrade soils directly beneath the pavements should be chemically treated with lime. The decision about the type and proper amount of additive should be made after the subgrade is open for inspection. Chemical treatment will increase the supporting value of the subgrade and decrease the effect of moisture on subgrade soils. These 6 inches of treatment is a required part of the pavement design and is not a part of the site and subgrade preparation for wet/soft subgrade conditions.

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

Rigid Pavement System			
Component	Material Thickness, Inches		
	DI-1	DI-2	DI-3
Reinforced concrete	5.0	6.0	7.0
Treated subgrade	6.0	6.0	6.0

Flexible Pavement System		
Component	Material Thickness, Inches	
	DI-1	DI-2
Asphaltic concrete	2.0	2.5
Base material	8.0	10.0
Treated subgrade	6.0	6.0

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

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

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

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

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

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

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

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

conventional saw or one inch when using early entry saws. The width of the cut should be in accordance with the joint sealant manufacturer recommendations.

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

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

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

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

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

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

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

Base Material – Base material should be composed of crushed limestone or crushed concrete meeting the requirements of TxDOT 2014 Standard Specifications Item 247, Type A or D, Grade 1 or 2. The base material should be compacted to at least 95 percent of the Modified Effort (ASTM D1557) maximum dry density at moisture content within 2 percent of the optimum moisture content.

Lime Treated Subgrade – The onsite clay fill soils should be treated with lime in accordance with the TXDOT 2014 Standard Specifications Item 260. The amount of lime should be determined for subgrade soils by conducting laboratory tests just prior to construction. Based on the classification test results, we recommend that about 5 to 7 percent lime by

dry weight be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 25 to 35 pounds of lime per square yard per 6-inch depth. The actual quantity of lime should be determined at the time of construction based on lime determination tests conducted using bulk samples of the subgrade soils. The pulverization, mixing and curing of the lime treated subgrade is of particular importance in these clays. The subgrade should be compacted to a minimum of 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content between optimum and 4 percent wet of the optimum moisture content.

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

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

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

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

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

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

General Comments

Our work is conducted with the understanding of the project as described in the proposal and incorporates collaboration with the design team as we completed our services to verify assumptions. Revision of our understanding to reflect actual conditions important to our work was based on these verifications and it is reflected in this report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

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

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

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is solely for information purposes only. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided

information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing.

Figures

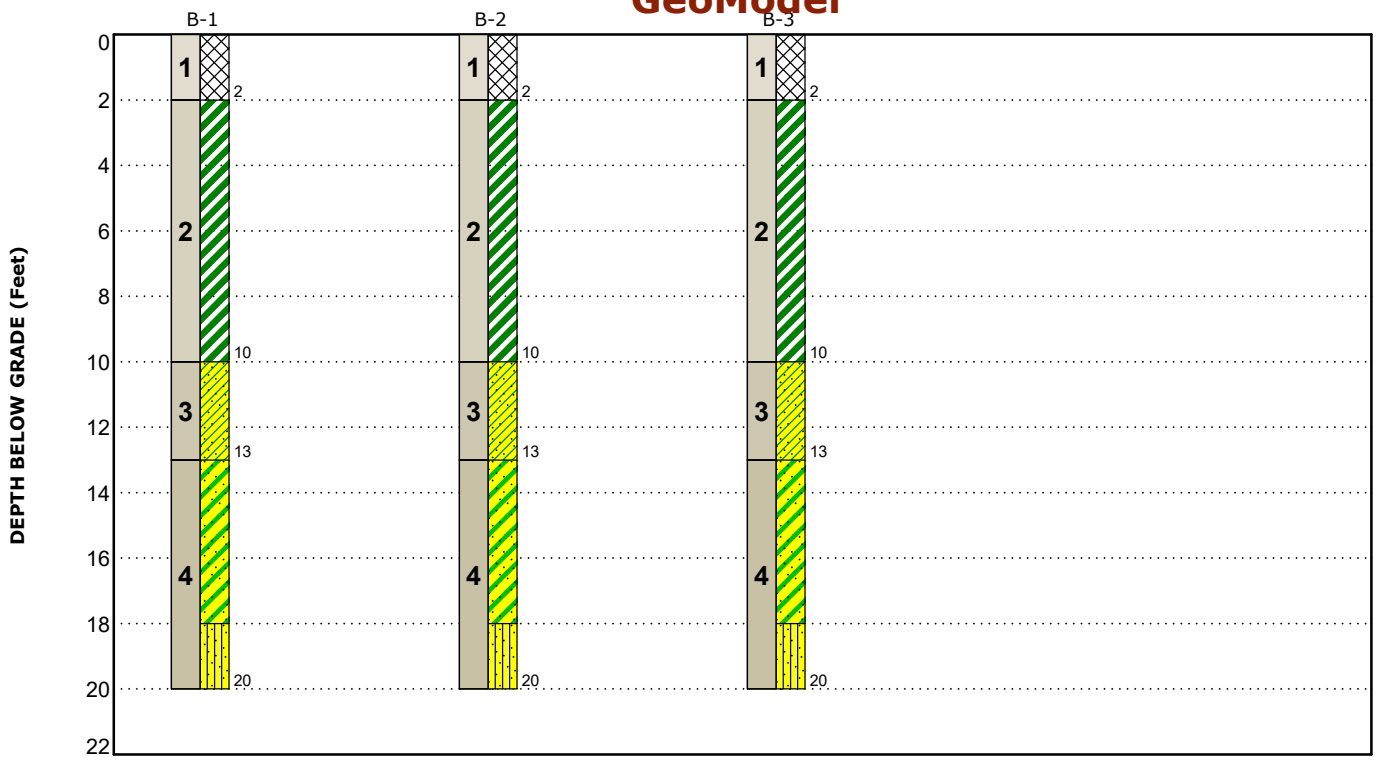
Contents:

GeoModel

Harris Health - Sunset Heights
1615 North Main Street | Houston, Texas
Terracon Project No. 92245604

Terracon
11555 Clay Rd, Ste 100
Houston, TX

GeoModel



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

Model Layer	Layer Name	General Description
1	**Fill: Sandy Lean Clay and Lean Clay**	light gray, gray, and tan, with ferrous stains and sand seams
2	**Fat Clay**	gray and tan, medium stiff to hard, with ferrous nodules and sand pockets
3	**Sandy Lean Clay**	light gray and tan, stiff to very stiff, with sand pockets and seams, and ferrous stains
4	**Clayey Sand and Silty Sand**	light gray and tan, medium dense, with clay pockets

Legend

- Fill
- Fat Clay
- Sandy Lean Clay
- Clayey Sand
- Silty Sand

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

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet) [1]	Location
3 (B-1 through B-3)	20	Building and pavement areas

1. Below existing grade at the time of our field program.

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

Subsurface Exploration Procedures: We advanced soil borings with a standard truck-mounted drill rig using solid stem continuous flight augers. Samples were obtained at 2-foot intervals in the upper 12 feet of each boring and at intervals of 5 feet thereafter. Soil samples were recovered using open-tube samplers. Hand penetrometer tests were performed on samples of soils in the field to serve as a general measure of consistency.

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

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

Property Disturbance: We backfilled the borings with auger cuttings upon completion. Excess auger cuttings were dispersed in the general vicinity of the boring. Our services do not include repair of the site beyond backfilling our borings. Because backfill material often settles below the surface after a period, we recommend borings be periodically checked and backfilled, if necessary. We can provide this service for additional fees, at your request.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- **ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass**
- **ASTM D7263 Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens**
- **ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils**
- **ASTM D1140 Standard Test Method for Determining the Amount of Materials Finer than No. 200 Sieve in Soils by Washing**
- **ASTM D2166/D2166M Standard Test Method for Unconfined Compressive Strength of Cohesive Soil**

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

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

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-3)

Note: All attachments are one page unless noted above.

Harris Health - Sunset Heights
1615 North Main Street | Houston, Texas
Terracon Project No. 92245604

11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 29.7735° Longitude: -95.3616°

Depth (Ft.)	Graphic Log	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2.0		**FILL - LEAN CLAY WITH SAND (CL)**, light gray and tan, with ferrous stains and sand seams				1.0 (HP)				19.2		42-16-26	
						1.5 (HP)							
			5			1.25 (HP)	UC	1.21	9	21.0	104		
						1.5 (HP)							
10.0						3.0 (HP)				18.2		56-17-39	
13.0		**SANDY LEAN CLAY (CL)**, light gray, very stiff, with sand pockets and ferrous stains	10			3.75 (HP)	UC	2.95	10.1	16.3	113		
		CLAYEY SAND (SC), light gray and tan, medium dense				4.0 (HP)							
18.0			15										
		SILTY SAND (SM), tan, medium dense, with clay pockets				4.0 (HP)							
20.0		***Boring Terminated at 20 Feet***	20										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed

Drill Rig
Truck

Driller
Herman Drilling

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
H. Zamudio

Boring Started
01-23-2025

Boring Completed
01-23-2025

Harris Health - Sunset Heights
1615 North Main Street | Houston, Texas
Terracon Project No. 92245604

11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 29.7735° Longitude: -95.3613°

Depth (Ft.)	Graphic Log	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2.0		**FILL - SANDY LEAN CLAY (CL)**, tan and gray, with sand seams				4.5 (HP)							
		FAT CLAY (CH), gray and tan, stiff to very stiff, with ferrous nodules				4.5 (HP)	UC	3.39	2.5	15.2	107	57-16-41	
			5			3.25 (HP)							
						1.5 (HP)				22.2		63-19-44	
10.0						3.0 (HP)	UC	2.97	8.3	22.7	106		
		SANDY LEAN CLAY (CL), light gray and tan, very stiff, with sand seams	10			3.75 (HP)							
13.0													
		CLAYEY SAND (SC), light gray and tan, medium dense				2.0 (HP)							
			15										
18.0													
		SILTY SAND (SM), tan, medium dense				2.5 (HP)							
20.0			20										
		Boring Terminated at 20 Feet											

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed

Drill Rig
Truck

Driller
Herman Drilling

Notes

Advancement Method
Dry augered to 20 feet.

Logged by
H. Zamudio

Boring Started
01-23-2025

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Boring Completed
01-23-2025

Harris Health - Sunset Heights
1615 North Main Street | Houston, Texas
Terracon Project No. 92245604

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 29.7733° Longitude: -95.3613°

Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
0.0	**FILL - SANDY LEAN CLAY (CL)**, tan and gray, with sand seams				0.75 (HP)				19.6		32-15-17	
2.0	**FAT CLAY (CH)**, gray and tan, medium stiff to hard, with ferrous nodules				1.0 (HP)				18.9			91.1
		5			4.5 (HP)	UC	4.62	7.2	13.5	118	53-15-38	
					4.0 (HP)							
10.0					4.0 (HP)							
	SANDY LEAN CLAY (CL), light gray and tan, very stiff, with sand seams	10			3.5 (HP)	UC	3.96	2.8	15.9	115		
13.0												
	CLAYEY SAND (SC), light gray and tan, medium dense				4.5 (HP)							
		15										
18.0												
	SILTY SAND (SM), tan, medium dense, with clay pockets				1.25 (HP)							
20.0	***Boring Terminated at 20 Feet***	20										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed

Drill Rig
Truck

Driller
Herman Drilling

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
H. Zamudio

Boring Started
01-23-2025

Boring Completed
01-23-2025

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

Harris Health - Sunset Heights
1615 North Main Street | Houston, Texas
Terracon Project No. 92245604

Terracon
11555 Clay Rd, Ste 100
Houston, TX

General Notes

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

Descriptive Soil Classification

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

Location And Elevation Notes

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

Strength Terms

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

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

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

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

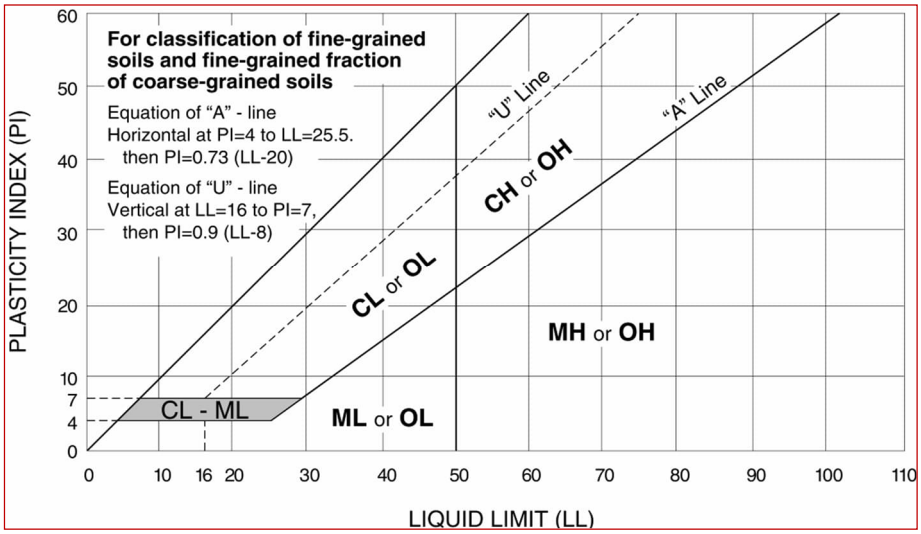
Relevance of Exploration and Laboratory Test Results

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

Unified Soil Classification System

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

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



SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Work covered by Contract Documents.
   2. Work performed by Owner.
   3. Contractor's use of site and premises.
   4. Work restrictions.
   5. Specification and Drawing conventions.

1.2 DEFINITIONS

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

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
   1. The project consists a of a single-story urgent care building expansion located at 1615 Main St, Houston, Texas 77009. The project will include the addition and site modifications, including development of a new staff parking lot and renovation of the existing north parking lot. And other work indicated in the Contract Documents.

1.4 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limits on 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. Driveways, Walkways and Entrances: Keep driveways, parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.6 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to hours approved by Owner. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two days in advance of proposed disruptive operations.
   2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: .
   1. Base Bid: as indicated on Drawing and as specified in Section ".".
   2. Alternate: as indicated on Drawing and as specified in Section ".".

END OF SECTION

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SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form provided in Project Manual.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
      j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
      k. Cost information, including a proposal of change, if any, in the Contract Sum.
      l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
      m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 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.

1.4 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.

1.5 PROCEDURES

A. Submit Substitution Requests with clearly defined “Cause” in compliance with this specification section.
    1. If a Substitution request is approved, compliance with Section 01 33 00 “Submittal Procedures” is required, in addition to specific submittal requirements specified in individual specification sections.

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution during the bidding period, up until seven days prior to the date of bid opening. Once the project has been bid, submit requests for substitution for cause 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: Not allowed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SUBSTITUTION REQUEST
BIDDING PHASE

PROJECT NO. & TITLE: 2321.06 Sunset Heights Urgent Care

TO (ARCHITECT):
O'Connell Robertson

FROM (BIDDER):

HEREBY REQUESTS ACCEPTANCE OF THE FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF THE BIDDING DOCUMENTS:

1. SPECIFIED PRODUCT OR SYSTEM:
   Substitution request for (Generic Description): _____

   Specification Section No._____ Article(s) _____ Para(s) _____

2. SUPPORTING DATA:
   - ☐ Product data for proposed substitution is attached (description of product, reference standards, performance and test data).

   ☐ Sample is attached ☐ Sample will be sent if requested

3. QUALITY COMPARISON:

	SPECIFIED PRODUCT	SUBSTITUTION
Name, brand:		
Catalog No.:		
Manufacturer:		
Vendor:		
Significant variations:		

   Maintenance Service Available: ☐ yes ☐ no

   Spare Parts Source: _____

4. PREVIOUS INSTALLATIONS:
   Identification of similar projects on which proposed substitution was used: (Attach list)
   Project: _____ Architect: _____
   Address: _____ Owner:_____
   _____ Date Installed: _____

5. REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:
   _____
   _____

6. EFFECT OF SUBSTITUTION:
   Proposed substitution affects other parts of Work: ☐ No ☐ Yes (If yes, explain)
   _____
   _____

   Substitution requires dimensional revision or redesign of structure or M & E Work:

   ☐ No ☐ Yes (If yes, attach complete data.)

7. BIDDER'S/SUPPLIER'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

I/we have investigated the proposed substitution. I/we:

- ☐ believe that it is equal or superior in all respects to specified product, except as stated above; and
- ☐ will provide the same warranty as specified for specified product; and
- ☐ have included complete implications of the substitution; and
- ☐ will pay redesign and other costs caused by the substitution which subsequently become apparent; and
- ☐ will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning resulting from the substitution.
- ☐ warrant and represent to the Owner and the Architect that the proposed substitution does not infringe on any patents or other rights held by others, or that a license has been or will be obtained timely from the holders of such rights for the use of the substitute as proposed; and acknowledge that by accepting this substitution neither the Architect nor the Owner makes any warranty or representation to the Contractor or any Subcontractor regarding the existence or potential for such infringement.

Bidder/Supplier: _____ Date: _____

By: _____

Answer all questions and complete all blanks - use "NA" if not applicable.

_____

_____

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.

_____ _____

Architect/Engineer Signature Date

SUBSTITUTION REQUEST
AFTER EXECUTION OF CONTRACT

PROJECT NO. & TITLE: 2321.06 Sunset Heights Urgent Care

TO (ARCHITECT):
O'Connell Robertson

FROM (CONTRACTOR):

HEREBY REQUESTS ACCEPTANCE OF THE FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF DIVISION ONE OF SPECIFICATIONS:

1. SPECIFIED PRODUCT OR SYSTEM:
   Substitution request for (Generic Description): _____

   Specification Section No._____ Article(s) _____ Para(s) _____

2. SUPPORTING DATA:
   - ☐ Product data for proposed substitution is attached (description of product, reference standards, performance and test data).
   - ☐ Sample is attached
   - ☐ Sample will be sent if requested

3. QUALITY COMPARISON:

	SPECIFIED PRODUCT	SUBSTITUTION
Name, brand:		
Catalog No.:		
Manufacturer:		
Vendor:		
Significant variations:		

   Maintenance Service Available: ☐ yes ☐ no

4. PREVIOUS INSTALLATIONS:
   Identification of similar projects on which proposed substitution was used: (Attach list)

   Project: _____ Architect: _____

   Address: _____ Owner: _____

   _____ Date Installed: _____

5. REASON FOR NON-AVAILABILITY OF SPECIFIED ITEM:
   Attach affidavit, certification or other data as proof of non-availability.

   - ☐ Strikes
   - ☐ Lockouts
   - ☐ Bankruptcy
   - ☐ Discontinuance of production
   - ☐ Proven shortage
   - ☐ Similar occurrences (explain below)

   _____

   _____

6. EFFECT OF SUBSTITUTION:
Proposed substitution affects other parts of Work: ☐ No ☐ Yes (If yes, explain)

_____

_____

Substitution changes Contract Time: ☐ No ☐ Yes Add/Deduct_____ day

Substitution requires dimensional revision or redesign of structure or M & E Work:

☐ No ☐ Yes (If yes, attach complete data.)

Saving or credit to Owner, if any, for accepting substitution: $ _____

7. CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

I/we have investigated the proposed substitution. I/we:

☐ believe that it is equal or superior in all respects to specified product, except as stated above;
☐ will provide the same warranty as specified for specified product;
☐ have included complete cost data and implications of the substitution;
☐ will pay redesign and special inspection costs caused by the use of this product;
☐ will pay additional costs to other contractors caused by the substitution;
☐ will coordinate the incorporation of the proposed substitution in the Work;
☐ will modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning;
☐ waive future claims for added cost to Contract caused by the substitution;
☐ warrant and represent to the Owner and the Architect that the proposed substitution does not infringe on any patents or other rights held by others, or that a license has been or will be obtained timely from the holders of such rights for the use of the substitute as proposed; and acknowledge that by accepting this substitution neither the Architect nor the Owner makes any warranty or representation to the Contractor or any Subcontractor regarding the existence or potential for such infringement.

Contractor: _____ Date: _____

By: _____

Answer all questions and complete all blanks - use "NA" if not applicable.

ARCHITECT'S REVIEW AND ACTION:

☐ No Exceptions Taken: The submittal is acceptable as submitted and no changes are necessary. No re-submittal is required.

☐ Exceptions Noted, Resubmit: All notations marked on the submittal must be addressed and re-submitted for review. Submit new drawings or data with notations incorporated.

☐ Rejected: The submittal does not conform with the Contract Documents and must be re-submitted.

☐ Pending Additional Information: Submittal is incomplete and lacks information required per specifications. Submit the requested information for review.

_____ _____

Architect/Engineer Signature Date approval from the A/E.

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
   7. Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00 - PAYMENT PROCEDURES

OHTPART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 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.

1.3 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 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.

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. Round dollar amounts to whole dollars, with total equal to Contract Sum.
         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. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
   5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site.

6. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
7. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
8. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
9. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 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.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
   1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts 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.

E. 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.

F. Transmittal: Submit one signed and notarized pdf file of each Application for Payment to Architect by a method ensuring receipt.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   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 preceded 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.

H. Include the following with each Application for Payment:
   1. Construction progress schedules, revised and current, as specified in Section 01 33 00 – Submittal Procedures.
   2. Periodic Construction Photographs, as specified in Section 01 32 33 “Photographic Documentation.” Provide number of photos required to substantiate completed Work, as well as photographs of procured stored materials.
   3. Affidavits attesting to off-site stored products.
   4. As stipulated in the Agreement, submit partial release of liens from major Subcontractors and vendors.

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. Products list (preliminary if not final).
   5. Schedule of unit prices.
   6. Submittal schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.

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.
      a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 77 00 "Closeout Procedures."
   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. Certification of completion of final punch list items.
   3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   4. Updated final statement, accounting for final changes to the Contract Sum.
   5. AIA Document G706.
   6. AIA Document G706A.
   7. AIA Document G707.
   8. Evidence that claims have been settled.
   9. 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.
   10. Final liquidated damages settlement statement.
   11. Proof that taxes, fees, and similar obligations are paid.
   12. Waivers and releases.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SUMMARY

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

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in Project meeting room, in temporary field office, and in prominent location in each built facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Information Exchange: Architect uses Newforma for Construction Administration information exchange with the Contractor, including RFIs, Submittals, Proposed Change Orders and Change Order Requests.

B. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. 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.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than 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 coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate

layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. 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, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format:
      a. Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using PDF format.
   3. Architect will furnish Contractor one set of pdf files of Drawings for use in preparing coordination digital data files.
      a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
   2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
   1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
   1. The following Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number, including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.

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

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

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 days prior to meeting.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
   1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Responsibilities and personnel assignments.
      b. Tentative construction schedule.
      c. Phasing.
      d. Critical work sequencing and long lead items.
      e. Designation of key personnel and their duties.
      f. Lines of communications.
      g. Use of web-based Project software.
      h. Procedures for processing field decisions and Change Orders.
      i. Procedures for RFIs.
      j. Procedures for testing and inspecting.
      k. Procedures for processing Applications for Payment.
      l. Distribution of the Contract Documents.
      m. Submittal procedures.
      n. Preparation of Record Documents.
      o. Use of the premises.
      p. Work restrictions.
      q. Working hours.
      r. Owner's occupancy requirements.
      s. Responsibility for temporary facilities and controls.
      t. Procedures for moisture and mold control.
      u. Procedures for disruptions and shutdowns.
      v. Construction waste management and recycling.
      w. Parking availability.
      x. Office, work, and storage areas.
      y. Equipment deliveries and priorities.
      z. First aid.
      aa. Security.
      bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.
      j. Compatibility requirements.
      k. Time schedules.
      l. Weather limitations.
      m. Manufacturer's written instructions.
      n. Warranty requirements.
      o. Compatibility of materials.
      p. Acceptability of substrates.
      q. Temporary facilities and controls.
      r. Space and access limitations.
      s. Regulations of authorities having jurisdiction.
      t. Testing and inspecting requirements.
      u. Installation procedures.
      v. Coordination with other work.
      w. Required performance results.
      x. Protection of adjacent work.
      y. Protection of construction and personnel.
   3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
   5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    a. Preparation of Record Documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Procedures for completing and archiving web-based Project software site data files.
    d. Submittal of written warranties.
    e. Requirements for completing sustainable design documentation.
    f. Requirements for preparing operations and maintenance data.
    g. Requirements for delivery of material samples, attic stock, and spare parts.
    h. Requirements for demonstration and training.
    i. Preparation of Contractor's punch list.
    j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    k. Submittal procedures.
    l. Coordination of separate contracts.
    m. Owner's partial occupancy requirements.
    n. Installation of Owner's furniture, fixtures, and equipment.
    o. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals as defined by Project.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
        1) Review schedule for next period.
    b. Review present and future needs of each entity present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Status of sustainable design documentation.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site use.
        9) Temporary facilities and controls.
        10) Progress cleaning.
        11) Quality and work standards.
        12) Status of correction of deficient items.
        13) Field observations.
        14) Status of RFIs.
        15) Status of Proposal Requests.

16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file.
   2. PDF file.

B. Startup construction schedule.
   1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
   3. Total Float Report: List of activities sorted in ascending order of total float.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at monthly intervals.

H. Material Location Reports: Submit at monthly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.4 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss constraints, including work stages interim milestones and partial Owner occupancy.
   4. Review delivery dates for Owner-furnished products.
   5. Review schedule for work of Owner's separate contracts.
   6. Review submittal requirements and procedures.
   7. Review time required for review of submittals and resubmittals.
   8. Review requirements for tests and inspections by independent testing and inspecting agencies.
   9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
   10. Review and finalize list of construction activities to be included in schedule.

11. Review procedures for updating schedule.

1.5 COORDINATION

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

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Include the following activities related to HVAC scope:
      a. HVAC Install
      b. HVAC Electrical Hook Up
      c. HVAC Start Up
      d. HVAC Controls Hook Up
      e. Test and Balance
      f. Commissioning
   3. Temporary Facilities: Indicate start and completion dates for the following as applicable:
      a. Securing of approvals and permits required for performance of the Work.
      b. Temporary facilities.
      c. Construction of mock-ups, prototypes and samples.
      d. Owner interfaces and furnishing of items.
      e. Interfaces with Separate Contracts.
      f. Regulatory agency approvals.
      g. Punch list.
   4. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   5. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
   6. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
   7. Commissioning Activities: Coordinate with the commissioning authority and schedule all sequences of work required to complete the commissioning process for all pertinent systems and equipment, including any start-up activities such as energization, third-party testing, flushing and passivation, manufacturer start-ups, test and balance, networking, controls integration, and functional performance testing. The commissioning process shall be coordinated and scheduled in such a way as to allow for all functional performance testing and Owner training to be completed prior to Substantial Completion.

8. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
9. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Work Restrictions: Show the effect of the following items on the schedule:
      a. Partial occupancy before Substantial Completion.
      b. Use-of-premises restrictions.
      c. Seasonal variations.
      d. Environmental control.
   2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
      a. Subcontract awards.
      b. Submittals.
      c. Purchases.
      d. Mockups.
      e. Fabrication.
      f. Sample testing.
      g. Deliveries.
      h. Installation.
      i. Tests and inspections.
      j. Adjusting.
      k. Curing.
      l. Building flush-out.
      m. Startup and placement into final use and operation.
      n. Commissioning.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:
   1. Temporary enclosure and space conditioning.

F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
   1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and the Contract Time.

H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Final Completion percentage for each activity.

I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

J. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
   a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
   a. Preparation and processing of submittals.
   b. Mobilization and demobilization.
   c. Purchase of materials.
   d. Delivery.
   e. Fabrication.
   f. Utility interruptions.
   g. Installation.
   h. Work by Owner that may affect or be affected by Contractor's activities.
   i. Testing and inspection.
   j. Commissioning.
   k. Punch list and Final Completion.
   l. Activities occurring following Final Completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.8 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions, including presence of rain or snow.
   7. Testing and inspection.
   8. Accidents.
   9. Meetings and significant decisions.
   10. Unusual events.
   11. Stoppages, delays, shortages, and losses.
   12. Meter readings and similar recordings.
   13. Emergency procedures.
   14. Orders and requests of authorities having jurisdiction.
   15. Change Orders received and implemented.
   16. Construction Change Directives received and implemented.
   17. Services connected and disconnected.
   18. Equipment or system tests and startups.
   19. Partial completions and occupancies.
   20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
   1. Material stored prior to previous report and remaining in storage.
   2. Material stored prior to previous report and since removed from storage and installed.
   3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
   1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.1 SUMMARY

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

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Submit photos by uploading to Newforma Info Exchange site. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with date, Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag excavation areas and construction limits before taking construction photographs.
   2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
   3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
   4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
   1. Underground utilities.
   2. Underslab services.
   3. Piping.
   4. Electrical conduit.
   5. Waterproofing and weather-resistant barriers.

E. Periodic Construction Photographs: Take 50 photographs monthly, 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. Comply with Section 01 29 00 "Payment Procedures."

F. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

G. Additional Photographs: Architect 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 shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
      d. Substantial Completion of a major phase or component of the Work.
      e. Extra record photographs at time of final acceptance.
      f. Owner's request for special publicity photographs.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submittal schedule requirements.
   2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

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

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal Category: Action; informational.
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Architect's final release or approval.
      g. Scheduled dates for purchasing.
      h. Scheduled date of fabrication.
      i. Scheduled dates for installation.
      j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
   1. Project name.
   2. Date.
   3. Name of Architect.

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

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
1. Comply with Section 01 25 00 “Substitution Procedures” for products by manufacturers not listed in individual specification sections.

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

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Newforma Info Exchange: Prepare submittals in PDF format, and send via Newforma Info Exchange. Enter required data in Newforma Info Exchange to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. Submittals received by Architect after 1:00pm will be considered as received the following working day. 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.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Include a copy of applicable Specification Section in every submittal.

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 unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams that show factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

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.

D. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
3. 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 not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Where product and material selections are not scheduled on Finish Schedule, or where materials are indicated to “match existing,” submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit number of Sample sets indicated below as a minimum to Architect for verification. Architect will retain one approved sample. Mark up and retain one approved Sample set as a project record Sample on site.
        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.
        3) For natural stone finish or cladding materials, submit a range sample set including at least five samples to capture the expected range in variation of stone material.

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.

F. 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.

G. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

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

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

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
   1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S AND ENGINEER’S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required.
   1. Submittals by Newforma Info Exchange: Architect will indicate, via Newforma Info Exchange, the appropriate action.
   2. Submittal Actions:
      a. No Exceptions Taken: The submittal is acceptable as submitted and no changes are necessary. No re-submittal is required.
      b. Exceptions Noted: All notations marked on the submittal must be addressed. No re-submittal is required.
      c. Exceptions Noted, Resubmit: All notations marked on the submittal must be addressed and re-submitted for review. Submit new drawings or data with notations incorporated.
      d. Rejected: The submittal does not conform with the Contract Documents and must be re-submitted.
      e. For Record Only: Submittal required or submitted for record. No action is required.
      f. Pending Additional Information: Submittal is incomplete and lacks information required per specifications. Submit the requested information for review.

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. Architect will discard submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

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

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
   1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
   1. Mockups are used for one or more of the following:
      a. Verify selections made under Sample submittals.
      b. Demonstrate aesthetic effects.
      c. Demonstrate the qualities of products and workmanship.
      d. Demonstrate successful installation of interfaces between components and systems.
      e. Perform preconstruction testing to determine system performance.
   2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
   3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

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

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

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
   1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
   2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager does not have other Project responsibilities.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
   1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
   2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
   3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, telephone number, and email address of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement of whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement of whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
   1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and

perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
   1. Provide test specimens representative of proposed products and construction.
   2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
   5. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
   6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups of size indicated.
   2. Build mockups in location indicated or, if not indicated, as directed by Architect.
   3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
   5. Demonstrate the proposed range of aesthetic effects and workmanship.
   6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
   8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   10. Demolish and remove mockups when directed unless otherwise indicated.

L. Specialty Mockups: See Section 01 43 39 "Mockups" for additional construction requirements for integrated exterior mockups.

1.10 QUALITY CONTROL

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

3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Engage a qualified testing agency to perform quality-control services.
      a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and

provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
   1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
   2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

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SECTION 01 43 39 - MOCKUPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Integrated exterior mockups.
   2. Testing of Integrated exterior mockups.

1.2 DEFINITIONS

A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems, including waterproofing subcontractor responsible for installation of air barrier, whose Work is included in integrated exterior mockups.
   2. Review list of approved submittals representing all materials required to be installed on integrated exterior mockup.
   3. Review coordination of equipment and furnishings provided by the Owner for room mockups.
   4. Review locations and extent of mockups.
   5. Review testing procedures to be performed on mockups.
   6. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and testing and maintain schedule for the Work.

1.4 ACTION SUBMITTALS

A. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. List of Approved Material Submittals, including:
   1. Specification Number
   2. Manufacturer Name.
   3. Product/Material Name
   4. Date Submittal was approved.

B. Daily Reports: PDF of daily field reports including description of materials installed, materials intended to be installed each remaining day until planned date of completion. Provide digital photographs with daily reports.

C. Qualification Data: For testing agency.

1.6 QUALITY ASSURANCE

A. Build mockups to do the following:
   1. Verify selections made under Sample submittals.
   2. Demonstrate aesthetic effects.

3. Demonstrate the qualities of products and workmanship.
4. Demonstrate acceptable coordination between components and systems.
5. Perform preconstruction testing, such as window air- and water-leakage testing.

B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

C. Notifications:
1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
2. Notify Architect fourteen days in advance of the dates and times when mockups will be tested.
3. Allow seven days for review and re-review of each product installed.
4. Allow fourteen days for review of completed mockup.

D. Approval: Obtain Architect's written approval of integrated exterior mockup before starting fabrication or construction of corresponding Work.
1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
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 COORDINATION

A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design support structure for free-standing mockups.

B. Structural Performance:
1. Wind Loads: As indicated on Drawings.

C. Mockup Testing Performance Requirements: Perform tests using design pressures and performance criteria indicated for assemblies and products that are specified in other Sections and incorporated into integrated exterior mockups.

2.2 INTEGRATED EXTERIOR MOCKUPS

A. Commence erection of integrated exterior mockup only after obtaining Architect’s approval of required submittals for each material and product to be included in the mockup.

B. Construct integrated exterior mockups according to approved mockup Shop Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.
   1. Mockup will be reviewed in two phases, as defined below

C. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

D. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

E. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.

F. The Work of integrated exterior mockups includes, but is not limited to, the following:
   1. Phase One:
      a. Cold-formed metal framing and sheathing.
      b. Wood Blocking
      c. Gypsum Sheathing
      d. Air barriers.
      e. Thermal insulation, installed on half of the mockup only
      f. Through-wall flashing at base of wall and at head of framed opening
      g. Flashing and sheet metal trim.
      h. Thermal Z-Girts.
      i. Masonry Veneer veneer anchors.
      j. Framed Glazing Assemblies (Storefront)
         1) Flashing frame assembly to air barrier assembly.
      k. Wood Nailers at perimeter of framed opening.
      l. Loose Lintel.
   2. Phase Two: Contingent upon Architect’s approval of Phase One
      a. Brick Veneer.
      b. Mortar with integral color - final approval of match existing intent.
      c. Brick expansion joints.
      d. Brick accessories.
      e. Fiber-Reinforced Cementitious Wall Cladding, including mounting clips and tracks.
      f. Metal Composite Material Wall and Soffit
      g. Joint sealants.
      h. Vertical control joint

G. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Section 01 32 33 "Photographic Documentation." Provide photographs showing details of interface of different materials and assemblies.

PART 3 EXECUTION

3.1 TESTING OF INTEGRATED EXTERIOR MOCKUPS

A. Integrated Exterior Mockup Testing Agency: Owner will 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. Integrated Exterior Mockup Testing AAMA 503 Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing: Perform the following tests in the following order:
   1. Water-Spray Test: Before installation of interior finishes has begun, test areas designated by Architect in accordance with AAMA 501.2 for evidence of water penetration.
      a. Perform a minimum of two tests in areas as directed by Architect.
   2. Air Leakage: Test in accordance with ASTM E783 at 1.5 times the rate specified in "Mockup Testing Performance Requirements" Paragraph in "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
      a. Perform a minimum of two tests in areas as directed by Architect.
   3. Water Penetration: Test in accordance with ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Mockup Testing Performance Requirements" Paragraph in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and verify no evidence of water penetration.

C. Integrated exterior mockup will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 RELATED WORK

A. Section 01 50 10 “Temporary Project Identification Signage” for construction signs identifying Project Scope, Owner Team and AEC Team.

1.3 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Water Service: Pay water-service use charges for water used by all entities for construction operations.

C. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
   1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
   2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
   3. Indicate methods to be used to avoid trapping water in finished work.

F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   4. Waste-handling procedures.
   5. Other dust-control measures.

G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
   1. Methods used to meet the goals and requirements of the Owner.
   2. Concrete cutting method(s) to be used.
   3. Location of construction devices on the site.
   4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
   5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
   6. Indicate locations requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in TDLR “2012 Texas Accessibility Standards” (TAS).

1.6 PROJECT CONDITIONS

A. 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 Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails.

B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

F. Mineral-Wool Board Insulation, Type IVB: ASTM C612, Type IVB; unfaced.

2.2 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-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.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

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

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.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
      a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

D. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
   1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.
   1. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Contractor's emergency after-hours telephone number.
      e. Architect's office.
      f. Engineers' offices.
      g. Owner's office.
      h. Principal subcontractors' field and home offices.

H. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:
   1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
   1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
   1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
   2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 31 20 00 "Earth Moving."
   3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

G. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

H. 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.

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

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

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
   1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. 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 requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by building occupants from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
   2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
      a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
   3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
   4. Insulate partitions to control noise transmission to occupied areas.
   5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
   6. Protect air-handling equipment.
   7. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard and replace stored or installed material that begins to grow mold.
   7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
      b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. 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.
   2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

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SECTION 01 50 10 - TEMPORARY PROJECT IDENTIFICATION SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary project identification signage.

1.2 INFORMATIONAL SUBMITTALS

A. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

PART 2 PRODUCTS

2.1 TEMPORARY PROJECT IDENTIFICATION SIGNAGE

A. Project Identification
   1. Project Identification Sign Material: Provide Aluminum Composite Materials (ACM) consisting of two layers of aluminum with a polyethylene core (Dibond).
      a. Signage Fabricator Contact: Drew Hargrove at Fingerprint Ideas. (512) 817-2200
   2. For Sizes and Print Layout, see Drawings.
   3. Installation:
      a. Install project identification sign within 15 days after date fixed by Notice to Proceed.
      b. Erect at location of high public visibility adjacent to main entrance to site.
      c. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
      d. Install sign surface plumb and level, with butt joints. Anchor securely.
      e. Paint exposed surfaces of sign, supports and framing.
   4. Maintenance: Maintain signs and supports clean, repair deterioration and damage.
   5. Removal: Remove signs, framing, supports and foundations at completion of Project and restore area.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

B. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Maintain and touch up signs, so they are legible at all times.

3.3 TERMINATION AND REMOVAL

A. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been

delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
   3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
   1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

1.3 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.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Speed.
   e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:
   1. 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 and with adequate protection from wind.
   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.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on

product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
   2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
   3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Non-Limited List of Products: 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.
    a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: 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.
    a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 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 a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 00 - EXECUTION

PART 1 GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.
   1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
      a. Contractor's superintendent.
      b. Trade supervisor responsible for cutting operations.
      c. Trade supervisor(s) responsible for patching of each type of substrate.
      d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
   2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certified Surveys: Submit complete survey digitally signed by land surveyor.

C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. 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, or when encountering the need for cutting and patching of elements whose structural function is not known, 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 results in increased maintenance or decreased operational life or safety.
   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 that results in increased maintenance or decreased operational life or safety.
   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. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.
   1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

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. Use materials that are not considered hazardous.

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and

verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from 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.

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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. 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.

D. 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. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb, and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   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 in accordance with requirements in Section 01 10 00 "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 minimize 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, as judged by Architect. 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 eliminate 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, corner to corner of wall and

edge to edge of ceiling. 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.
6. Patching of Existing Concrete Slabs: Where removal or abandonment of existing utilities results in voids in existing concrete, patch concrete with mix design matching existing slab.

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 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than 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.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 00 "Commissioning."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous construction waste.
   2. Recycling nonhazardous construction waste.
   3. Disposing of nonhazardous construction waste.

1.2 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 MATERIALS OWNERSHIP

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

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 14 days of date established for the Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use form acceptable to Architect and Owner. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) in tons.
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

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

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. 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. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may not serve as Waste Management Coordinator.

B. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4

for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in transportation and tipping fees by donating materials.
7. Savings in transportation and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
   2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

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

3.3 RECYCLING CONSTRUCTION WASTE

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

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

D. Paint: Seal containers and store by type.

3.4 DISPOSAL OF WASTE

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

B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION

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SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   6. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."

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

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

C. Accessibility Inspection: Owner will engage a Registered Accessibility Specialist to perform accessibility inspection required by TDLR
1. Coordinate inspection schedule with Owner’s Accessibility Specialist
2. Correct deficiencies identified in accessibility inspection report
3. Notify Owner when deficiencies have been corrected.

1.8 LIST OF INCOMPLETE ITEMS

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

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
1. Submit by uploading to Newforma Info Exchange

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 MATERIALS

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

PART 3 EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
      i. Vacuum and mop concrete.
      j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
      k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
      l. Remove labels that are not permanent.
      m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
      n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
      o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
      p. Clean ducts, blowers, and coils.
      q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.

r. Clean strainers.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

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SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Emergency manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

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

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit by uploading to Newforma Info Exchange. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
   1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

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

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Architect.
   8. Name and contact information for Commissioning Authority.
   9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

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

3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.

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

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

D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product,

list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
      a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies:
      a. Submit one PDF set(s) of marked-up record prints.
      b. Submit one full size printed set of marked-up prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
   1. Submit one full size printed Project manual including annotated Project Specifications including Addenda, PRs, and ASIs

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

A. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
   1. Format: Annotated PDF electronic file.
   2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
   3. Refer instances of uncertainty to Architect for resolution.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Format: Annotated PDF electronic file.
   2. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. Note related Change Orders where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.
   1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.
   2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit digital file of video recording within seven days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Date of video recording.
   2. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Systems and equipment operation manuals.
      c. Systems and equipment maintenance manuals.
      d. Product maintenance manuals.
      e. Project Record Documents.
      f. Identification systems.
      g. Warranties and bonds.
      h. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.
      f. Special operating instructions and procedures.
   4. Operations: Include the following, as applicable:
      a. Startup procedures.
      b. Equipment or system break-in procedures.
      c. Routine and normal operating instructions.
      d. Regulation and control procedures.
      e. Control sequences.
      f. Safety procedures.
      g. Instructions on stopping.
      h. Normal shutdown instructions.
      i. Operating procedures for emergencies.
      j. Operating procedures for system, subsystem, or equipment failure.
      k. Seasonal and weekend operating instructions.
      l. Required sequences for electric or electronic systems.
      m. Special operating instructions and procedures.
   5. Adjustments: Include the following:
      a. Alignments.

b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

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

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
   2. Owner will furnish an instructor to describe Owner's operational philosophy.
   3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

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

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.
   1. Submit video recordings on CD-ROM or thumb drive.
   2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
   3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
   4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
      a. Name of Contractor/Installer.
      b. Business address.
      c. Business phone number.
      d. Point of contact.
      e. Email address.

B. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 PRODUCTS

PART 3 EXECUTION

END OF SECTION

SECTION 01 91 00 - COMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Commissioning description.
2. Submittals.
3. Commissioning services.
4. Commissioning responsibilities.
5. Commissioning meetings.
6. Commissioning reports.
7. Test equipment.
8. Verification check and startup procedures.
9. Functional performance test procedures.
10. Function performance test methods.
11. Deficiencies and test approvals.
12. Demonstration.

1.2 RELATED WORK

A. Section 23 08 00 - Commissioning of HVAC: Mechanical systems commissioning requirements.

B. Section 26 08 00: Electrical systems commissioning requirements.

C. Section 22 08 00: Plumbing systems commissioning requirements.

1.3 REFERENCES

A. Associated Air Balance Council:
1. AABC - ACG Commissioning Guideline.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE Guideline 0 - The Commissioning Process.
2. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

C. National Environmental Balancing Bureau:
1. NEBB - Procedural Standards for Building Systems Commissioning.

D. Latest edition of the International Energy Conservation Code.

1.4 COMMISSIONING DESCRIPTION

A. Commissioning: Systematic process of ensuring systems perform interactively in accordance with Owner’s project requirements according to design intent and in accordance with Owner’s operational needs. Commissioning process encompasses and coordinates system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training, and verification of actual performance.

B. Commissioning Intent:
1. Verify equipment and systems are installed in accordance with manufacturer’s instructions, industry accepted minimum standards, and Contract Documents.
2. Verify equipment and systems receive adequate operational checkout by Contractor.
3. Verify and document proper performance of equipment and systems.

4. Verify complete operation and maintenance documentation is delivered to Owner.
5. Verify Owner's operating personnel are adequately trained.

C. Equipment and Systems to Be Commissioned: Refer to Section 22 08 00, Section 23 08 00 and Section 26 08 00 for equipment and system lists.

D. Commissioning does not relieve Contractor of responsibility to provide finished and fully functioning Project.

E. Commissioning Process Overview and General Order of Commissioning Tasks:
1. Commissioning begins with initial commissioning meeting.
2. Conduct progress commissioning meetings throughout construction, to plan, scope, coordinate, schedule future activities and resolve problems.
3. Equipment documentation is submitted to Commissioning Provider during normal submittals, with detailed start-up procedures.
4. Commissioning Provider works with Contractor and equipment and system installers to develop startup plans and startup documentation formats, including verification checklists to be completed by installers, during verification check and startup process.
5. In general, checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with verification checklists being completed before functional testing.
6. Equipment and system installers execute and document verification checklists and perform verification check and startup. Commissioning Provider documents checklists and startup were completed according to approved plans.
7. Commissioning Provider shall develop specific equipment and system functional performance test procedures. Contractor shall review functional performance tests.
8. Equipment and system installers shall execute procedures in coordination with, and documented by Commissioning Provider. Commissioning Provider shall witness testing and compliance with the Contract Documents.
9. Items of non-compliance in material, installation or setup are corrected at Contractor's expense and system retested.
10. Commissioning Provider reviews operation and maintenance documentation for completeness.
11. Commissioning shall be completed before Substantial Completion, except for warranty and post occupancy phase commissioning.
12. Commissioning Provider reviews training plan provided by Contractor equipment and system installers to the Owner and verifies that training was completed.
13. Deferred testing is conducted, as specified.

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

1.6 COMMISSIONING SUBMITTALS

A. Furnish one copy of Contract Documents including addenda, change orders, requests for interpretation, meeting minutes, and supplemental instructions to Commissioning Provider.

B. Furnish two copies of submittals directly to Commissioning Provider for review in accordance with procedures specified in Division 01 - Submittal Procedures.
1. Make submittals for each piece of equipment or system indicated to be commissioned.
2. Make submittals to Commissioning Provider concurrent with submittals to Architect/Engineer.
3. Distribute two copies of approved submittals to Commissioning Provider.

C. Furnish two copies of preliminary operation and maintenance data manuals to Commissioning Provider for each piece of equipment or system indicated to be commissioned.
   1. Submit required manuals for review before Applications for Payment exceed 50 percent of Contract Sum/Price.

D. Make additional submittals requested by Commissioning Provider for each piece of equipment or system indicated to be commissioned. Incorporate requested submittal information into related operation and maintenance manuals. Include the following:
   1. Manufacturer's printed detailed installation and start-up, operating, troubleshooting and maintenance procedures.
   2. Equipment performance curves.
   3. Factory test reports.
   4. Full sequence of operation and control diagrams.
   5. Proposed testing, adjusting and balancing procedures.
   6. Complete warranty information, with Owner responsibilities to keep warranty in force identified.
   7. Lists of installation and checkout materials shipped with equipment.
   8. Manufacturer's field checkout forms to be used by factory or field technicians.
   9. Other documentation necessary for commissioning process.

E. Furnish two copies of verification check and startup plan to Commissioning Provider for review and approval. Include the following as minimum:
   1. Verification checklists with party responsible for each item indicated.
   2. Manufacturer’s standard startup procedures copied from installation manuals.
   3. Manufacturer’s standard field checkout sheets.
   4. Supplemental procedures and checklists prepared by equipment and system installers to accommodate Project conditions.
   5. Sensor and actuator calibration procedures.
   6. Include boxes or lines for recording and documenting checking and inspections of each procedure and summary statement with signature block at end of plan.

F. Submit written training plan to Owner and Commissioning Provider for review and approval prior to conducting training including the following:
   1. Equipment included in training session.
   2. Intended audience.
   3. Location of training.
   4. Objectives.
   5. Subjects covered.
   6. Duration of training on each subject.
   7. Instructor for each subject.
   8. Instructional methods to be used.

G. Commissioning Provider will review submittals for conformance to Contract Documents as related to commissioning process for primary purpose of aiding development of functional testing procedures and secondarily to verify compliance with equipment specifications.

1.7 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit operation and maintenance manuals as specified in individual equipment and system specifications.
   1. Submittals made to Commissioning Provider do not constitute compliance with operation and maintenance manual documentation.

C. As-built Documentation: Submit as-builts for all systems commissioned.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with AABC, ASHRAE or NEBB guidelines.

1.9 COMMISSIONING SERVICES

A. Owner will employ and pay for specified services of an independent firm as Commissioning Provider.

1.10 COMMISSIONING RESPONSIBILITIES

A. Responsibilities indicated for Owner, Architect/Engineer and Commissioning Provider are provided only to clarify commissioning process.

B. Architect/Engineer Responsibilities:
   1. Perform site observation of each system just before system startup.
   2. Furnish design narratives and sequences documentation requested by Commissioning Provider.
   3. Clarify operation and control of commissioned equipment when specifications, control drawings, or equipment documentation are not sufficient for writing detailed testing procedures.
   4. Coordinate resolution of design issues affecting system performance identified during commissioning.
   5. Coordinate resolution of system deficiencies identified during commissioning, according to Contract Documents.
   6. Prepare and submit final design intent documentation, reflecting installed conditions, for inclusion in operation and maintenance manuals.
   7. Review and approve operation and maintenance manuals.
   8. Review verification checklists for major pieces of equipment.
   9. Review functional test procedure forms for major pieces of equipment.

C. Commissioning Provider Responsibilities:
   1. Basic Responsibilities:
      a. Coordinate, direct and approve commissioning work.
      b. Develop and coordinate execution of commissioning plan. Revise commissioning plan to suit Project conditions.
      c. Coordinate scheduling of commissioning work with Contractor for inclusion in Project schedule.
      d. Plan and conduct commissioning meetings.
      e. Request and review commissioning submittals required to perform commissioning tasks.
      f. Review verification tests and checklists.
      g. Review verification check and startup plan in cooperation with Contractor and equipment and system installers.
      h. Review functional performance test procedures in cooperation with Contractor and equipment and system installers.
      i. Review test and balance execution plan.
      j. Attend [selected] Project [progress] and [pre-installation] meetings. Review meeting minutes. Resolve potential conflicts with commissioning activities.
      k. Observe equipment and system installations.
      l. Document equipment and systems are installed and perform in accordance with design intent, Owner’s Project Requirements and Contract Documents.
      m. Notify [Owner] [Architect/Engineer] of deficiencies.

n. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
o. Review content and adequacy of Owner's personnel training.
p. Review operation and maintenance manuals.
q. Compile commissioning record and testing data manual.
r. Provide final commissioning report.

2. Commissioning Provider may not:
   a. Release, revoke, alter or enlarge on requirements of Contract Documents.
   b. Approve or accept any portion of the Work.
   c. Assume duties of Contractor or Architect/Engineer.
   d. Stop the Work.

D. Owner Responsibilities:
1. Arrange for Owner's personnel to attend commissioning activities and training sessions according to commissioning plan.
2. Approve commissioning work completion.
3. Ensure seasonal or deferred testing and deficiency issues are addressed.

E. Contractor Responsibilities:
1. Participate in Commissioning Provider's cloud-based commissioning software.
2. Include requirements for commissioning submittal data, operation and maintenance data, commissioning tasks and training in each purchase order and subcontract for equipment and systems indicated to be commissioned.
3. Facilitate coordination of commissioning work by Commissioning Provider.
4. Attend commissioning meetings.
5. Cooperate with Commissioning Provider, and provide access to the Work and to manufacturers' facilities.
6. Require equipment and system installers to execute test to review and provide comments on functional test procedures.
7. Require manufacturers to review commissioning test procedures for equipment installed by manufacturer.
8. Furnish proprietary test equipment required by manufacturers to complete equipment and system tests.
9. Provide temporary facilities as specified in Division 01 – Temporary Facilities and Controls for Commissioning Provider's exclusive use for documentation and instrument storage and preparation of reports.
10. Furnish qualified personnel to assist in completing commissioning.
11. Furnish manufacturer's qualified field representatives as specified in Division 01 - Quality Requirements and individual specification sections to assist in completing commissioning.
12. Ensure equipment and system installers execute commissioning responsibilities according to Contract Documents and schedule.
13. Coordinate Owner's personnel training.
14. Prepare operation and maintenance manuals specified in Division 01 – Execution and Closeout Requirements. Update original sequences of operation reflecting actual installation.
15. Ensure equipment and system installers execute seasonal and deferred functional performance testing, witnessed by Commissioning Provider.
16. Ensure equipment and system installers correct deficiencies and make necessary adjustments to operation and maintenance manuals and Record Documents for issues identified in seasonal testing.

1.11 COMMISSIONING MEETINGS

A. Division 01 - Administrative Requirements: Progress meetings.

B. Commissioning Provider will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

C. Initial Commissioning Meeting:
   1. Commissioning Provider will schedule meeting within 90 days after start of construction.
   2. Attendance Required: Commissioning Provider, Owner, Owner's facility operating personnel, Architect/Engineer, Contractor, subcontractors, test, adjust and balance agency. Require attendance by installers of the following equipment and systems indicated to be commissioned including:
      a. Mechanical equipment and systems.
      b. Plumbing equipment and systems.
      c. Electrical equipment and systems.
      d. Temperature controls equipment and systems.
   3. Agenda:
      a. Designation of personnel representing parties for commissioning activities.
      b. Review commissioning process and responsibilities.
      c. Review commissioning plan development procedures.
      d. Review required commissioning submittals.
      e. Present initial commissioning schedule.

D. Progress Commissioning Meetings:
   1. Commissioning Provider will schedule meetings throughout progress of the Work at maximum two-month intervals.
      a. Beginning 3 months before Substantial Completion, meetings will be scheduled at maximum two-week intervals.
   2. Attendance Required: As specified for initial commissioning meeting, as appropriate for status of project.
   3. Agenda:
      a. Coordination of commissioning activities.
      b. Commissioning deficiency resolution.
      c. Commissioning schedule.
      d. Planning for future commissioning activities.

E. Commissioning Provider will record meeting minutes and distribute copies within five days after meeting to participants and those affected by decisions made.

1.12 COMMISSIONING REPORTS

A. Commissioning Provider Reports: Submit reports regularly to Owner, Architect/Engineer and Contractor. Include the following.
   1. Progress reports.
   2. Scheduling changes.
   3. Observation reports of specific commissioning activities.
   4. Testing progress and approvals.
   5. Deficiency and deficiency resolution reports.

B. Commissioning Provider Functional Performance Test Procedures: Review test procedures and forms developed by contractor or equipment supplier, with the following information as a minimum. Include completed documentation in operation and maintenance manuals.
   1. System and equipment or component names.
   2. Equipment location and identification number.
   3. Unique test identification number and reference to unique verification checklist and startup documentation identification numbers for piece of equipment.
   4. Date.
   5. Project name.

6. Participating parties.
7. Copy of specification section describing test requirements.
8. Copy of specific sequence of operations or other specified parameters being verified.
9. Formulas used in calculations.
10. Required pre-test field measurements.
11. Instructions for setting up test.
12. Special cautions, alarm limits, and safety concerns.
13. Specific step-by-step procedures to execute test, in clear, sequential and repeatable format.
14. Acceptance criteria of proper performance with Yes/No check box to allow for marking whether or not proper performance of each part of test was achieved.
15. Section for comments.
16. Signatures and date block for Commissioning Provider.

1.13 SEQUENCING

A. Division 01 - Summary: Requirements for sequencing.

B. Sequence work to complete commissioning and Owner's personnel training before Substantial Completion.

C. Contractor shall sequence work to achieve Functional Completion before Final Completion. Complete the following for each piece of equipment and system indicated to be commissioned to achieve Functional Completion:
1. Complete and sign startup and verification checklist documentation.
2. Submit trend log data.
3. Submit final approved test and balance report.
4. Complete functional testing.
5. Complete training of Owner personnel.
6. Submit approved operation and maintenance data manuals.
7. Correct identified deficiencies or obtain approval by Owner or Engineer to exclude deficiencies from Functional Completion.

D. For equipment or systems requiring seasonal operation, perform commissioning for other season within six months of Substantial Completion.

E. For equipment or systems where commissioning is delayed by Owner occupancy requirements or other unforeseen conditions, perform commissioning as specified for seasonal operation equipment.

1.14 SCHEDULING

A. Division 01 - Administrative Requirements: Requirements for scheduling.

B. Schedule work to allow adequate time for commissioning activities.

C. Identify commissioning milestones, activities and durations on Project schedule.
1. Identify the following for each piece of equipment and system including:
   a. Operation and maintenance manual submittal.
   b. Verification check and startup.
   c. Functional performance test.
   d. Functional completion.
   e. Demonstration and training sessions.
   f. Commissioning completion.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Testing Equipment: Calibrated within last year; of sufficient quality and accuracy to test and measure system performance within the following tolerances unless otherwise specified for individual equipment or systems.
   1. Temperature Sensors and Digital Thermometers: 0.5 degrees F accuracy and plus or minus 0.1 degrees F resolution.
   2. Pressure Sensors: Accuracy of plus or minus 2.0 percent of measured value range.

B. Recalibrate test equipment according to manufacturer's recommended intervals and when dropped or damaged.
   1. Affix calibration tags to test equipment or furnish certificates upon request.

C. Equipment Furnished by Contractor and Remaining Property of Contractor:
   1. Standard testing equipment required to perform verification check and startup and required functional performance testing.
   2. Two-way radios for personnel performing commissioning.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify equipment and systems are installed in accordance with individual specification sections.

C. Verify utility and power connections are complete and services operational.

3.2 VERIFICATION CHECK AND STARTUP PROCEDURES

A. Notify Commissioning Provider and schedule verification check and startup activities with each party required to complete verification check and startup minimum two weeks in advance.

B. Allow Commissioning Provider to witness verification check and startup.
   1. Primary Equipment: Commissioning Provider will witness procedures for each piece of equipment. For multiple units, Commissioning Provider will witness procedures on 20 percent, but not less than 4, of each type unit.
   2. Secondary Equipment: Commissioning Provider will witness sampling of each type unit as specified in Commissioning Plan.

C. Verification Check and Startup:
   1. Perform verification check and startup in accordance with approved verification check and startup plan.
   2. Complete entire plan for each piece of equipment or system indicated to be commissioned.
   3. Complete each procedure in sequence performed by party assigned to each procedure.
   4. Record completion of each procedure. Indicate results of procedure where required. Sign and date plan by individual performing procedure.
   5. Identify items not completed successfully.
   6. Sign and date plan indicating completion of entire plan.
   7. Submit executed plan to Commissioning Provider within five days of completion.

D. Deficiencies and Approvals:
   1. Commissioning Provider will review verification check and startup reports and issue deficiency report or approval.

2. Correct deficiencies and resubmit updated verification check and startup report with statement indicating corrections made for Commissioning Provider approval.
3. Repeat process until verification check and startup report is approved.
4. Costs for incomplete verification check and startup items that later cause deficiencies or delays during functional tests may be charged to party responsible for incomplete item.

3.3 FUNCTIONAL PERFORMANCE TEST PROCEDURES

A. Complete the following before performing functional tests:
   1. Verification check and startup.
   2. Control system testing with approval by Commissioning Provider for use for test and balance operations.
   3. Air system balancing and water system balancing.

B. Notify Commissioning Provider of completion of verification check and startup activities.

C. Commissioning Provider will witness and document results of functional performance tests.

D. Conduct functional performance tests as specified in [Section 23 08 00] [and] [_____] .

E. Demonstrate each piece of equipment and system is operating according to documented design intent and Contract Documents.
   1. Conduct testing proceeding from components to subsystems, to systems.
   2. Bring equipment and systems to condition capable full dynamic operation.
   3. Verify performance of individual components and systems.
   4. Verify performance of interactions between systems.
   5. Identify and correct areas of deficient performance.

F. Operate each piece of equipment and system through each specified mode of operation including seasonal, occupied, unoccupied, warm-up, cool-down, partial load and full load conditions.
   1. Verify each sequence in sequences of operation.
   2. Test for proper responses to power failure, freezing, overheating, low oil pressure, no flow, equipment failure, and other abnormal conditions.

3.4 FUNCTIONAL PERFORMANCE TEST METHODS

A. Perform testing and verification by using manual testing or by monitoring performance and analyzing results using control system trend log capabilities or by stand-alone data loggers as specified for each piece of equipment or system.

B. Simulated Conditions: Simulating conditions, not by overwritten values, is permitted. Timing tests to use real conditions is encouraged wherever practical.

C. Overwritten Values: Overwriting sensor values to simulate conditions may be used with caution and avoided when possible.

D. Simulated Signals: Using signal generator to create simulated signals to test and calibrate transducers automatic temperature controls is generally recommended over using sensors as signal generators with simulated conditions or overwritten values.

E. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test specific sequence is acceptable. Reset setpoint after completing test.

F. Indirect Indicators: Using indirect indicators for responses or performance is permitted only after visually and directly verifying and documenting indirect readings through control system representing actual conditions and responses over tested parameter range.

G. Perform each function and test under conditions simulating actual conditions as close as is practically possible.
   1. Provide materials, system modifications, and other things necessary to produce flows, pressures, temperatures and other responses to execute test according to specified conditions.
   2. At completion of test, return modified equipment and systems to pretest condition.

3.5 DEFICIENCIES AND TEST APPROVALS

A. Deficiencies:
   1. Commissioning Provider will record and report deficiencies to Owner.
   2. Minor deficiencies may be corrected during tests at Commissioning Provider's discretion. Deficiency and resolution will be documented on procedure form.
   3. Failure to attend scheduled verification check, startup or functional performance test will be considered deficiency.
   4. When deficiency is identified, Commissioning Provider will discuss issue with party executing test.
      a. When party executing test accepts responsibility to correct deficiency:
         1) Commissioning Provider documents deficiency and executing party's response.
         2) Commissioning Provider submits deficiency report to Owner, [Contractor,] and party executing test.
         3) Party executing test corrects deficiency, signs statement of correction on deficiency form certifying equipment is ready for retesting and submits form to Commissioning Provider.
         4) Testing is rescheduled for Commissioning Provider to witness and test is repeated until satisfactory performance is achieved.
      b. When party executing test disputes deficiency or responsibility for deficiency:
         1) Commissioning Provider documents deficiency and executing party's response.
         2) Commissioning Provider submits deficiency report to Owner, [Contractor,] and party executing test and party believed to be responsible for deficiency.
         3) Commissioning Provider works with parties involved to determine potential corrective action or procedures and documents corrective action plan.
         4) Continuing disputes will be referred to Architect/Engineer for resolution in accordance with Contract Documents.
         5) When dispute is resolved, the appropriate party corrects deficiency; signs statement of correction on deficiency form certifying equipment is ready for retesting and submits form to Commissioning Provider.
         6) Testing is rescheduled for Commissioning Provider to witness and test is repeated until satisfactory performance is achieved.

B. Retesting Costs:
   1. When verification check and startup or functional performance test deficiency is discovered requiring rescheduling or retesting:
      a. Owner will compensate Commissioning Provider for attending and directing additional testing.
      b. Owner will deduct additional testing compensation from final payment due to Contractor in accordance with the Owner/Contractor Agreement.

C. Provide written report to Commissioning Provider before each scheduled commissioning meeting concerning status of each deficiency. Include explanations of disagreements with resolution proposals for each discrepancy.
   1. Commissioning Provider will retain original deficiency forms until end of Project.

D. Manufacturing Defects: When 10 percent, but not less than three identical pieces of equipment or equipment with only small size or capacity differences fail to perform to Contract Document requirements due to manufacturing defect, all identical units may be considered defective by Owner.
   1. Within one week of notice from Owner, examine all other identical units and record findings. Submit findings to Owner within two weeks of original notice.
   2. Within two weeks of original notification, provide signed and dated, written explanation of problem, cause of defect, and proposed solutions meeting Contract Document requirements. Include equipment submittals supporting solution.
   3. Owner will determine whether replacement or repair of all identical units is required.
   4. Install two examples of proposed solution. Owner will test installations for up to one week, before deciding solution is acceptable.
   5. Upon acceptance, replace or repair all identical items, at Contractor's expense. Extend warranty accordingly, when original equipment warranty had begun.
   6. Complete repairs or replacements with reasonable speed beginning within one week from when parts can be obtained.

E. Test Approval: Commissioning Provider notes each satisfactorily demonstrated function on functional performance test form.
   1. Commissioning Provider recommends acceptance of each test to Owner using standard form.
   2. Owner gives final approval for each test using same form, providing signed copy to Commissioning Provider and Contractor.

3.6 DEMONSTRATION

A. Division 01 – Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate equipment and systems and train Owner's personnel as specified in individual equipment and system specifications.
   1. Owner will determine type and extent of training for each commissioned piece of equipment and system.
   2. Owner will communicate training requirements to Contractor for benefit of equipment and system installers and manufacturers with training responsibilities.

C. Commissioning Provider will develop criteria for determining training was satisfactorily completed, including attending some training sessions.
   1. Commissioning Provider will make recommendation to Owner regarding approval of training.

D. For primary mechanical equipment training:
   1. Require controls contractor to provide short discussion of equipment control as part of training session.

END OF SECTION

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.

B. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 SUMMARY:

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Admixtures.
4. Vapor retarders.
5. Curing materials.
6. Accessories.
7. Repair materials.
8. Concrete mixture materials.
9. Concrete mixture class types.
10. Concrete mixing.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Portland cement.
2. Blended hydraulic cement.
3. Fly ash.
4. Silica fume.
5. Natural or other pozzolans.
6. Aggregates.
7. Ground calcium carbonate and aggregate mineral fillers.
8. Admixtures.
9. Vapor retarders.
10. Curing materials.

11. Joint fillers.
12. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Compressive strength at 28 days or other age as specified.
3. Compressive strength required at stages of construction.
4. Durability exposure classes for Exposure Categories F, S, W, and C.
5. Maximum w/cm ratio.
6. Slump or slump flow limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Intended placement method.
10. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:

1. Concrete class designation.
2. Location within Project.
3. Exposure class designation.
4. Formed surface finish designation and final finish.
5. Final finish for floors.
6. Floor treatment, if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.

10. Repair materials.

C. Material Test Reports: For the following:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral filler.
10. Admixtures.

D. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC's Acceptance Criteria AC380.

E. Preconstruction Test Reports: For each mix design.

F. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements or equivalent approval by a State DOT.

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties on behalf of the Architect/Engineer.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Level 1. Testing agency laboratory supervisor tests to be an ACI-certified Concrete Laboratory Testing Technician, Level 2.

1.7 PRECONSTRUCTION TESTING

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

1. Include the following information in each test report:

    a. Admixture dosage rates.
    b. Slump.
    c. Air content.
    d. Seven-day compressive strength.
    e. 28-day compressive strength.
    f. Evaluation of permeability-reducing admixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 as follows:

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When air temperature has fallen to, or is expected to fall below 40 deg F during the protection period, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type II.
2. Pozzolans: ASTM C618, Class C, F, or N.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Ground Glass Pozzolan: ASTM C1866/C1866M, Type GS or GE.

C. Normal-Weight Aggregates:

1. Coarse Aggregate: ASTM C33/C33M.
2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
3. Fine Aggregate: ASTM C33/C33M.
4. Recycled Aggregate: Provide documentation of characteristics of recycled aggregate and mechanical properties and durability of proposed concrete, which incorporates recycled aggregate to conform to appliable requirements for the class of concrete.
5. Alkali-Silica Reaction: Comply with one of the following for each aggregate used:

    a. Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
    b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567. Do not use this option with fly ash with an alkali content greater than 4.0 percent. Submit supporting data for each aggregate showing expansion in excess of 0.10 percent when tested in accordance with ASTM C1260.
    c. Alkali Content in Concrete: Not to exceed 4 lb./cu. yd. for aggregate with expansion greater than or equal to 0.04 percent and less than 0.12 percent or 3 lb./cu. yd. for aggregate with expansion greater than or equal to 0.12 percent and less than 0.24 percent. Test aggregate reactivity in accordance with ASTM C1293. Calculate alkali content of concrete in accordance with ACI 301. Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.

2.3 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.

C. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602/C1602M.

2.4 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F (10 deg C): Black.
b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

C. Water: Potable water that does not cause staining of the surface.

2.6 ACCESSORIES

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

2.7 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.

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

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.8 CONCRETE MIXTURE MATERIALS

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
2.

B. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

2.9 CONCRETE MIXTURE CLASS TYPES

A. Class A: Normal-weight concrete used for footings, grade beams, and interior slabs-on ground.

1. Exposure Class: ACI 318 Class F1, Class S0, Class W1, Class C1.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm Ratio: 0.50.
4. Slump Limit: 4 inches, plus or minus 1 inch for concrete.
5. Target air content per ACI 318 Table 19.3.3.1.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 TOLERANCES

A. Comply with ACI 117.

3.4 INSTALLATION OF VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.6 INSTALLATION OF JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourthof concrete thickness as follows:
1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.7 APPLICATION OF FINISHING FLOORS AND SLABS

A. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.

2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface. Use of an approved finishing aid is acceptable.
5. Do not apply troweled finish to concrete, which has a total air content greater than 3 percent.
6. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:
        1) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.

3.8 APPLICATION OF CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305R, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:

   a) Water.
   b) Continuous water-fog spray.

3.9 INSTALLATION OF JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

   1. Defer joint filling until concrete has aged at least one month.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.10 INSTALLATION OF CONCRETE SURFACE REPAIRS

A. Defective Concrete:

   1. Repair and patch defective areas when approved by Architect.
   2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of 0.01 inch spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and match surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.

12) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
13) Information on storage and curing of samples at the Project site, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.

B. Delivery Tickets: comply with ASTM C94/C94M.

C. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 150 cu. yd. or fraction thereof.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests as needed.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.

a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample when strength test specimens are cast.

5. Concrete Density: ASTM C138/C138M:

a. One test for each composite sample when strength test specimens are cast.

6. Compression Test Specimens: ASTM C31/C31M:
a. Cast, and field cure two sets of four standard cylindrical specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of two standard cured specimens at seven days and one set of two specimens at 28 days.
    b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.7.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.12 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Brick.
2. Mortar and grout materials.
3. Ties and anchors.
4. Embedded flashing (Thru-Wall Flashing).
5. Accessories.
6. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:
1. Steel lintels in unit masonry.

1.2 DEFINITIONS

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

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Provide data for flashing membranes, drip plate, sealants, gasketed fasteners for metal stud, concrete block or concrete surface and accessories as specified. Provide installation and storage instructions for flexible flashing membrane and drip plates. Provide letter from the flexible membrane flashing manufacturer that the flexible flashing membrane and sealants are compatible with specified fluid applied air barrier membrane.

B. Concurrent Submittal for components of compliant NFPA 285 Assembly:
1. Submit NFPA 285 test reports listing thru-wall flashing, polyisocyanurate continuous cavity wall insulation product as specified in Section 07 21 00 “Thermal Insulation,” and fluid-applied membrane air barrier assembly, as specified in Section 07 27 26 “Fluid-Applied Membrane Air Barriers,” as part of an approved NFPA 285 Assembly

C. Shop Drawings: For the following:
1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Include exterior elevations showing masonry veneer colors, coursing patterns, and expansion joint (brick).
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Verification: For each type and color of the following:
1. Clay face brick: Provide a set of five (5) brick samples representing range of color and texture resulting for natural material firing and cutting.
2. Special brick shapes.
3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep/cavity vents.
5. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
   2. Flashing Materials
   3. Cementitious materials. Include name of manufacturer, brand name, and type.
   4. Mortar admixtures.
   5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   6. Grout mixes. Include description of type and proportions of ingredients.
   7. Reinforcing bars.
   8. Joint reinforcement.
   9. Anchors, ties, and metal accessories.

B. Qualification Statements: For testing agency.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
   2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Face Brick: Twenty-five (25) brick units of each color, size and finish represented on the project.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
      a. Company specializing in performing work of this section with minimum five years of documented experience.

1.8 MOCKUPS

A. Wall Mockups: Build mockups to set quality standards for materials and execution and to set quality standards for installation. See Section 01 43 39 "Mockups" for additional construction requirements for integrated exterior mockups.

1.9 DELIVERY, STORAGE, AND HANDLING

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

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

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain exposed masonry units from single source from a single manufacturer.

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

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 402/602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions.

B. Clay Face Brick: Facing brick complying with ASTM C216, Grade SW, Type FBS.
   1. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.

C. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."

D. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

E. Application: Use where brick is exposed unless otherwise indicated.

F. Provide face brick matching color range, texture, and size of existing adjacent brickwork.
   1. One Color, intended to match existing building.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime, and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Argos USA LL; Eaglebond Porland Lime Cement
      b. Holcim (US) Inc; Rainbow Mortamix Custom Color Cement/Lime
      c. Lehigh Hanson; HeidelbergCement Group; Lehigh Custom Color Portland/Lime Cement.
      d. Oldcastle APG: a CRH Company; Amerimix.
   2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer’s standard colors.
   3. Pigments shall not exceed 10 percent of Portland cement by weight.

D. Mortar Cement: ASTM C1329/C1329M or the use of premixed mortars containing mortar cement is not permitted

E. Masonry Cement: ASTM C91/C91M or the use of premixed mortars containing masonry cement is not permitted.

F. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.

G. Aggregate for Grout: ASTM C404.

H. Water: Potable.

2.5 JOINT REINFORCEMENT

A. Provide Joint Reinforcement per ASTM A951/A951M and formed from the following:
   1. Galvanized carbon-steel wire, ASTM A1064/A1064M, coating and class as follows:
      a. ASTM A153/A153M, Class B-2, for both interior and exterior walls, 1.50 oz./ft².

B. Description: Welded-Wire Units prefabricated with deformed continuous side rods into straight lengths of not less than 10 feet with prefabricated corner and TEE Units and complying with the following:
   1. Wire Diameter Side Rods: 9 gauge (W1.7, 0.148 inches in diameter).
   2. Wire Diameter Cross Rods: 9 gauge (W1.7, 0.148 inches in diameter).

C. For veneer masonry with reinforced concrete block backup, provide adjustable (2-piece) tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches on center; with side rods spaced for embedment within each face shell of back-up wythe and with separate adjustable ties engaging the cross ties and extended to engage outer veneer wythe and spaced not more than 16 inches on center, length of pintle as required to provide minimum 2-inch embedment into the veneer masonry with minimum 5/8 inch mortar cover; length of eye wire based on board insulation thickness; eyelets shall be three-point welded to reinforcement; provide type as follows:
   1. Provide Joint Reinforcement per ASTM A951/A951M and formed from the following:
      a. Galvanized carbon-steel wire, ASTM A1064/A1064M, coating and class as follows:
         1) ASTM A153, Class B-2, 1.50 oz./ft².
   2. Description: Welded-Wire Units prefabricated with deformed continuous side rods into straight lengths of not less than 10 feet with prefabricated corner and TEE Units and complying with the following:
      a. Wire Diameter Side Rods: 9 gauge.
      b. Wire Diameter Cross Rods: 9 gauge.
   3. Eyes and pintles: 3/16- inch diameter.
   4. Ladder design with eyes and pintles:
      a. Hohmann and Barnard Lox All Adjustable Joint Reinforcement 270-2X Ladder Eye-Wire.

2.6 TIES AND ANCHORS

A. General: Ties and anchors extend at least 2-inches into veneer but with at least a 5/8-inch cover on outside face.

B. Mesh Wall Tie: Hot-dip galvanized wire, ½- inch square by 16 gauge, Hohmann & Barnard #MWT.

C. Rectangular Wall Ties: Fabricated from cold-drawn steel wire 3/16- inch diameter conforming to ASTM A1064/A1064M, hot-dipped galvanized after fabrication to ASTM A153/A153M Class B2. Provide length required to provide minimum 2-inch embedment into masonry with minimum 5/8-inch mortar cover.

D. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
   2. Stainless Steel Wire: ASTM A580/A580M, Type 304.
   3. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
   4. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

E. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
   2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch-thick steel sheet, galvanized after fabrication.
   3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
   4. Masonry-Veneer Anchors:
      a. Basis of Design: Subject to compliance with requirement, provide one of the following:
         1) Anchoring to Steel Stud:
            a) Hohmann & Barnard, HB-213, Dur-O-Wal D/A 213
            b) WireBond; RJ-711 Plate with #2402 Pintle
            c) Heckmann Double Double Pintle Plate Veneer Anchor 213 with Double Pintle Wire Tie 282
         2) Hohmann & Barnard, Inc; HB5213 for anchoring to concrete block and/or concrete
      b. Size: As required to accommodate thickness of insulation as specified in Section 07 21 00 "Thermal Insulation," anchor depth not to exceed 4 inches.
   5. Expansion anchors for concrete and masonry:
      a. Hohmann and Barnard BL-523 Brass Expansion Bolt.
   6. Adjustable Veneer Anchors at Sills
      a. Provide two-piece assemblies for attachment of sills to wood blocking.
         1) Anchor: Anchor system for masonry sills to wood blocking shall consist of the following:
            a) Back Plate: Provide 14-gauge plate.
            b) Sheet metal shall conform to ASTM A1008/A1008M. Anchor shall be hot-dip galvanizing after fabrication conforming to ASTM A153/A153M Class B2, (1.5 oz./ft²).
            c) Products: DW-10HS by Hohmann & Barnard, or approved equal.
         2) Tie: Provide 3-inch-long Vee Byna-Tie fabricated from cold-drawn steel wire 3/16 inch diameter conforming to ASTM A1064/A1064M (tensile strength). Hot-dip galvanizing after fabrication shall conform to ASTM A153/A153M Class B2.
         3) Steel Drill Screws for wood:
            a) Wood screws; hex washer head, size #10, lengths required to penetrate wood 1-1/4 inches. The use of nails is not permitted.
            b) Provide stainless steel screws, Type 304 or 316, compatible with preservative-treated lumber/plywood and stainless steel through wall flashing.
            c) Provide neoprene sealing washers.

7. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.

2.7 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
   1. Stainless Steel: ASTM A240/A240M or ASTM A666/A666M, Type 304, 0.016 inch thick.
   2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft.. Provide splice plates at joints of formed, smooth metal flashing.
   3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
   4. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:
   1. Stainless Steel Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric with a butyl adhesive, to produce an overall thickness required for application.
      a. Basis of Design: Subject to compliance with requirements, provide the following:
         1) York Manufacturing, Inc; Flash-Vent SS (No cavity drainage material required)
         2) York Manufacturing, Inc.; Multi-Flash (requires cavity drainage material)
         3) Hohmann and Barnard; Mighty-Flash (requires cavity drainage material)
   2. Tensile strength, stainless-steel: 100,000 psi average.
   3. Puncture resistance, stainless-steel: 2,500 psi average.
   4. Mold resistance: ASTM D3273.
   5. Fire rating: Class A, per ASTM E84.
   6. Stainless-steel Sheet Metal Core: Type 304 complying with ASTM A240/A240M. Where projects are located within 5 miles of the coast provide Type 316.
   7. Fabrics:
      a. Polymer Fabric: Laminated to back side of stainless-steel core.
      b. Non-Woven Drainage Fabric: Laminated to front face of stainless-steel core.

C. Inside and outside corners: 26 gage stainless-steel.

D. End Dam: Product may be formed in the field or provide 26 gage preformed stainless-steel.

E. Splice Material: Provide one of the following materials.
   1. York Manufacturing, York 304 self- adhering stainless-steel material. For projects located within 5 miles of the coast provide Type 316.
      a. Widths: 4, 6, 9,12,18,24, and 36 -inch.
      b. Length: 20 and 50 feet.
   2. York Manufacturing Multi-Flash SS stainless-steel fabric flashing.
      a. Widths: 12,18,24, and 36- inch
      b. Length: 60 feet

F. Drip plate at head of window detail: Hohmann & Barnard DP, 26- gauge Stainless steel drip plate Type 316, 3 ½ inches wide. (Required where cavity drainage material is installed)

G. Flat Drip Plate: Hohmann & Barnard FDP, 26-gauge stainless steel flat drip plate, Type 316, 3 ½ inches wide. Provide 26-gauge stainless steel flat drip plate Type 316, 3 ½ inches inside and outside corners. (Required at base or wall conditions everywhere, when cavity drainage material is installed)

H. Solder and Sealants for Sheet Metal Flashings:
   1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.

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

J. Mastic as recommended by flashing manufacturer. Provide a letter from the air barrier manufacturer certifying that the mastic material is compatible with the membrane material.
   1. York Manufacturing UniverSeal US-100.
   2. STS Coatings GreatSeal LT-100.

K. Sealants:
   1. York Manufacturing UniverSeal US-100.
   2. STS Coatings GreatSeal LT-100.

L. Termination Bars for embedded flashing: One inch, 1/8 inch thick, minimum stainless-steel termination bar with sealant lip and holes spaced at 8 inches on center. NOTE: Plastic termination bars will not be allowed.

2.8 ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

C. Weep/Cavity Vents: Use the following unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
      a. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
         1) Hohmann & Barnard; Quadro Vent #QV
         2) Heckmann Building Products Inc.; No. 85 Cell Vent.
         3) Wire-Bond; Cell Vent.
      b. Color: As selected by Architect from Manufacturer’s full range

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. (Not needed with York Flash-Vent SS products).
   1. Mortar Deflector: Strips, full depth of cavity and 10 inches high, with dimpled surface that prevent clogging with mortar droppings.
      a. Basis of Design Product: Subject to compliance with requirements, provide Masonry Mat as manufactured by CavClear, or comparable product by one of the following:
         1) Advanced Building Products Inc.; Mortar Break/Mortar Break II
         2) Wire-Bond; Cavity Net 3611

E. Joint Filler: Closed-cell neoprene sponge conforming to ASTM D1056, 3 inch wide, 3/8 inch and 1 inch thick as manufactured by Hohmann and Barnard, Inc. or approved equivalent

F. Lintels: Steel lintels shall be hot-dip galvanized ASTM A36/A36M shop primed for field-painting.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. For exterior masonry, use portland cement-lime mortar.
   4. For reinforced masonry, use portland cement-lime mortar.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S.
   3. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments do not exceed 10 percent of portland cement by weight.
   2. Mix to match Architect's sample.
   3. Application: Use pigmented mortar for exposed mortar joints with the following units:
      a. Exterior Exposed Unit Masonry
      b. Exterior Exposed Cast Stone
      c. Exterior Exposed Anchored Stone Masonry Veneer

E. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry and limestone without discoloring or damaging masonry or stone surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Products:
      a. 202V Vana-Stop; Diedrich Technologies, Inc.
      b. Sure Klean Vana Trol; ProSoCo, Inc.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.

7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

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

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in stacked bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 CAVITY WALLS

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

B. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.
1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Embed tie sections in masonry joints.
   3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   4. Space anchors 16 inches o.c. vertically and horizontally.

B. Provide not less than 1-5/8 inches of airspace between back of masonry veneer and face of insulation.
   1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at[corners,] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints in brick as follows:
   1. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."

C. Install masonry expansion joints at the following locations, unless otherwise indicated on Drawings:
   1. Exterior Walls: 20 feet on center and within 24 inches on each side of inside and outside corners.
   2. At changes in wall height.
   3. On one side of openings up to 6’-0” wide. At openings over 6’-0” wide provide joints on each side of opening.
   4. At changes in wall thickness.
   5. Above movement joints in foundations and floors.

6. At parapets where masonry is exposed on back side and joints are spaced more than 15 feet on center install an extra joint located between those joints carried up from the building wall below.
7. Shelf Angles: Locate horizontal expansion joints immediately below shelf angles.
8. At offset and setbacks.

D. Do not install adjustable masonry veneer anchors through expansion joints.

E. Install joint filler in continuous lengths. Set face of joint filler 1-1/2 inches in from outside face of brick or block.

F. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where indicated and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are indicated without structural steel or other supporting lintels.

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

3.11 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend thru-wall flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of thru-wall flashing to sheathing through termination bar.
3. At lintels and shelf angles, extend flashing 6 inches minimum at each end. At heads and sills, extend flashing 6 inches minimum and turn ends up not less than 2 inches to form end dams.
4. Install metal drip edges beneath thru-wall flashing at exterior face of wall where indicated. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
5. Cut thru-wall flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep vents in head joints in exterior wythes at 32 inches o.c. horizontally at block and 24 inches o. c. horizontally for brick above through-wall flashing, above lintels, shelf angles and at bottom of walls. Above window and door openings install weep vents at 16 inches o.c. for both brick and block. Install weep vents at top of walls and below shelf angles spaced at 32 inches o.c. Install a weep vent at each end dam.
1. At masonry sills install weep vents in the horizontal position at 24 inches on center. Provide a minimum of two weep vents per sill.

2. All weep vents installed in conjunction with through wall flashing shall be placed directly on top of the horizontal surface of the through wall flashing. Do not place on top of the mortar bed joint at this location.
3. Set weep vents flush with face of masonry.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Level 2 in TMS 402/602.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

C. Testing Prior to Construction:
1. Mortar: Mold and test one set of compressive strength cubes in accordance withASTM C780.
2. Grout: Mold and test one set of compressive strength cubes in accordance with ASTM C1019.
3. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
4. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
6. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other steel items not defined as structural steel.

B. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for painting requirements.

1.2 SUMMARY:

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Galvanized repair paint.
8. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
4. Identify members not to be shop primed.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Mill test reports for structural-steel materials, including chemical and physical properties.

C. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.

2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Option 1: Connection designs have been completed and connections indicated on the Drawings.

C. Moment Connections: Type FR, fully restrained.

D. Construction: Moment frame.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles, M-Shapes: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A490 & A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

2.4 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.

1. Nuts: ASTM A563 heavy-hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436, Type 1, hardened carbon steel.
4. Finish: Plain.

2.5 PRIMER

A. Steel Primer:

1. Comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

B. Galvanized-Steel Primer: MPI#26.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
   1. Fabricate beams with rolling camber up.
   2. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces to be field welded.
   2. Surfaces of high-strength bolted, slip-critical connections.
   3. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   4. Galvanized surfaces.
   5. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
   1. SSPC-SP 7 (WAB)/NACE WAB-4.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

   1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
   2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

      a. Liquid Penetrant Inspection: ASTM E165/E165M.
      b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      c. Ultrasonic Inspection: ASTM E164.
      d. Radiographic Inspection: ASTM E94/E94M.

   4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

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

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3.5 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

END OF SECTION

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.

B. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 SUMMARY:

A. Section Includes:

1. Roof deck.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Test and Evaluation Reports:

1. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

E. Qualification Statements: For welding personnel.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.3/D1.3M.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

2.2 ROOF DECK

A. Manufacturers and products
1. Verco HSB-36
2. ASC Steel Deck B-Deck
3. New Millennium Standard B Deck
4. Cordeck 1.5" B Wide Rib
5. D-MAC Type 1.5B
6. Canam 1.5" Type B

B. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard.

2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 80, G90 zinc coating.
3. Deck Profile: As indicated.
4. Profile Depth: As indicated.
5. Design Uncoated-Steel Thickness: As indicated.
6. Span Condition: As indicated.
7. Side Laps: Interlocking seam.

2.3 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter:as indicated, nominal.
2. Weld Spacing: as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 12 inches, and as follows:
   1. Button punch.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 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, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weldto substrate to provide a complete deck installation.

   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

   1. Wire brush and clean rust spots, welds, and abraded areas on both surfacesof prime-painted deck immediately after installation, and apply repair paint.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

   1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

      a. Field welds will be subject to inspection.

   2. Steel decking will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior non-load-bearing wall framing.
   2. Soffit framing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: Cold-formed steel framing materials.

B. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   3. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.

C. Delegated Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Mill certificates signed by manufacturers of cold-formed metal framing certifying that their products comply with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, and galvanized-coating thickness.

E. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
   1. Steel sheet.
   2. Power-actuated anchors.
   3. Mechanical fasteners.
   4. Vertical deflection clips.
   5. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer, licensed in the state in which project is constructed, to prepare and sign and seal design calculations, Shop Drawings, and other structural data.

B. Professional Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind

indicted that have resulted in the installation of cold-formed metal framing similar to this Project in material, design and extent and that have a record of successful in-service performance.

C. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

F. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ClarkDietrich.
   2. CEMCO
   3. Telling Industries
   4. The Steel Network, Inc

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated on Drawings.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
      b. Deflection of L/180 for metal wall panels and soffit panels.
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 3/4 inch.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S240.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 90 percent.

B. Framing Members, General: Comply with AISI S240 for conditions indicated.

C. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 or equivalent.

D. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch.
   2. Minimum Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.
   2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard head and bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
      a. VertiClip SL as manufactured by The Steel Network, Inc – Head Condition
      b. VertiClip SLB as manufactured by The Steel Network, Inc – Bypass Clip

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch.
   2. Minimum Flange Width: 1-5/8 inches, minimum.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers and knee braces.
   9. Joist hangers and end closures.
   10. Hole-reinforcing plates.
   11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20.

B. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

C. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: 16 inches on center to align with spacing of masonry or stone veneer anchors as specified in Division 04.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Connect vertical deflection clips to bypassing studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according toASTM A780/A780M and manufacturer's written instructions.

3.7 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous Framing and Supports:
      a. Steel framing and supports for overhead doors.
      b. Steel framing and supports for countertops.
      c. Steel framing and supports for equipment.
      d. Steel tube reinforcement for low partitions.
   2. Metal Ladders and Accessories:
      a. Steel ladders.
   3. Metal bollards.
      a. Type 1: Fixed Steel Pipe Bollard.
      b. Type 2: Fixed Stainless Steel Bollard.
      c. Type 3: Retractable Stainless Steel Bollard.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 RELATED WORK

A. Section 07 92 00 "Roof Accessories" for roof hatches.

B. Section 09 91 13 "Exterior Painting" for paint systems intended for concrete filled steel pipe bollards.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Submit roof hatch access ladders concurrently with roof hatch and safety railing systems specified in Section 07 92 00 "Roof Accessories."

B. Product Data: For the following:
   1. Nonslip aggregates and nonslip-aggregate surface finishes.
   2. Fasteners.
   3. Shop primers.
   4. Shrinkage-resisting grout.
   5. Metal bollards.

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
   1. Metal bollards.
   2. Supports for interior architectural systems.

D. Samples for Verification: For each finish and filler material of extruded nosing.

E. Delegated Design Submittal: For metal fabrications supporting architectural and mechanical systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Engineering Responsibility: Engage a stair and ramp fabricator who assumes undivided responsibility for engineering stair and ramp framing by employing a qualified professional engineer, licensed in the state in which project is constructed, to prepare and sign and seal design calculations, Shop Drawings, and other structural data.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State of Texas.

B. Welding certificates.

C. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders and mechanical system support .

B. Structural Performance of Ladders: Ladders to withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.

C. Regional Materials: Manufacture products within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.

D. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

H. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

I. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum and stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563/A563M; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563/A563M; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting."

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, non-gaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
   1. Provide stainless steel attachment assemblies, including anchoring and fastening hardware, for all metal fabrications.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Galvanize miscellaneous framing and supports on exterior of building.

2.7 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3.

B. Steel Ladders:
   1. Space siderails 16 inches apart unless otherwise indicated.
   2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
   3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   4. Slip-resistant rungs: Provide 13 gage galvanized steel rungs, 1-5/8 inch wide by 1-1/8 inch high with 3 rows of closely spaced perforated buttons for slip resistance
      a. Basis of Design: Subject to compliance with requirements, provide Traction-Tread Ladder Rungs as manufactured by McNichols Company.
   5. Support each ladder with welded or bolted steel brackets.
      a. Size brackets to support design loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7-inches.
      b. Extend side rails 42 inches above top rung and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure to provide secure ladder access.
   6. Galvanize exterior ladders, including brackets.

2.8 METAL BOLLARDS

A. Bollard (Type 1): Fabricate metal bollards from Schedule 40 steel pipe, ASTM A123/A123M hot dipped galvanized, shop prime for field painting.
   1. Concrete filled: 3,000 psi as specified in Section 03 30 00 “Cast-in-Place Concrete.” Crown capped.
   2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
   3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
   4. Fabricate sleeves for bollard anchorage from hot dip galvanized steel or stainless steel pipe or tubing with 1/4-inch-thick, hot dip galvanized steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
   5. Field painted.
   6. Acceptable Alternate: Calpipe Security Bollards Industrial Fixed Bollards Model #IBF04080-HDG-1023-36-12-D.
      a. Thickness: ScheDiameter: 4 inches.
      b. Diameter: 4 inches.
      c. Height: 36 inches.
      d. Embedded Depth: 12 inches.
      e. Cap profile: Domed.
      f. Finish: Not Dipped Galvanize, and prefinished to match RAL selection from Architect.

B. Bollard (Type 2) Permanent Stainless Steel Bollard:
   1. Basis of Design: Calpipe Security Bollards Stainless Steel Fixed Bollards Model #SSF04080-304-36-12-D.
   2. Diameter: 4 inches.
   3. Height: 36 inches above grade.
   4. Embedded Depth: 12 inches.
   5. Cap profile: Domed.
   6. Finish: Satin Stainless, Type 304.

C. Bollard (Type 3) Retractable Stainless Steel:
   1. Basis of Design: Ameristar Manual Retractable Bollards
      a. Height: 36 inches
      b. Diameter: 5 inches.
      c. Finish: Stainless Steel.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.3 INSTALLATION OF METAL BOLLARDS

A. Comply with manufacturer's written instructions for installation of manufactured bollards.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete or in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 REPAIRS

A. Touchup Painting:
   1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood blocking, cants, and nailers.
   2. Plywood backing panels.

1.2 RELATED WORK

A. Section 10 28 00 "Toilet Accessories" for grab bars intended to be supported by engineered wood blocking.

1.3 DEFINITIONS

A. Lumber grading agencies, and abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. SPIB: The Southern Pine Inspection Bureau.
   4. WCLIB: West Coast Lumber Inspection Bureau.
   5. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates:
   1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Reports: For the following, from ICC-ES:
   1. Wood-preservative-treated wood.
   2. Fire-retardant-treated wood.
   3. Power-driven fasteners.
   4. Post-installed anchors.

C. Qualification Statements: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that

periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
   4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:
   1. Dimension Lumber: 19 percent unless otherwise indicated.

C. Engineered Wood Blocking at grab bars and wall hung cabinets:
   1. Engineer blocking to resist a single concentrated load of 250 pounds applied in any direction at any point.
   2. Provide a rigid wall backing system; Backit as manufactured by The Steel Network.
      a. ASTM A1003/A1003M Structural Grade 50 (340) Type H, ST50H (ST340H): 50ksi (340MPa) minimum yield strength, 65ksi (450MPa) minimum tensile strength, 43mil minimum thickness (18 gauge, 0.0451” design thickness) with ASTM A653/A653M G60 (Z180) hot dipped galvanized coating.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3B.
   1. Preservative Chemicals: Water-borne preservative Ca-C, copper azole Type C, and acceptable to authorities having jurisdiction.
   2. After treatment, redry dimension lumber to 19 percent maximum moisture content.
      a. Plywood: 18 percent maximum

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Roof cant, roof nailers, roof blocking, roof curbing
   2. Blocking/Nailers in exterior cavity wall openings
   3. Blocking/Nailers in exterior wall openings

4. Blocking at window heads.
5. Wood leveling base at cabinetry.

2.3 FIRE-RETARDANT TREATMENT

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
      a. Arch Wood Protection, Inc; Dricon FRT
      b. Viance; D-Blaze
   2. Treatment shall not promote corrosion of metal fasteners.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
   1. Concealed wood blocking at window heads
   2. Plywood backing panels installed at security, electrical and technology panel boards

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Cants.
   4. Furring.
   5. Grounds.

B. Concealed Wood Blocking, Curbing, Nailers, Cants: 19 percent maximum moisture content and the following species and grades:
   1. Mixed southern pine or southern pine; No. 2 grade; SPIB.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
   1. Products shall contain no added formaldehyde resins.

B. Plywood in accordance with DOC PS 1 and as follows:
   1. Exterior
      a. Not Exposed: APA rated all veneer plywood sheathing, exterior, Group 1 minimum 5 plies, of thickness shown on Drawings.
      b. Moisture content of panels at time of shipment shall not exceed 18 percent.
   2. Interior
      a. Not Exposed: APA rated all veneer plywood sheathing, exposure 1, Group 1, minimum 5 plies, of thickness indicated on Drawings.
      b. Moisture content of panels at time of shipment shall not exceed 18 percent.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

B. All fasteners and anchors used in contact with pressure-treated wood and in high humidity locations (lumber and plywood) shall be labeled as appropriate for use with the specified wood treatments and shall be:
   1. Screws, nails and small bolts: Stainless steel Type 304 or 316, size and type to suit condition.
   2. Bolts ¼-inch diameter or greater: Hot-dipped galvanized per ASTM A153/A153M.
   3. For pressure-preservative-treated wood, use stainless steel fasteners.
   4. At all non-treated and fire-retardant-treated locations, provide hot-dipped galvanized perASTM A153/A153M unless noted otherwise, size and type to suit location.

C. Nails, Brads, and Staples: ASTM F1667/F1667M.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

D. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous high-temperature underlayment between wood and metal decking, as specified in Section 07 62 00 “Sheet Metal Flashing and Trim.”

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. FM Global Property Loss Prevention Data Sheet 1-49 for wood blocking and nailers at roofing and flashing.
3. ICC-ES evaluation report for fastener.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD NAILERS

A. Install where indicated and where required for attaching other work, such as open eaves and edges, where wood cants are install, where wood curbs are install, and where shown in Drawings. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Exterior Wall Openings, Framed Metal Backup:
1. At window openings, secure 2 x wood nailers plus two layers of 5/8 inch plywood, unless otherwise noted on the drawings through the 1/2 inch sheathing to the metal stud framing using Rodenhouse Inc., #10 Grip Deck Ceramic Coated self-drilling screws. Pre drill wood.
   a. At 3 1/2 inch wide material, provide 2 fasteners centered as shown, spaced at maximum 16 inches on center. Ensure fasteners engage metal stud framing minimum 4 pitches of thread.
   b. At 5 1/2 inch wide material, provide 2 vertical rows of fasteners, spaced as shown at maximum 16 inches on center. Ensure fasteners engage metal stud framing minimum 4 pitches of thread

3.3 PROTECTION

A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.4 SCHEDULE

A. Roof cants, roof nailers, roof blocking, roof curbing, and blocking/nailers in exterior openings:
   1. Southern pine species for lumber, preservative treated.
   2. Group 1, exterior grade for veneer core plywood, preservative treated.

B. Wood blocking at window heads:
   1. Southern pine species for lumber, fire-retardant treated.
   2. Group 1, exterior grade for veneer core plywood, fire-retardant treated.

C. Concealed wood blocking in interior metal stud partitions for supporting washroom accessories, door stops, wall-hung equipment, steel support brackets, etc:
   1. Southern pine species for lumber, untreated. Wood blocking or nailers on metal stud framing shall be bolted to framing.

D. Concealed wood blocking in interior metal stud partitions for supporting grab bars, floor-mounted cabinets and wall-hung cabinets:
   1. 2 by 6 Southern pine, untreated, installed with Backit rigid wall backing. Provide an approved hot-dipped galvanized screw fastener in each guide hole in the rigid wall backing plate.

E. Security, electrical and technology panel boards:
   1. Fire-retardant-treated veneer core plywood panel. Paint panel black. Do not paint over the International Building Code required fire-retardant treated wood label.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Parapet sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.5 WARRANTY

A. Wall sheathing shall have a 12-month exposure warranty.

B. Wall sheathing shall have a 5-year warranty against manufacturing defects.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Mold Resistance: Wall sheathing and roof boards shall receive a score of 10 indicating no mold growth detected in the category of mold and mildew resistance when tested in accordance with ASTM D3273ASTM D3273.

B. Fire Performance, Wall Sheathing and Roof Board:
   1. Maximum flame spread – 10, maximum smoke developed – 0, when tested in accordance with ASTM E84.
   2. Non-combustible when tested in accordance with ASTM E136.
   3. Type X exterior sheathing, conducted in accordance with ASTM E119, shall qualify the product to be listed for various UL listings in the UL Fire Resistance Directory.

C. Wall sheathing shall be compatible with materials specified in Division 7 which are to be installed directly to the sheathing.

2.2 WALL AND PARAPET SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C1177/C1177M.

B. Basis of Design: Subject to compliance with requirements provide Dens-Glass Gold as manufactured by Georgia Pacific Gypsum LLC, or one of the following:
   1. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing
   2. USG Corporation; Securock

3. CertainTeed Corporation; GlasRoc

C. Type and Thickness: Regular, 1/2 inch for non-rated construction, Type X, 5/8 inch thick where 1-hour construction is noted on the plans.

D. Size: 48 by 96 inches for vertical installation.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667/F1667M.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
   1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Installation accessory materials used to seal joints must be approved by manufacturer of air barrier assembly as specified in Section 07 27 26 “Fluid-Applied Membrane Air Barriers.”

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
   2. ICC-ES evaluation report for fastener.

D. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.

2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Installation on wall: Attach sheathing perpendicular (horizontal) to framing, with end joints staggered not less than one stud spacing. Abut ends of boards over centers of stud flanges. Fit boards tightly against each other and around openings.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Seal sheathing joints in compliance with Section 07 27 26 “Fluid-Applied Membrane Air Barriers.”

END OF SECTION

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SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced and Solid Surface interior architectural woodwork at reception desk and teamwork desk (SS-21, PL-4).
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural woodwork.

1.2 RELATED WORK

A. Section 06 10 00 “Miscellaneous Rough Carpentry”

B. Section 06 41 16 “Plastic-Laminate-Clad Architectural Cabinets”

C. Section 12 36 61.16 "Solid Surfacing Countertops."

D. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 6.2 Architectural Woodwork August 2022 and Appendix 9.11 Plastic Laminate and Solid Surface February 2024

1.3 COORDINATION

A. Coordinate layout and installation of architectural woodwork with other work penetrating the ceiling including light fixtures, HVAC equipment, and fire suppression system components.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Convene minimum two weeks prior to starting work of this section. Agenda shall include project conditions, coordination with work of other trades, and layout of items that penetrate ceilings and walls.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Plastic laminate
   2. Anchors.
   3. Adhesives, including VOC content.
   4. Shop finishing materials.

B. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

C. Shop Drawings:
   1. Include the following:
      a. Include plans, elevations, sections, and attachment details.
      b. Show large-scale details.
      c. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
      d. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad architectural woodwork.
      e. Apply AWI Quality Certification Program label to Shop Drawings.

1) Contractor's Option: WI Certified Compliance label to Shop Drawings.

D. Samples for Initial Selection: For each type of shop-applied exposed finish.
   1. Size:
      a. Panel Products: 12 inches by 12 inches.
      b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

E. Samples for Verification: For the following:
   1. Plastic Laminates: 12 by 12 inches, for each type, color, pattern, and surface finish required.
      a. Provide one sample applied to core material with specified edge material applied to one edge.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Product Certificates: For the following:
   1. Composite wood products.
   2. Adhesives.

1.7 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
   1. As Contractor's Option: WI Certified Compliance Program Certificates

1.8 QUALITY ASSURANCE

A. Fabricator's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Fabrication shop has at least five years of experience fabricating and installing millwork on a minimum of five projects of similar scope and complexity as this project.
   1. Fabricator's Certification: Licensed participant in AWI's Quality Certification Program.
   2. Alternate: Woodworking Institute's (WI) Certified Compliance Program Licensee with experience fabricating work complying with the Certified Compliance Program meeting requirements of the North American Architectural Woodwork Standards (NAAWS).
      a. Woodwork Institute Contact in Texas: Shannon Davidson, Architectural Sales Representative. Email: shannon@woodinst.com. Phone: (737) 314-0220

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockups of typical interior architectural woodwork as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.10 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 PANELING, GENERAL

A. Quality Standard: Comply with ANSI 0622.0646-2024 "Architectural Woodwork Institute - Interior & Exterior Millwork."
   1. Aesthetic: Custom Grade
   2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.2 ARCHITECTURAL WOODWORK FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
   1. Buda Woodworks, LLC
   2. Dovetail Custom Woodworks
   3. K&J Woodworks
   4. Millennia Cabinetry Inc
   5. Trautschold Millwork, Ltd
   6. https://awiqcp.org/woodworkers/find-a-qcp-firm/
   7. Contractor’s Option: Qualified firms with experience fabricating work in compliance with NAAWS, and the Certified Compliance Program of the Woodwork Institute.

2.3 INTERIOR ARCHITECTURAL WOODWORK

A. Comply with requirements in Section 06 41 16 “Plastic Laminate Clad Architectural Cabinets” and Section 12 36 61.16 "Solid Surfacing Countertops."

B. Plastic Laminate: High-pressure decorative laminate complying with ISO 4586-3.
   1. Faces: Grade HGS.
   2. Backs: Balance material with thickness matching exposed surface.
   3. Exposed Edges: Same as faces.

C. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
   1. As indicated on List of Finishes on Drawings.

2.4 MISCELLANEOUS MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Medium Density Fiberboard (MDF): ANSI A208.2, Grade 155 MR50
      a. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
         1) Roseburg Forest Products; Medite II (Typical)
         2) Roseburg Forest Products; Medex (Wet areas, countertops and backsplashes)
      b. Recycled Content: 100 percent pre-consumer recycled wood residuals
      c. Binder: Formaldehyde-free adhesive system
   2. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.

C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   1. Interior Contact Adhesive and Sealants: Maximum volatile organic compound (VOC) content in accordance with SCAQMD Rule 1168.
      a. Contact adhesive: Maximum VOC 80 g/L.
      b. Special purpose contact adhesive: Maximum VOC 250 g/L.
      c. Architectural sealants: Maximum VOC content 250 g/L.
      d. Architectural sealant primers: Maximum VOC content:
         1) Non-porous: 250 g/L
         2) Porous: 775 g/L

D. C-Hangers: Suspension hangers that are direct-screwed to the panel and hang over the heavy duty-grid. Hangers are made of spring-steel with phosphate pre-treatment and corrosion-resistant coating.

E. Dowel Clips: Clips are spring-steel with phosphate pre-treatment and corrosion-resistant coating and are attached by fitting around the dowel and attaching to the grid system.

F. Z-Clips: Male/female aluminum attachment clips, similar to a French cleat but with a thinner profile, used to hang wood wall panels on furring strips.

2.5 FABRICATION

A. Edges, borders, and perimeter trims shall be indicated on the Drawings in accordance with the manufacturer's standard design details.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
   1. Disassemble components only as necessary for shipment and installation.
   2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.

PART 3 EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

B. Install interior architectural woodwork level, plumb, true in line, and without distortion.
   1. Shim as required with concealed shims.
   2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

3.3 CLEANING

A. Clean interior architectural woodwork.

END OF SECTION

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SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced architectural cabinets (PL-4).
   2. Cabinet hardware and accessories.
   3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets that are not concealed within other construction.

1.2 RELATED WORK

A. Section 06 41 16 "Plastic Laminate-Faced Architectural Cabinetry."

B. Section 12 36 23.13 "Plastic Laminate-Faced Countertops."

C. Section 12 36 61.16 "Solid Surfacing Countertops"

D. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.11 Plastic Laminate and Solid Surface February 2024

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 DEFINITIONS

A. Exposed exterior surfaces, defined as all exterior surfaces exposed to view, include:
   1. All surfaces visible when doors and drawers are closed, including knee spaces.
   2. Underside of cabinet bottoms over 42 inches above the finished floor, including cabinet bottoms behind light valances and the bottom edge of light valances.
   3. Cabinet tops under 80 inches above the finished floor, or if 80 inches and over and visible from an upper building level or floor.
   4. Front edges of stretchers, ends, divisions, tops, and bottoms.
   5. Sloping tops of cabinets that are visible.

B. Exposed interior surfaces, defined as all interior surfaces exposed to view in open casework or behind transparent doors, include:
   1. Shelves, including edgebanding.
   2. Divisions and partitions (Front edge is an exposed surface).
   3. Interior face of ends (sides), backs and bottoms (including pull-outs). Also included are the interior surfaces of cabinet top members 36 inches or more above the finished floor.
   4. Interior face of door and applied drawer fronts.

C. Semi-exposed surfaces, defined as those interior surfaces only exposed to view when doors or drawers are opened, include:
   1. Tops and bottoms of shelves, including front edge banding (Front edge is an exposed surface).
   2. Divisions and partitions (Front edge is an exposed surface).
   3. Interior face of ends (sides), backs and bottoms (including a bank of drawers). Also included are the interior surfaces of cabinet top members 36 inches or more above the finished floor.

4. Drawer sides, sub-fronts, backs and bottoms.
5. The underside of cabinet bottoms between 24 inches and 42 inches above the finished floor.
6. Security and dust panels or drawer stretchers.

D. Concealed surfaces, defined as those exterior or interior surfaces that are covered or not normally exposed to view include:
1. Toe space unless otherwise specified.
2. Sleepers, stretchers and solid sub-tops.
3. The underside of cabinet bottoms less than 24 inches above the finished floor.
4. The flat tops of cabinets 80 inches or more above the finished floor, except if visible from an upper floor or building level.
5. The three non-visible edges of adjustable shelves.
6. The underside of countertops, knee spaces and drawer aprons.
7. The faces of cabinet ends of adjoining units that butt together.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. For adhesives and sealants, indicate VOC content.

B. Shop Drawings:
1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply AWI Quality Certification Program or WI Certified Compliance Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

D. Samples for Verification: For the following:
1. Plastic Laminates: 12 by 12 inches, for each type, color, pattern, and surface finish required.
a. Provide one sample applied to core material with specified edge material applied to one edge.
2. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
   1. As Contractor's Option: WI Certified Compliance Program Certificates

1.9 QUALITY ASSURANCE

A. ANSI/AWI 0641-2019—Architectural Wood Casework Standard for Structural Performance.

B. Fabricator's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Fabrication shop has at least five years of experience fabricating and installing millwork on a minimum of five projects of similar scope and complexity as this project.
   1. Fabricator's Certification: Licensed participant in AWI's Quality Certification Program.
   2. Alternate: Woodworking Institute's (WI) Certified Compliance Program Licensee with experience fabricating work complying with the Certified Compliance Program meeting requirements of the North American Architectural Woodwork Standards (NAAWS).
      a. Woodwork Institute Contact in Texas: Shannon Davidson, Architectural Sales Representative. Email: shannon@woodinst.com. Phone: (737) 314-0220

C. Installer Qualifications: Fabricator of products.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockups of typical architectural cabinets as shown on Drawings.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.11 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control:
   1. Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
   2. Monitor site for temperature and humidity to verify environmental conditions meet door manufactuer's standards.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Buda Woodworks, LLC

2. Dovetail Custom Woodworks
3. K&J Woodworks
4. Millennia Cabinetry Inc
5. Trautschold Millwork, Ltd
6. https://awiqcp.org/woodworkers/find-a-qcp-firm/
7. Contractor's Option: Qualified firms with experience fabricating work in compliance with NAAWS, and the Certified Compliance Program of the Woodwork Institute.

2.2 CABINETS, GENERAL

A. Quality Standard: In accordance with ANSI 0641-2019:
   1. Aesthetic: Custom Grade
   2. Duty Level 3: Institutional Casework and 4: Laboratory Casework
   3. Provide labels and certificates from AWI certification program indicating that woodwork[and installation] complies with requirements of grades specified.

2.3 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Type of Construction: Frameless.

B. Door and Drawer-Front Style: Flush overlay.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
   1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
      a. As indicated on Finish Schedule.

D. Laminate Facing for Exposed Surfaces:
   1. Horizontal Surfaces and High Usage Exposure: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: Grade VGS.
   5. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

E. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels with MDF core.
      a. Edges of Plastic-Laminate Shelves and other semi-exposed edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
      b. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.
      c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Colors, Patterns, and Finishes for thermally fused panel:
      a. White or Black
   3. Drawer Sides and Backs: Solid-hardwood lumber.
   4. Drawer Bottoms: Hardwood plywood.

F. Dust Panels: 1/2-inch plywood or MDF above compartments and drawers unless located directly under tops.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued doweled joints or glued dovetail joints.

I. Toe Base (at Rubber Base): Dimensional lumber preservative-treated in dimension indicated on Drawings. Provide rubber base indicated on List of Finishes.

J. Toe Base (Plastic-Laminate-Faced): 3/4-inch-thick preservative-treated plywood with no inner voids intended for plastic-laminate-faced finish in PL# indicated on Drawings. Install preservative treated plywood in front of leveling base, maintaining toe kick clearance indicated on Drawings.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.

B. Plywood: ANSI/HPVA HP-1 (latest edition), preservative treated with no inner voids.

C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Medium Density Fiberboard (MDF): ANSI A208.2, Grade 155 MR50
      a. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
         1) Roseburg Forest Products; Medite II (Typical)
         2) Roseburg Forest Products; Medex (Wet areas, countertops and backsplashes)
      b. Recycled Content: 100 percent pre-consumer recycled wood residuals
      c. Binder: Formaldehyde-free adhesive system
   2. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
   3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
   4. Thermally Fused Laminate (TFL) Panels: MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
      a. Interior Finish Color: White or Black

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:
   1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.

C. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening, self-closing.
   1. Provide screws as recommended by hinge manufacturer for panel product specified to host hinge assembly.

D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

E. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141. Heavy Duty, Aluminum.
   1. Knape & Vogt 918 ALUM

F. Catches: Spring-Loaded Elbow Catches, ANSI/BHMA A156.9. Install on inactive leaf of doors indicated to be locked.
   1. Hafele 245.74.200

G. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.
   1. Knape & Vogt 87 ANO Standards (96 inch length) with 187LL ANO Brackets.

H. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
   1. Knape & Vogt #345 NP
   2. Alternate: Bainbridge Manufacturing, Inc.; 32201 Shelf Support 5MM Pegs in clear color.

I. Drawer Slides: ANSI/BHMA A156.9.
   1. Standard Duty (Grade 1 and Grade 2): Side mount and extending under bottom edge of drawer.
      a. Keyboard Drawer Slide:
         1) Accuride CBERGO Tray 300
         2) CompX Waterloo C400
      b. Box and File Drawers: 100 lb. load rating, side mounting, steel ball bearing, full extension, for drawer widths up to 24 inches wide and drawer depths deeper than 6 inches.
         1) Accuride 7432
         2) Finish: Clear zinc (ROHS compliant)
   2. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200):
      a. Large Storage, Lateral Files. 200 lb. load rating, side mounting, steel ball bearing, over travel, for drawer widths 24 inches to 42 inches
         1) Accuride 3640
   3. At all file storage drawers, provide extruded aluminum hangrails systems, adjustable to accommodate up to 11x17 document sizes, with framework mounted to both side panels, to support hanging files.
   4. Pencil drawers not more than 3 inches high and not more than 24 inches wide, provide 50 lb load capacity.
   5. General purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 75 lb load capacity.
   6. File drawers more than 6 inches high or more than 24 inches wide, provide 100 lb load capacity.
   7. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 150 lb load capacity.
   8. Lateral file drawers more than 6 inches high and more than 30 inches wide, provide 200 lb load capacity.
   9. Computer keyboard tray, provide 75 lb load capacity.

J. Digital Door Lock: Battery-powered electronic alphanumeric keypad interface and key slot to operate locks with an ADA compliant user key.
   1. Basis of Design: Digilock Curve
   2. Style: Vertical body style with pull handle
   3. Deadlatch or Deadlock.
   4. Finish: Manufacturer's standard.

K. Digital Drawer Lock: Battery-powered electronic alphanumeric keypad interface and key slot to operate locks with an ADA compliant user key.

1. Basis of Design: Digilock Curve
2. Style: Verticle body style with pull handle
3. Deadlatch or Deadlock.
4. Finish: Manufacturer's standard.

L. Surface Bolts: Provide two on inactive leaf of cabinet units 48 inches or taller.

M. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

N. Door and Drawer Bumpers: Clear plastic bumpers

O. Grommets for Cable Passage: 2-3/8 inch OD, molded-plastic grommets and matching rotating plastic caps with slot for wire passage.
1. Hafele 631.26.301, Black

P. Heavy-Duty Shelf and Rod Supports: Knape & Vogt 1195 White.
1. Coat Rods: Knape & Vogt 770-1, extra-duty round steel tube, 1-1/16 inch OD. Provide flange KV 734 at each end of rod. Finish Chrome

Q. Concealed Aluminum Bracket (Non-Ferrous Type, Heavy-Duty): Rakks EH-1818FM
1. Size: 18 inches by 18 inches, for countertop depth up to 25 inches.
2. Load Capacity: 450lbs.
3. Confirm installation with lead lined systems to maintain radiation protection barrier.

R. Standard Workstation Brackets (BR1): A&M Hardware, Inc. Factory prime for field painting.
1. Standard Bracket for 24-inch counters: 21 inches by 21 inches.
a. Spacing: Maximum 36 inches on-center
2. Standard Bracket for 30-inch countertops: 24 inches by 29 inches
a. Spacing: Maximum 36 inches on-center

S. Extended Concealed Brackets 2.0 (BR2): A&M Hardware, Inc
1. Size: 24 inches by 26 inches
2. Color: Black

T. Concealed Flat Brackets (BR3): A&M Hardware, Inc
1. Extended Concealed Flat Bracket
a. Size: 26 inches by 26 inches
2. Concealed Flat Bracket
a. Size: 26 inches by 26 inches
3. Spacing: Maximum 36 inches on-center
4. Finish: Prefinished Black

U. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: ANSI/BHMA 630.

V. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   1. Interior Contact Adhesive and Sealants: Maximum volatile organic compound (VOC) content in accordance with SCAQMD Rule 1168.
      a. Contact adhesive: Maximum VOC 80 g/L.
      b. Special purpose contact adhesive: Maximum VOC 250 g/L.
      c. Architectural sealants: Maximum VOC content 250 g/L.
      d. Architectural sealant primers: Maximum VOC content:
         1) Non-porous: 250 g/L
         2) Porous: 775 g/L

D. MDF Waterproof Edge Sealer: The West System; Two-part epoxy system.
   1. Part A, West System 105 Epoxy Resin.
   2. Part B, West System 206 Slow Hardener.
   3. VOC Content: The combined VOC content is 9.59 g/L. for waterproofing sealers.
   4. Complies with: SCAQMD Rule 1113, Architectural Coatings. Max VOC Content for waterproofing sealers: 100 g/L.

2.7 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
   1. Inspection entity is to prepare and submit report of inspection.

B. Contractor’s Option: Comply with Field Quality Control Inspection requirements as outlined by the Woodwork Institute’s Certified Compliance Program.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

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SECTION 06 64 00 - RESIN FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resin panel divider system, frameless cable/rod system (RP-1).
   2. Resin panels serving as workstation privacy screen, captured along bottom edge at countertop and top edges at ceiling framing (RP-2).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health Design Standards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Submit manufacturer’s product data; include product description, fabrication information, and compliance with specified performance requirements.

B. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.

C. Samples: Submit minimum 4-inch by 4-inch sample for each type, texture, pattern and color of solid plastic fabrication.

1.4 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

B. Manufacturer’s Qualifications: Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least five (5) consecutive years and which can show evidence of those materials being satisfactorily used on at least six (6) projects of similar size, scope and location. At least three (3) of the projects shall have been successful for use five (5) years or longer.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 RESIN PANELING

A. Engineered co-polyester resin installed as wall finish with manufacturer’s stand-off hardware.
   1. Basis of Design: Provide 3Form Varia Ecoresin.
   2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: 3/8 inch.
4. Size: As indicated on Drawings.
5. Edge Finish: Match Surface Finish.
6. Color and Surface Finish:
    a. RP-1: White, Frosted.
    b. RP-2: As indicated on List of Finishes.

2.3 ACCESSORIES

A. Mounting Hardware: Provide hardware by manufacturer of divider system sheet product, as required for a complete installation.
    1. Countertop Dividers: Captured on top and bottom edge by channel.
    2. Full Dividers: Tensioned cable/rod fittings.
        a. Basis of Design: 3 Form Frameless Suspended Partition System.

2.4 FABRICATIONS

A. Factory fabricate panels to greatest extent possible. Do not cut panels on site.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

END OF SECTION

SECTION 07 14 16 - COLD FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Single-component, cold-applied waterproofing.
   2. Protection course.
   3. Molded-sheet drainage panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
   3. Indicate VOC content.

B. Shop Drawings:
   1. Indicate locations and extent of waterproofing.
   2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Sustainable Design Submittals:
   1. Environmental Product Declaration (EPD): For each product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer must have completed a minimum of 5 projects of similar size, complexity and scope in the past 5 years.

B. Exterior waterproofing coatings shall comply with South Coast Air Quality Management District SCAQMD 1113 , current amended version.
   1. Waterproofing Concrete/Masonry Sealers: 100 g/L.

C. Limits Exterior adhesives and sealants shall comply with South Coast Air Quality Management District SCAQMD 1168, Adhesive and Sealant Application, current amended version:
   1. Architectural Sealants: 250 g/L.
   2. Architectural Sealant Primers:
      a. Non porous: 250 g/L.
      b. Porous: 775 g/L.

1.6 MOCKUPS

A. Build mockups to set quality standards for installation.
   1. Build mockup for each typical waterproofing installation, including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
      a. Size: 100 sq. ft. in area.
      b. Description: Each type of wall installation.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
   1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
   2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period. Warranty includes removal and replacement of all materials concealing waterproofing.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source and from single manufacturer.

2.2 POLYURETHANE WATERPROOFING

A. Single-Component, Modified Polyurethane Waterproofing: ASTM C836/C836M and coal-tar free.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
      a. WR Meadows Hydralastic 836
         1) VOC: 36 g/L.
      b. Carlisle Coatings & Waterproofing Inc; Miraseal
         1) VOC: 36 g/L.
      c. Henry Company; CM100
         1) VOC: less than 40 g/L.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.

C. Sheet Flashing: 50-mil-minimum, nonstaining, uncured sheet neoprene.
   1. Adhesive: Manufacturer's recommended contact adhesive.

D. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

E. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; ASTM C920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications and Grade P for deck applications; Use NT exposure; and as recommended by manufacturer for substrate and joint conditions.
   1. Backer Rod: Closed-cell polyethylene foam.

2.4 PROTECTION COURSE

A. Protection Course: Provide type as required by membrane manufacturer to furnish manufacturer’s 10-year waterproofing membrane.

2.5 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft..

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C1471/C1471M.

B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.
   1. Comply with ASTM C1193 for joint-sealant installation.
   2. Apply bond breaker on sealant surface, beneath preparation strip.
   3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

B. Install sheet flashing and bond to deck and wall substrates where required in accordance with waterproofing manufacturer's written instructions.
   1. Extend sheet flashings for 4 inches onto perpendicular surfaces and items penetrating substrate.

3.5 INSTALLATION OF WATERPROOFING

A. Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in ASTM C1471/C1471M.

B. Start installing waterproofing in presence of manufacturer's technical representative.

C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.

D. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
   1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a minimum dry film thickness of 60 mils.
   2. Apply waterproofing to prepared wall terminations and vertical surfaces.
   3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft..

E. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

F. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
   1. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, in accordance with manufacturer's written instructions. Use adhesive or another

method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.

3.8 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Above Grade Cavity Wall Insulation:
      a. Polyisocyanurate foam-plastic board insulation.
   2. Mineral-wool blanket insulation.
   3. Glass-fiber blanket insulation

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Polyisocyanurate foam-plastic board insulation
   2. Mineral-wool blanket insulation.
   3. Glass-fiber blanket insulation

B. Concurrent Submittal for components of compliant NFPA 285 Assembly:
   1. Submit NFPA 285 test reports listing thru-wall flashing as specified is Section 04 20 00 “Unit Masonry,” polyisocyanurate continuous cavity wall insulation product and fluid-applied membrane air barrier assembly, as specified in Section 07 27 26 “Fluid-Applied Membrane Air Barriers,” as part of an approved NFPA 285 Assembly

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Letter from Manufacturer certifying that adhesive used to bond insulation to air barrier membrane is compatible with specified air barrier membrane.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

D. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
   1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
   2. Sign, date, and post the certification in a conspicuous location on Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Contractor shall provide evidence of having completed 3 projects of similar size and scope in the past 3 years.
   2. Contractor shall provide evidence of certification by the rigid insulation manufacturer as having been properly trained in the proper installation of the submitted products

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.7 WARRANTY

A. Warranty: Provide manufacturer’s minimum 15-year thermal performance warranty.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 25 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

D. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

E. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

F. Thermal-Resistance Value (R-Value): R-Value of 6.0 per inch, in accordance with ASTM C518.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Single Source Responsibility: Provide each type of building insulation and related accessories from one single manufacturer.

B. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2, Grade 3 (25 psi)
   1. Basis of Design: Subject to compliance with requirements, provide one of the following products:
      a. Atlas; EnergyShield XR.
      b. Hunter; Xci Foil Class A Plus.
      c. Rmax; ThermaSheath.
   2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

C. Board Size: 48 inches by 120 inches. Provide board scored on both sides to fit between spacing of masonry anchors.
   1. Coordinate width of board insulation with spacing of zee furring.

D. Continuous Insulation at Exterior Wall Installed Thickness: 2 inches

2.3 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
      a. Rockwool; Comfortbatt
         1) Where installed as one component of an assembly required to comply with acoustic and/or fire ratings, provide Rockwool; AFB Evo
      b. Owens Corning; ThermaFiber UltraBatt
         1) Where installed as one component of an assembly required to comply with acoustic and/or fire ratings, provide Owens Corning; ThermaFiber SAFB FF
      c. Johns Manville; a Berkshire Hathaway Company; TempControl Mineral Wool Batts
         1) Where installed as one component of an assembly required to comply with acoustic and/or fire ratings, provide MinWool Sound Attenuation Fire Batt
   2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
      a. Johns Manville; a Berkshire Hathaway Company; Formaldehyde-free Unfaced thermal and acoustical batts
      b. Certainteed; SAINT-GOBAIN; InsulPure FF
      c. Owens Corning; EcoTouch Pink Fiberglas Insulation
      d. Knauf; EcoBatt with ECOSE
   2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

B. Provide manufacturer’s retainer clips to hold glass-fiber blanket insulation in place between studs.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids, including roof to wall transitions.
   1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
      a. Basis of Design Product: Carlisle SealTite PRO Closed Cell

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
   1. Verify adhesives have a VOC content of 70 g/L or less.
   2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
   1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
   2. Press units firmly against inside substrates.
   3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

B. Install mineral wool insulation between exterior metal stud framing where the insulation will be exposed to the elements before the exterior wall sheathing can be applied and sealed and at other locations noted.

C. At built-up metal stud headers installed at exterior walls, fill header with mineral wool batt insulation using 6 inch R24 insulation.

D. At built up jamb studs fill cavity with stone wool batt insulation.

E. Glass Fiber Blanket Insulation Thermal Resistance at Exterior Walls:
   1. At 6-inch metal studs install R-19
   2. At 3-5/8 inch and 2-inch metal stud walls install R13

F. Mineral Wool Blanket Insulation Thermal Resistance at Exterior Walls
   1. At 6-inch metal studs install R-24 insulation
   2. At 3-5/8 inch metal stud walls install R15 insulation
   3. At 2-1/2 inch metal stud walls install R10 insulation

G. Mineral Wool Blanket Insulation Thermal Resistance at Curbs
   1. At equipment curbs, install R-15 insulation
   2. At rooftop mechanical curbs, install R-24 insulation

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Do not leave continuous insulation uncovered and exposed to UV for longer than an aggregate of 60 days between storage and uncovered installation.

D. At the end of each work day seal exposed edges to be weathertight.

END OF SECTION

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SECTION 07 26 00 - UNDER SLAB VAPOR BARRIER

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforced-polyethylene vapor retarders.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review under-slab vapor barrier system materials, intended extent of use for each material, type of penetrations and correct products and installation method for each condition, and instructions for installation specific to project foundation configuration (crawl space, void form, slab-on-grade, etc)
   2. Review transitions within waterproofing systems and between waterproofing and adjacent air barrier.
   3. Review details, specifications, and installation instructions with manufacturer's on site technical representative prior to commencing with work.

B. Manufacturer's on-site technical representative must approve installation prior to pouring of concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include, manufacturer's installation instructions for placement, seaming and pipe boot installation

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Independent laboratory test results showing compliance with ASTM E154/E154M, maintaining permeance of less than 0.01 perms (grains/ft² * hr * in. Hg) after mandatory conditioning test per sections 8, 11, 12 and 13 of ASTM E154/E154M.

C. Independent laboratory test results showing compliance with ASTM E1745 Class A and Perm rating of 0.01 grains/ft² * hr * in. Hg or less, per ASTM E96/E96M or ASTM F1249. The water vapor permeance shall only be expressed in the perm unit grains/ft² * hr * in. Hg.

PART 2 PRODUCTS

2.1 REINFORCED-POLYETHYLENE VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 20 lb/1000 sq. ft., with maximum permeance rating of 0.1 perm.
   1. Basis of Design: Subject to compliance with requirements, provide Stego Wrap 15-mil Vapor Barrier by Stego Industries, or one of the following:
      a. Fortifiber Building Systems Group; Moistop Ultra 15
      b. W.R. Meadows; Perminator

2.2 ACCESSORIES

A. Seams

1. Tape by Stego Industries. Tape shall have the following qualities:
   a. A 3 ¾ inches wide tape composed of polyethylene film and an acrylic, pressure-sensitive adhesive.
   b. Water Vapor Transmission Rate: ASTM E96/E96M; 0.3 perms or lower.

B. Sealing penetrations in the vapor barrier
1. Use one or both of the following materials:
   a. Stego Mastic by Stego Industries.
      1) Mastic must have the following qualities:
      2) Water Vapor Transmission Rate: ASTM E96/E96M; 0.3 perms or lower.
2. Stego Tape by Stego Industries.

C. Perimeter/edge seal
1. Stego Crete-Claw Tape by Stego Industries. A 6-inch-wide tape composed of polyethylene film, aperture film and an acrylic sensitive adhesive.
2. StegoTack Tape by Stego Industries: A 2-inch-wide double-sided adhesive strip.

D. Pre-Cut Pipe Boots
1. Stego Pre-Cut Pipe Boots, constructed from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

B. Ensure that subsoil is approved by Architect or geotechnical firm.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Installation shall be in accordance with manufacturer's instructions and ASTM E1643
1. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
   a. Face laps away from direction of placement of concrete.
2. Overlap joints 6 inches and seal laps using the following tape:
   a. At slab-on-grade seal joints using Stego 3 ¾ inch wide seam tape.
   b. Where concrete slab is suspended over void cartons, seal joints using Stego 6-inch-wide Crete-Claw tape.
3. Seal vapor barrier to perimeter of slab using Stego 2-inch-wide double-sided tape.
   a. Where concrete slab is suspended over void cartons, seal vapor barrier to the entire slab perimeter using 6-inch-wide Stego Crete Claw tape.
4. Seal all penetrations (including pipes) per manufacturer's instructions.
5. No penetration of the Vapor Barrier is allowed except for reinforcing steel and permanent utilities.
6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape

B. Place vapor retarders on side of construction indicated on Drawings.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Vapor-permeable, fluid-applied air barriers.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
   2. Do not proceed with the installation of the air barrier membrane and the through wall flashing membrane prior to the pre-installation conference.
   3. Do not proceed with the pre-installation conference if any one of the following parties is not in attendance:
      a. Manufacturer’s representative
      b. Installer
      c. Owner’s representative (if applicable)
      d. Architect
      e. General contractor

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product data, installation instructions, and manufacturer’s printed instructions for evaluating, preparing and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
   2. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer
   3. Include statement that materials are compatible with adjacent materials proposed for use
   4. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.
   5. Indicate VOC content.

B. Concurrent Submittal for components of compliant NFPA 285 Assembly:
   1. Submit NFPA 285 test reports listing thru-wall flashing as specified is Section 04 20 00 “Unit Masonry,” polyisocyanurate continuous cavity wall insulation product as specified is Section 07 21 00 “Thermal Insulation,” and fluid-applied membrane air barrier assembly as part of an approved NFPA 285 Assembly

C. Shop Drawings: For air-barrier assemblies.
   1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
   2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   3. Include details of interfaces with other materials that form part of air barrier.
   4. Detail transitions of air barrier systems at unit masonry veneer wall design to EIFS wall system to ensure a continuous installation

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Air barrier assemblies shall be evaluated both as a material in accordance with ASTM E2178 and as an assembly in accordance with ASTM E2357 by the Air Barrier Association of America as well as passed all other evaluations by the Air Barrier Association of America.

B. Testing Laboratory Qualifications:
   1. The testing laboratory shall be accredited to perform the test protocol for each test method listed in Field Quality Control. Three qualified testing laboratories are listed below.
      a. IAS (International Accreditation Service, Inc.)
      b. A2LA (American Association for Laboratory
      c. SCC (Standard Council of Canada)

C. Manufacturer's Qualifications: Provide primary products, including each component of the air barrier membrane system, which has been commercially available for a minimum of 3 years

D. Submit in writing, a document stating that the applicator of the primary air barrier membrane specified in this section is recognized by the manufacturer as suitable for the execution of the Work

E. At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the air barrier membrane manufacturer’s representative

F. Components used in this section shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics and adhesives.

G. Comply with VOC content limits for sealants and sealant primers: SCAQMD Rule 1168 Adhesive and Sealant Applications, current amended version. Maximum VOC content shall not exceed the following limits:
   1. Architectural sealants: 250 g/L.
   2. Architectural sealant primers, non porous: 250 g/L
   3. Architectural sealant primers, porous: 775 g/L.

H. Comply with VOC content limits for building envelope coatings: SCAQMD Rule 1113, Architectural Coatings current amended version. VOC content shall not exceed the following limits:
   1. Building envelope coating: 100 g/L.

I. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer to be licensed by ABAA according to ABAA's Quality Assurance Program and to employ ABAA-certified installers and supervisors on Project.

J. Mockups: Provide air barrier products and accessories required for a complete installation as part of the Integrated Exterior Mockup specified in Division 01 Section “Mockups”

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Self-adhering membrane for transition, joint treatment, window and door openings, inside and outside corners and where noted shall be a high temperature membrane 40 mil thick polyester-backed synthetic butyl rubber-based adhesive membrane. Verify compatibility of this transition membrane with all materials it will contact. Provide separation where required.

C. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 FLUID-APPLIED AIR BARRIERS, VAPOR PERMEABLE

A. Vapor-Permeable Air Barrier Synthetic Polymer Type: Synthetic polymer membrane with an installed and tested dry film thickness.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having

equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect

a. Kemper Systems America, Inc; Wall Guardian FW-100A
    1) VOC content: 50 g/L
b. W.R. Meadows, Inc.; Air-Shield LMP
    1) VOC content: 40 g/L
c. Henry Air-Bloc 17 MR
    1) VOC content: 50 g/L

B. Physical and Performance Properties:
1. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
2. Vapor Permeance: Minimum 5 perms; ASTM E96/E96M, Procedure A, Desiccant Method.
3. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
4. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
5. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly including foam plastic cavity wall insulation specified in Section 07 21 00 “Thermal Insulation”
6. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Self-adhering membrane for transition, joint treatment, inside and outside corners, window and door openings, closure between air barrier membrane and window, storefront, curtainwall and door frames and at other locations noted shall be UT-40 universal tape, 35 mil thick polyester-backed synthetic butyl rubber-based adhesive membrane. Confirm compatibility between transition membrane and all material it is in contact with.

C. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

D. Sealants: Sealant system including primer, sealant and backer rod compatible with air barrier system materials and approved by the manufacturer of the air barrier for installation indicated.
1. Basis of Design: Kemper Systems America, Inc. GreatSeal PE-150 Polyether-based sealant.

E. Liquid Tape Sealant: Provide Kemper Systems America, Inc. GreatSeal LT100 Liquid Tape: Polyether-based, moisture curing, elastomeric vertical seam sealer.

F. Stainless Steel Sheet: ASTM A240/A240M, Type 304, 0.0187 inch thick, and Series 300 stainless steel fasteners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

E. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

F. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
   1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of sheet metal through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 17 mils, applied in one or more equal coats.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Air-barrier dry film thickness.
   3. Continuous structural support of air-barrier system has been provided.

4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:
   1. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783 or ASTM E2357.
   2. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

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SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal composite material (MCM) fabricated into the following:
      a. Wall panel system including MCM, joints, attachment system components and miscellaneous materials as appropriate for the design of the project to provide a weather-resistant exterior cladding system
      b. Column cover system including MCM, joints, attachment system components and miscellaneous materials as appropriate for the design of the project to provide a weather-resistant exterior cladding system

1.2 RELATED WORK:

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

B. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.

C. Section 07 46 46 "Fiber-Cement Siding" for requirements of cladding support system.

D. Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing.

1.3 DEFINITIONS

A. DBVC: Drained and back-ventilated cavity rainscreen system designed to drain and dry water entering cavity through drainage channels, weeps, and air ventilation.

B. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, MCM system Installer, MCM system manufacturer's representative, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to MCM system installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM system.
   6. Review mockup requirements for each required mockup
   7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   8. Review temporary protection requirements for system assembly during and after installation.
   9. Review procedures for repair of panels damaged after installation.
   10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

A. Product Data:
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel, system, and accessory.

B. Shop Drawings:
   1. Include details showing thickness and dimensions of the system parts, details of edge conditions, attachment system, corners, fastening and anchoring methods, locations of joints and gaskets, location and configuration of joints necessary to accommodate thermal movement, and all trim and flashings.
   2. Accessories: Include details of flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
   3. System Calculations: Submit MCM System Fabricator's complete system design and engineering analysis/calculations including, but not limited to the following
      a. Show governing MCM types, mounting system including anchorages, connections, and fasteners. Indicate location, type magnitude, and direction of loads imposed on the building structural frame
      b. Analysis/Calculations shall be signed and sealed by a qualified Design Professional in the project jurisdiction that the MCM system shows conformance with the performance requirements and design criteria identified for this project
   4. Provide signed and sealed drawings, by a qualified design professional in Project jurisdiction, of MCM system showing compliance with performance requirements and design criteria identified for this Project.

C. Samples for Initial Selection: For each type of MCM panel indicated, with factory-applied color finishes.
   1. Size: Manufacturers' standard size.
   2. Include Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of MCM panel required, with factory-applied color finishes.
   1. MCM Panel: One sample, Manufacturers' standard size.
   2. MCM System: 12 inches long by actual panel width, fabricated into panel systems indicated. Include fasteners, closures, and other MCM panel accessories.

E. Concurrent Submittal for components of compliant NFPA 285 Assembly:
   1. Submit NFPA 285 test reports listing thru-wall flashing as specified is Section 04 20 00 "Unit Masonry," polyisocyanurate continuous cavity wall insulation product as specified is Section 07 21 00 "Thermal Insulation," and fluid-applied membrane air barrier assembly as specified in Section 07 27 26, as part of an approved NFPA 285 Assembly

1.6 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Product Test Reports: For each MCM panel, for tests performed by qualified testing agency.
      a. MCM Panel Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
   2. MCM System Fabricator's certified system test reports: Certified system test reports showing system compliance with specific performance characteristics or a third-party listing documenting compliance to a comparable code section. Performance requirements shall be based on the type of MCM systems provided
      a. Drained and Back-Ventilated Rainscreen System (DBVR) Tested to AAMA 509 Standard

B. Certificates: Product certificates signed by MCM Manufacturer when requested certifying MCM complies with specified performance requirements indicated in this specification

C. Qualification Statements: For fabricator and Installer.

D. Delegated design engineer qualifications.

E. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For MCM panels.

B. Warranty Documentation:
   1. Manufacturers' special warranties.
   2. Installer's special warranties.

1.8 QUALITY ASSURANCE

A. Qualifications:
   1. MCM System Fabricator: The MCM System Fabricator of this project's MCM System must be:
      a. Prequalified MCM Fabricator: CEI Materials, LLC
      b. A Certified MCM Fabricator by the Metal Construction Association (MCA) or meet the Fabricator Requirements by providing documentation to substantiate the following:
         1) The MCM System Fabricator shall demonstrate and offer written attested certification by at least one (1) specified MCM Manufacturer that he has fabricated; a minimum of 150,000 square feet (13935 square meters) of architectural walls per year, that are used as the building weathering envelope, utilizing MCM of at least 4mm (0.157 inch) thickness
         2) System components are shop fabricated
         3) MCM System Fabricator shall have been in business under its present name for at least five (5) years prior to the start of this project
         4) MCM System Fabricator shall substantiate a track record of one of the Manufacturers listed in this specification working with the Fabricator/Installer for three (3) consecutive years and at a scale of operations cited above
   2. MCM System Installer:
      a. The MCM System Installer shall have been in business under the present name for at least five (5) years prior to the start of this project and have experience with similar sized MCM system projects. The MCM System Installer must be capable of providing field service representation during construction
      b. The MCM System Installer must be an approved installer by a MCA Certified Fabricator for the installation of their MCM System and have undergone proper training for the specified system thereof
   3. Testing Agency: An agency acceptable to authorities having jurisdiction.

1.9 MOCKUPS

A. Wall Mockups: Build mockups to set quality standards for materials and execution and to set quality standards for installation. See Section 01 43 39 "Mockups" for additional construction requirements for integrated exterior mockups.

B. Wall System Mockup of tapered vertical wall transitions at pedestrian bridge.

C. Wall System Mockup of exterior stair and guardrail wall including shop fabricated wall cap

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.

B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack MCM panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on MCM panels during installation.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.12 COORDINATION

A. Coordinate MCM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.13 WARRANTY

A. Panel Integrity Warranty: Manufacturer agrees to repair or replace components of MCM panels that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: 10 years from date of Substantial Completion.

B. Panel Finish Warranty: Manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits:
      a. Perimeter Framing: Deflection of panel perimeter framing member shall not exceed L/175 normal to plane of the wall where L is the unsupported span of the perimeter framing member
      b. Panel: Deflection of the panel face shall not exceed L/60 at design load where L is the unsupported span of the panel

c. Anchor: At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 0.0625 inch (1.6 mm).

4. System Requirements:
   a. Drained and Back Ventilated Rainscreen System (DBVR) – (Tested to AAMA 509 Standard)
      1) ASTM E283 – Air Leakage – When tested to AAMA 509 standards, the air flow measurement across the MCM system (excluding jamb conditions) shall be measured to determine the V-axis classification on chart 1b from AAMA 509.
      2) ASTM E331 and AAMA 501.1 – Water Infiltration Measurement - When tested to AAMA 509 standards, at pressures of 6.24 psf (300 Pa) and 12.0 psf (575 Pa) for ASTM 331 and AAMA 501.1, the average water from the four (4) tests shall be collected, measured, and averaged to determine the W-axis classification.
      3) ASTM E330 (Modified ((AAMA 509))) – Structural Performance – MCM system must be engineered to meet the project design loads, however the MCM system must meet or exceed the following criteria when tested to a minimum pressure of 30.0 psf (1436 Pa). Note: ASTM E330 test shall be conducted with MCM system joinery closed (taped or sealed) producing the required static loads on the MCM system. The AWB is not to be loaded for the measurement:
         a) Deflections do not exceed limitations defined within the section on Deflection and Thermal Movement.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

D. Fire Propagation Characteristics:
   1. Fire Performance: Wall assemblies containing MCM System shall meet the requirements of the Intermediate Scale Multi-story test, NFPA 285, where required by code based for the design of this project.

2.2 METAL COMPOSITE MATERIAL (MCM)

A. Aluminum-Faced Panels (MCM): ASTM B209 alloy as standard with manufacturer, temper as required to suit finish and forming operations with 0.020-inch- thick, aluminum sheet facings
   1. Basis of Design: Subject to compliance with requirements, provide Alucobond Plus, as manufactured by Alucobond, or comparable panels by one of the following:
      a. Alpolcc, Inc; a Mitsubishi Chemical Company
      b. Reynobond
   2. Core: FR.
   3. Panel Thickness: 0.118 inch, 4mm
   4. Bond Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
   5. Fire Performance: Flame-spread index less than 25 and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.

2.3 METAL COMPOSITE MATERIAL (MCM) FABRICATORS

A. Prequalified MCM Fabricators:
   1. CEI Materials, LLC.

2. KSC, Inc.
3. Auzmet Architectural, LLC.

2.4 ACCESSORIES

A. Cladding Support System: Slotted steel material fabricated with thermal tape to minimize thermal conductivity through above grade continuous cavity wall insulation.
   1. Basis of Design: Subject to compliance with requirements, provide ThermaFast J-Track and ThermaFast Z-Track as manufactured by The Steel Network

B. Panel Accessories: Provide components required for a complete panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, fasciae, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.
   1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM system manufacturer.

2.5 FABRICATION

A. Fabricate and finish MCM panels at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated panel performance requirements demonstrated by laboratory testing.

B. Shop-fabricate MCM systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of MCM panel manufacturer, of indicated system profiles, and with dimensional and structural requirements.
   1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of 70 deg F. Allow for ambient temperature range at time of fabrication.
   2. Formed MCM panel lines, breaks, and angles to be sharp and straight, with surfaces free from warp or buckle.
   3. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
   4. Fabricated Panel Tolerances: Shop-fabricate panels to sizes and joint configurations indicated on Drawings.
      a. Width: Plus or minus 0.079 inch at 70 deg F.
      b. Length: Plus or minus 0.079 inch at 70 deg F.
      c. Squareness: Plus or minus 0.079 inch at 70 deg F.
   5. Attach routed-and-returned panel flanges to panel clips with manufacturer's standard fasteners.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams.
   4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Coil-Coated Aluminum Finish:
   1. PVDF Fluoropolymer: AAMA 2605, two-coat with suspended mica flakes fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Color: Match Existing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM system supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM system manufacturer.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION TOLERANCES

A. Shim and align MCM panels within installed tolerance of 1/4 inch in 20 ft., non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films as MCM panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.

B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.4 PROTECTION

A. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiber-cement soffit - Match Existing (CFP4).
   2. Fiber-cement siding - Match Existing (CFP1, CFP2, CFP3, CFP4)
   3. Cladding Support System: Thermal-Z (and Subgirt) through continuous rigid insulation for exterior walls. Applicable for fiber-cement panels and metal composite material wall panels.

1.2 RELATED WORK:

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

B. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.

C. Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing.

1.3 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   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 methods and procedures related to metal panel installation, including manufacturer's written instructions.
   3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
   5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   6. Review temporary protection requirements for metal panel assembly during and after installation.
   7. Review of procedures for repair of metal panels damaged after installation.
   8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For each type of fiber-cement panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

3. Designations on Product Data for each fiber-cement panel type match designations on Drawings and in Specifications

B. Shop Drawings:
1. Include fabrication and installation layouts of fiber-cement panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Show panel layout in elevation, indicating locations where field-cutting is required. Panel layouts must optimize manufactured, shop finished sizes in order to minimize field cutting panels with shop finishes
   a. Designations on Shop Drawings match designations on Drawings and Specifications
3. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Structural Calculations:
1. Submit Panel manufacturer's comprehensive analysis of design loads, including dead loads, live loads, wind loads and thermal movement.
2. Submit façade attachment/support framing system including manufacturer's comprehensive analysis of design loads, including dead loads, live loads, wind loads and thermal movement, signed and sealed by a licensed engineer in the applicable State

D. Samples for Initial Selection: For fiber-cement siding panels including related accessories.
1. Include Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type, color, texture, and pattern required. Include fasteners, closures, and other accessories.
1. 12-inch-long-by-actual-width Sample of siding.
2. 12-inch-long-by-actual-width Sample of soffit.
3. 12-inch-long-by-actual-width Samples of trim and accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of fiber-cement siding and soffit.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

D. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of fiber-cement siding and soffit, including related accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer. Experienced Installer with minimum of 5 years' experience with successfully completed projects of a similar nature and scope.

B. Fabricator Qualifications: Cladding support fabricator shall employ a professional engineer, licensed to practice engineering in the State of Texas to engineer each cladding support system and attachment to substrate including:

1. Steel stud framing

C. Cladding support fabricator shall employ a professional engineer, licensed to practice engineering in jurisdiction where Project is located to engineer each cladding support system and attachment to substrate including:
   1. Frequency and spacing of horizontal and vertical cladding support framing.

D. Wall Mockups: Build mockups to set quality standards for materials and execution and to set quality standards for installation. See Section 01 43 39 "Mockups" for additional construction requirements for integrated exterior mockups.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish full lengths of fiber-cement siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.10 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Build mockups for fiber-cement siding and soffit including accessories.
      a. Size: 48 inches long by 60 inches high
      b. Include outside corner on one end of mockup and inside corner on other end.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, fiber-cement panels, and other manufactured items so as not to be damaged or deformed. Package fiber-cement panels for protection during transportation and handling.

B. Store materials in original containers with labels intact on elevated platforms, under cover, and in a dry location.

1.12 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of fiber-cement panels to be performed according to manufacturers' written instructions and warranty requirements.

1.13 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including cracking and deforming.
      b. Deterioration of materials beyond normal weathering.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design and sub-framing system.

B. Fire Propagation Characteristics: Fiber-cement panel system passes NFPA 285 testing with air barrier specified in Section 07 27 26 "Fluid Applied Membrane Air Barriers," cavity wall insulation specified in Section 07 21 00 "Thermal Insulation," and thru-wall flashing specified in Section 04 20 00 "Unit Masonry."

2.3 FIBER-CEMENT SIDING

A. Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges.
   1. Basis of Design: Subject to compliance with requirements, provide the following Fiber-Cement Panels as manufactured by Nichiha:
      a. CFP1: Provide Vintagewood Wood Series by Nichiha
      b. CFP2, CFP3: Provide Tuffblock Modern Series by Nichiha
      c. CFP4: Provide Ribbed Dimension Series by Nichiha

B. Dimensions: 17-7/8 inches x length indicated in Drawings.

C. Nominal Thickness: Not less than 5/8 inch.

D. Profiles:
   1. CFP1: Wood plank with three, 3/8 inch grooves.
      a. Groove orientation: horizontal.
   2. CFP2, CFP3: Flush
   3. CFP4: 9 ribs per panel with chamfered edges.
      a. Rib orientation: vertical.

E. Colors:
   1. CFP1: Cedar
   2. CFP2: Bamboo
   3. CFP3: Walnut
   4. CFP4: Ivory

F. Finishes:
   1. CFP1: Wood grain, textured.
   2. CFP2, CFP3: Matte, textured.
   3. CFP4: Metallic, moderately textured ribs.

G. Factory sealed on 6 sides.

H. Clips: Provide manufacturer's standard clip system compatible with cladding support system.

2.4 CLADDING SUPPORT SYSTEM

A. Cladding Support System: Hot dipped galvanized steel z girt fabricated with slotted horizontal section and low conductivity material integral to back leg minimizing thermal transfer.

1. Framing System: Steel material and coating: ASTM A1003/A1003M Structural Grade 50 Type H, ST50H 50ksi minimum yield strength, 65ksi minimum tensile strength, with ASTM A653/A653M G90 hot dipped galvanized coating
    a. Basis of Design: Subject to compliance with requirements, provide ThermaFast J-Track ThermaFast Corner Angle, and ThermaFast Z-Track installed with gasketed screws, as manufactured by The Steel Network, or comparable products listed below:
        1) Knight Wall System (KWS): Therma-Zee Cladding Attachment.
    b. Thickness: 54 mil minimum thickness.
    c. Slotted at horizontal to provide added thermal performance, and drainage.
    d. Low conductance material applied to back leg acting as thermal break.
    e. Depth: As required by installation orientation of formed metal wall panels over indicated backup construction.
    f. Thermal Isolation: Located between back flange and substrate; continuous along length of member.
        1) Thermal Tape:
            a) Size: 1/16- inch thick by 1 inch wide.
            b) Density per ASTM D1667: 15 lbs/ft3.
            c) Thermal conductivity, k factor per ASTM C518: 0.3
        2) Low-conductive thermal break material: Less than 0.18 Watts per Meter Kelvin.
            a) Size: ¼ inch thick by height of back flange
            b) Installed with high temperature butyl tape to seal fastener penetrations in air barrier assembly.
        3) High Temperature Butyl Tape: Install between air barrier material and thermal isolation material continuously to seal penetrations in air barrier.
2. Subgirts Framing: Minimum 16 gauge G90 galvanized 3/4 inch or 1-1/2 inch deep subgirts. Refer to details for size.
    a. Spacing of subgirts to be determined by metal wall panel engineer
3. No framing component shall penetrate the layer of continuous exterior insulation.

2.5 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
    1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
    1. Corner posts.
    2. Door and window casings.
    3. Fasciae.
    4. Moldings and trim.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Fasteners: Minimum 304 series stainless steel fasteners and anchors of type, size and spacing required for type of substrate and project conditions, to meet performance requirements specified and as indicated in design calculations and shop drawings. Grommet fasteners should be used to ensure face seal of the bracket.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and soffit and related accessories.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

B. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
   1. Read warranty and comply with terms necessary to maintain warranty coverage.
   2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
   3. Use trim details as indicated on drawings.
   4. Panels shall be rear ventilated with a continuous ventilation cavity of depth recommended by manufacturer for height of cladding.
   5. Install panels with appropriate joint layout and configuration. Vertical and horizontal joints shall be open. Typical joint spacing to be 5/16” wide. Minimum joint spacing allowed is ¼”.

B. Installation of Concealed-Fastener, Fiber-Cement Panels
   1. Framed Wall Construction:
      a. Fiber-Cement Panels Installed in a horizontal orientation: Sheathing, Thermal Z, Subgirt (3/4 inch), formed metal wall panel clips
      b. Formed Metal Wall Panels Installed in a vertical orientation: Sheathing, Thermal Z, formed metal wall panel clips
   2. Note to Team: Check exterior elevations for transitions of formed metal wall panels in horizontal and vertical orientation.
   3. Note: Blocking depth must match the depth of the Thermal-Z (plus subgirt) at window head, jamb, sill detail

C. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

D. Do not install siding less than 6 inches from ground surface, or closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

E. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges
   1. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

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SECTION 07 54 23 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adhered thermoplastic polyolefin (TPO) roofing system, including:
      a. Roof insulation, first layer mechanically fastened to metal deck, second layer fully-adhered.
      b. Cover Board, fully-adhered
      c. Thermoplastic polyolefin (TPO) roof membrane, fully adhered
   2. Insulation accessories.
   3. Asphalt materials.
   4. Walkways.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
   2. For adhesives and sealants, indicate VOC content.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
   1. Layout and thickness of insulation.
   2. Base flashings and membrane termination details.
   3. Flashing details at penetrations.
   4. Tapered insulation layout, thickness, and slopes.
   5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
   6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
   7. Tie-in with adjoining air barrier.

C. Samples for Verification: For the following products:
   1. Roof membrane and flashings, of color required.
   2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Manufacturer.
   1. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.

B. Manufacturer Certificates:
   1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
      a. Submit evidence of compliance with performance requirements.

C. Intent to Warranty Assembly:
   1. The roofing manufacturer shall provide an intent to warrant assembly letter outlining in detail the assembly of the entire roof system including base flashings for the project. The assembly letter shall be on the roof system manufacturer’s letterhead and signed and dated by an approved representative of the roof manufacturer. Include the project name, Architect’s name and roofing installer’s name on the letter.

D. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

E. Manufacturer of roofing assembly provide confirmation of compatibility between factory-primed cover board products and adhesives required for adhering subsequent layers

F. Evaluation Reports: For components of roofing system, from ICC-ES.

G. Field Test Reports:
   1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

H. Field quality-control reports.

I. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturers: A qualified manufacturer that is UL listed and listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
   2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
      a. Installer must have a minimum of ten (10) years of experience in roofing membrane assembly installation method indicated.
      b. Provide a list of up to five (5) projects available for inspection employing same roof system.

B. Comply with SCAQMD Rule 1168, Adhesive and Sealant Applications, most current amended version:
   1. Single Ply Roof Membrane Adhesive: 250 g/L.
   2. Panel adhesive (roof coverboard): Max VOC Content 50 g/L.
   3. Plastic foam (Polyisocyanurate insulation): Max VOC Content 50 g/L.
   4. Single Ply Roof Membrane Sealants: Max VOC Content 250 g/L.
   5. Sealant Primers Other: Max VOC Content 750 g/L.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 EXISTING CONDITIONS

A. If discrepancies are discovered between the existing conditions and those noted on the Drawings, immediately notify the owner's representative by phone and solicit the manufacturer's approval prior to commencing with the work. Necessary steps shall be taken to make the building watertight until the discrepancies are resolved.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
   2. Warranty Period: 30 years, No Dollar Limit, from date of Substantial Completion.
   3. Hail Rider: Provide Rider for coverage (no exclusions) due to damage resulting from Hail up to two inches in diameter.
   4. Pro-rated system warranties are not acceptable.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, and walkway products, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

C. Roofing system manufacturer shall provide, at no cost to the Owner, the following services in year 2:
   1. Inspection by a technical service representative and delivery of a written inspection report documenting roof conditions.
   2. Necessary repairs, including splits, tears, or breaks in the roof membrane system and flashings which threaten the integrity of the roof system and are not exempt from coverage due to neglect, negligence, vandalism, or other exclusion.
   3. General rooftop housekeeping and clean-up, subject to limits, but generally including removal of incidental debris.
   4. During the two-year correction period, the roofing installer shall be responsible for repairing any defects attributable to the roofing installer's method or manner of installation of the roof membrane at the roofing installer's sole cost and expense.
      a. During the eleventh month following the date of substantial completion, the roofing installer shall have thirty (30) days to coordinate and perform a roof inspection with the roof material manufacturer's representative and the Owner's representative.
      b. The roofing installer shall coordinate and perform a roof inspection with the roof material manufacturer's representative and the Owner's representative during the ninety (90) day period preceding the expiration date of the two-year warranty.
      c. Failure to perform inspections specified above and repair defects (if any) will be cause to consider the roofing installer in default. In such a case, the Owner will then submit written notice of default to the roofing installer's bonding company.

1.12 INSPECTION BY MANUFACTURER

A. The General Contractor shall coordinate the inspection of the work, by an authorized technical representative of the roof system manufacturer

B. Provide manufacturer's field inspection reports upon completion of the site visit.

C. The Roofing System Manufacturer's Representative shall make 3 interim site visits during installation, in addition to a final inspection, to coincide with the Substantial Completion inspection by the Architect. Provide interim inspection site visits to align with 10% initial setup, 50% complete, and 95% compete. The Roofing Material Manufacturer's representative's inspection report will be attached to the General Contractor's and Architect's lists of items to be completed or corrected. All items on these lists shall have been completed prior to the project being judged Finally Complete.

1.13 REFERENCE STANDARDS

A. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2024.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
   1. Accelerated Weathering: Roof to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
   2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the wind uplift pressures indicated on Structural Drawings, when tested according to FM Approvals 4474, UL 580, or UL 1897:

D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
   1. Fire/Windstorm Classification: Class 1A-90 in Roof Zone 1.
   2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 VSH.

E. Minimum Roof Reflectance and Emittance based on the following rating systems or energy codes:
   1. 2021 International Energy Conservation Code (IECC), Section C402.3 Roof solar reflectance and thermal emittance:
   2. Roofs in climate zones 1, 2 and 3 shall comply with one of the following:
      a. Three-year- aged solar reflectance of 0.55 and three-year aged thermal emittance of 0.75. Calculation of the aged SRI and aged thermal emittance shall be based on aged tested values of solar reflectance and thermal emittance as rated by the Cool Roof Rating Council (CRRC).
      b. Three-year-aged solar reflectance index of 64 as determined in accordance with ASTM E 1980 using a convection coefficient of 2.1 Btu/h per square foot per degree F. Calculation of the aged SRI shall be based on aged tested values of solar reflectance as rated by the Cool Roof Rating Council (CRRC).

F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced TPO sheet.
   1. Basis of Design: Subject to compliance with requirements, provide Sure-Weld TPO Membrane as manufactured by Carlisle, or one of the following products:
      a. Johns Manville; JM TPO
      b. GAF; EverGuard TPO
      c. Holcim Elevate; UltraPly TPO
   2. Source Limitations: Obtain components for roofing system from roof membrane manufacturer.
   3. Thickness: 80 mils, nominal.
   4. Exposed Face Color: White.

2.3 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
   1. Adhesive and Sealants: Comply with VOC limits
      a. Max VOC Content for Single Ply Roof Membrane Adhesives: 250 g/L.
   2. Max VOC Content for Single Ply Roof Membrane Sealants: 250 g/L.

B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

C. Roof Vents: As recommended by roof membrane manufacturer.
   1. Size: Not less than 4-inch diameter.

D. Bonding Adhesive: Manufacturer's standard.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

H. Provide additional adhered or welded roof membrane layer to serve as a base for adhered/welded attachment of weighted pipe supports feet, weight guardrail supports, and/or as required for solar panel ready areas where required by solar panel contractor.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards, manufactured by roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roofing assemblies.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2, Grade 2, inorganic glass-fiber mat facer on both major surfaces.

1. Basis of Design: As approved by roofing system manufacturer as part of a system complying with performance requirements and warranty.
2. Compressive Strength: 20 psi, minimum
3. Size: 48 by 48 inches.
4. Thickness: 4-1/2 layers minimum as required to achieve R-25
   a. Install in two layers, each layer 2.2 inches thick to achieve a minimum LTTR R- value of 25

C. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:
   a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
   b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

D. Roof Drain Sump Insulation:
1. First layer 4 foot x 4 foot, 2.9 inches thick polyisocyanurate filler insulation.
2. Second layer: Tapered 1/2 inches to 1 ½ inches, (½" per foot) 24 inches wide 48 inches long polyisocyanurate insulation.
3. Furnish four pieces at each roof drain. Miter ends of each board at 45 degrees to form a 48 inch by 48 inch square sump

E. Insulation Accessories:
1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
3. Insulation Fasteners: Provide fasteners as described below for each specific deck type and to comply with Factory Mutual recommendations for specified wind uplift resistance. All fasteners shall comply with the corrosion resistance requirements of Factory Mutual Standard 4470. Fasteners shall utilize metal stress distribution plates, with screws of sufficient length to penetrate each type of roof deck the minimum required by Factory Mutual.
   a. Steel Decks: InsulFast #12 roofing fasteners as provided by Carlisle Syntec. Minimum deck penetration is 3/4 inch for steel decks, or comparable fasteners by Johns Manville.
   b. Fastener Plates: Shall be galvalume-coated steel insulation plates, as provided by Carlisle Syntec, with a diameter of 3 inches, 0.20 nominal thickness and a galvalume finish.
4. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   a. Full-spread spray-applied, low-rise, two-component urethane adhesive.
   b. Provide appropriate adhesive catalyst where temperatures are below 50 degrees F as recommended by roof membrane manufacturer.
   c. Max VOC Content 50 g/L.

2.5 COVERBOARD

A. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board. As approved by manufacturer of roofing membrane for required Warranty and Hail Rating.
1. Basis of Design: Subject to compliance with requirements, provide DensDeck StormX Roof Prime Board as manufactured by Georgia-Pacific Corporation, or product approved as part of listed RoofNav Assembly, such as:
   a. National Gypsum Company DEXcell FA VSH
2. Thickness: 1/2 inch.

3. Surface Finish: Manufacturer of roofing assembly provide confirmation of compatibility between factory-primed product and adhesives required for adhering subsequent layers

B. Coverboard Adhesive: A two-component, spray applied or extruded low rise foam adhesive designed to adhere coverboard to insulation.
   1. Adhesive or product recommended by insulation manufacturer, coverboard manufacturer and roof membrane manufacturer.
   2. Provide appropriate adhesive catalyst where temperatures are below 50 degrees F as recommended by roofing manufacturer.
   3. Max VOC Content: 50 g/L.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
   1. Size: Approximately 36 by 60 inches.
   2. Color: Contrasting with roof membrane.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, approved shop drawings, and Contract Documents

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Deck:
   1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
      a. Make joints between adjacent insulation boards not more than 1/4 inch in width.
      b. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.
         1) Trim insulation, so that water flow is unrestricted.
      c. Fill gaps exceeding 1/4 inch with insulation.
      d. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
      e. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
         1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
         2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
   2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
      a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
      b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
      c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
      d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
         1) Trim insulation so that water flow is unrestricted.
      e. Fill gaps exceeding 1/4 inch with insulation.
      f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
      g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
         1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
   1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   2. At internal roof drains, conform to slope of drain sump.
      a. Trim cover board so that water flow is unrestricted.
   3. Cut and fit cover board tight to nailers, projections, and penetrations.
   4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
      a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.

D. Fold membrane sheet back onto itself so half the underside of the membrane is exposed.

E. Apply Bonding Adhesive in accordance with the manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply Bonding Adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
   1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
   2. Fold back the unbonded half of the sheet and repeat the bonding procedures.

F. Position adjoining sheets to allow a minimum overlap of 2 inches to provide a minimum 1-1/2 inch hot air weld.

G. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously

H. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

I. Apply roof membrane with side laps shingled with slope of roof deck where possible.

J. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity.
   2. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
   3. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   4. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

K. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 INSTALLATION OF WALKWAYS

A. Flexible Walkways:
   1. Install flexible walkways at the following locations:
      a. Locate membrane walkways
         1) Around the entire perimeter of all roof mounted equipment.
         2) Walkway shall start from all roof access points and terminate at each piece of roof-mounted equipment.
      b. As required by roof membrane manufacturer's warranty requirements.
   2. Provide 6-inch clearance between adjoining pads.
   3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
   1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formed low-slope roof sheet metal fabrications.
   2. Prefinished formed metal copings.
   3. Stainless steel flashing at exterior wall openings.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
   3. Review requirements for insurance and certificates if applicable.
   4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following
   1. Underlayment materials.
   2. Elastomeric sealant.
   3. Butyl sealant.
   4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.
   1. Include plans, elevations, sections, and attachment details.
   2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
   3. Include identification of material, thickness, weight, and finish for each item and location in Project.
   4. Include details for forming, including profiles, shapes, seams, and dimensions.
   5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   6. Include details of termination points and assemblies.
   7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
   8. Include details of roof-penetration flashing.
   9. Include details of special conditions.
   10. Include details of connections to adjoining work.
   11. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

D. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

E. Samples for Verification: For each type of exposed finish.
   1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
   3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
   4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.
   1. Provide certification that sheet metal fabricator is an authorized fabricator in accordance with NRCA's ITS Certification. Provide evidence that the sheet metal edge flashings and copings have been approved and listed by NRCA and Intertek Testing Services (ITS).

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
   1. Sealants: Contractor shall provide to sealant manufacturers, samples of all substrates which are in contact with sealant, regardless of whether adhesion must be achieved.
      a. For substrates which must support adhesion, submit to the Architect, for record only, sealant manufacturer's reports of adhesion tests conducted in accordance with ASTM C794

C. Evaluation Reports: For copings and roof edge flashing, from ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.
   1. Provide pull-off test results for edge flashings in accordance with current edition of ANSI/SPRI ES-1, SPRI test method RE-2.
      a. Test results shall meet or exceed design wind pressures as calculated to RE-2.
   2. Provide pull-off test results for copings in accordance with current edition of ANSI/SPRI ES-1, SPRI test method RE-3
      a. Test results shall meet or exceed horizontal and vertical design wind pressures as calculated according to RE-3

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Special warranty.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
   1. Company specializing in sheet metal work with minimum five years of documented experience

B. Comply with SCAQMD Rule 1168, Adhesive and Sealant Applications, most current amended version:
   1. Architectural Sealants: Max VOC Content 250 g/L.
   2. Architectural Sealant Primers:
      a. Non Porous: Max VOC Content 250 g/L.
      b. Porous: Max VOC Content 775 g/L.

C. Comply with SCAQMD Rule 1113, Architectural Coatings, most current amended version:
   1. Roof Primers, Bituminous: Max VOC Content 350 g/L.
   2. Mastic Coatings: Max VOC Content 100 g/L.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
   2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish Performance:
      a. Weathering:
         1) Color Retention: Free of fading or color change in excess of 5 delta E Units (Hunter) of color change as calculated in accordance with ASTM D2244.
         2) Chalk Resistance: Chalking shall be no more than that represented by a No. 8 rating based on ASTM D4214, test method A, after test site exposure.
         3) Gloss Retention: Not less than 50 percent loss of gloss after exposure test.
         4) Resistance to Erosion: Less than 10 percent film loss after the exposure test.
      b. Flexibility: No evidence of cracking when viewed with the unaided eye, and no loss of adhesion to the point of metal rupture, using a 180-degree bend on a 1/8-inch mandrel per ASTM D522.
      c. T Bend: Perform to a grade “1T” per ASTM D4145.
      d. Film Adhesion:
         1) No removal of film under the tape within or outside of the cross-hatched area or blistering anywhere on the test specimen, test in accordance with NCCA 4.2.10.
         2) No coating removed by scotch tape on tested area per ASTM D3359
      e. Reverse and Direct Impact Resistance:
         1) Hot-Dipped Galvanized (HDG), ASTM A525, G90, minimum steel or zinc-aluminum coated steel such as Galvalume: No cracking, no removal of film from substrate, using 3x metal thickness in inch lbs. and 5/8-inch ball indenter (Gardner Impact Test) when tested in accordance with ASTM D 2794.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. The sheet metal edge flashings and copings shall be listed by NRCA and tested by Intertek Testing Services (ITS). Sheet metal fabricator shall be NRCA ITS Certified
   1. The metal edge securement including the coping, except gutter, shall be installed as tested in accordance with the most current version of the ANSI/SPRI ES-1, American National Standard for Edge Systems Used with Low-Slope Roofing Systems.
   2. Copings: Copings shall be tested per the current edition of ANSI/SPRI ES-1, Test RE-3 for Copings. The coping system shall be tested simultaneously on horizontal and vertical surfaces and shall exceed horizontal and vertical design wind pressure as calculated in accord with the ANSI/SPRI ES-1 current edition, Test RE-3
   3. Edge Metal: The vertical face of edge metal flashing shall be tested per the current edition of ANSI/SPRI ES-1, Test RE-2 for edge metal. Test results shall meet or exceed design wind pressures as calculated in accord with ANSI/SPRI ES-1 current edition, RE-2

D. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
   1. Design Pressure: As indicated on Drawings.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Bare Galvalume Sheet Metal: ASTM A792-AZ55, Grade 40, structural quality, Galvalume-coated steel
   1. Finish: Galvalume Plus

C. Pre-Finished Metallic-Coated Steel Sheet (Galvalume): Provide aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A755/A755M.
   1. Exposed Coil-Coated Finish:
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Color: As selected by Architect from Manufacturer’s full range

D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.

E. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; 26 gauge, with smooth, flat surface.
   1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled) or ASTM A480/A480M, No. 2B (bright, cold rolled).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
   1. Basis of Design: Subject to compliance with requirements, and written approval by manufacturer of roofing membrane assemblies where underlayment materials come into contact with roof membrane, provide one of the following:
      a. GCP Applied Technologies Inc; Grade Ice and Water Shield HT
      b. Henry Company; Blueskin PE200HT
      c. Carlisle Residential, a Division of Carlisle Construction Materials; WIP 300HT
      d. Kemper Systems America UT-40 Universal Tape
   2. Source Limitations: Obtain underlayment from single source from single manufacturer.
   3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
   3. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Sealant: ASTM C920, Type S, Grade NS, Class 25 or higher. Use NT, T, M, G, A and O
   1. Basis of Design: Subject to compliance with requirements, provide MasterSeal NP 150 as manufactured by BASF Building Systems, or the following:
      a. Kemper System; GreatSeal PE 150 Multipurpose Sealant

1) VOC Content: 18.26 g/L.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
   1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
   4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
   1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:
   1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials:
   1. Galvalume: 24 gauge
   2. Finish:
      a. Pre-Finished
      b. Galvalume Plus
   3. Fasteners: Corrosion-resistant screw fasteners with neoprene washers spaced 16 inches o.c
   4. Joint: Minimum 1-inch-high double lock standing seam.
   5. Lap expansion joint fascia minimum of 2 inches at each standing seam

B. Pocket Receivers (Masonry above roof):
   1. Material: Stainless steel
   2. Thickness: 26 gauge
   3. Fasteners:
      a. Stainless steel screw fasteners
      b. Spacing: 8 inches o.c.
   4. Solder all outside and inside corners

C. Pocket Receivers (Framed Construction, Roof Curbs):
   1. Material: Galvanized steel.
   2. Thickness: 24 gauge
   3. Fasteners:
      a. Corrosion resistant, barbed, annular ring or screw shank nail
      b. Spacing: 8 inches o.c.
   4. Solder all outside and inside corners

D. Counterflashing (Installed with Stainless Steel Pocket Receiver): Shop fabricate interior and exterior corners. Fabricate from the following materials:
   1. Stainless Steel: 26 gauge
   2. Fasteners:
      a. Stainless steel screw fasteners
      b. Spacing: 8 inches o.c.

E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
   1. Galvanized Steel: 24 gauge
   2. Fasteners:
      a. Corrosion resistant screws with neoprene washers
      b. Spacing: 12 inches o.c.
      c. Solder all outside and inside corners

F. Penetration Flashing: Fabricate from the following materials:
   1. Galvanized steel: 24 gauge
      a. Fasteners:
         1) Corrosion resistant, barbed, annular ring or screw shank nail
         2) Spacing: Staggered 3 inches o.c.
         3) Length: Minimum 1 1/4 penetration into nailer
   2. Manufactured Roof Penetration Assembly: Chem Link Inc.; Chem Curb consisting of 2-inch-high pre-cast polyester shell, M-1 structural adhesive and 1-part pourable sealant.
      a. Warranty: Provide manufacturer’s 10-year warranty, which warrants the system against leaks for a period of 10 years from the date of substantial completion

G. Roof-Drain Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.0156 inch thick.

H. Copings: The metal gauge, fasteners, fastener spacings and installation shall be based on Test RE-3 of the ANSI/SPRI ES-1.
   1. Galvalume steel Thickness:
      a. Widths up to 12 inches: 24 gauge
      b. Widths 12 inches to 18 inches: 22 gauge
   2. Finish: Prefinished Galvalume Plus with coil coated color finish.
      a. Color: As Selected by Architect from manufacturer’s full range
   3. Fasteners:

a. Copings up to and equal to 12 inches in width: On roof side, corrosion-resistant screw fasteners with neoprene washers spaced 16 inches o.c. On the opposite side, provide a continuous cleat.
b. Copings over 12 inches in width but less than 24 inches: Provide continuous cleats on each side.

4. Cleat:
   a. Material: Galvanized steel with metal flange extension.
   b. Thickness: Cleat gauge to be one gauge heavier than metal thickness of coping.
   c. Fasteners:
      1) Corrosion-resistant, barbed, annular ring or screw shank nail
      2) Spacing: 6 inches o.c.
      3) Length: Minimum 1-1/4 inches penetration into nailer
      4) Locate fasteners near the lower brake

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
   1. Stainless Steel: 0.0156 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
   1. Stainless Steel: 0.0156 inch thick.

C. Exposed jamb and header trim at wall opening. Fabricate from the following material:
   1. Stainless Steel: 0.0625 inches thick.

D. Wall Expansion-Joint Cover: Fabricate from the following materials:
   1. Stainless Steel: 0.0188 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:
   1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
   2. Prime substrate if recommended by underlayment manufacturer.
   3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.

4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
   1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
   4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   5. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
   7. Do not field cut sheet metal flashing and trim by torch.
   8. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated.
      a. Embed hooked flanges of joint members not less than 1 inch into sealant.
      b. Form joints to completely conceal sealant.
      c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
      d. Adjust setting proportionately for installation at higher ambient temperatures.
         1) Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder metallic-coated steel sheet.
3. Do not pretin zinc-tin alloy-coated copper.
4. Do not use torches for soldering.
5. Heat surfaces to receive solder, and flow solder into joint.
   a. Fill joint completely.
   b. Completely remove flux and spatter from exposed surfaces.
6. Stainless Steel Soldering:
   a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
   b. Promptly remove acid-flux residue from metal after tinning and soldering.
   c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Copings: The metal gauge, fasteners, fastener spacings and installation shall be based on Test RE-3 of the ANSI/SPRI ES-1
   1. Coping Fasteners:
      a. Copings up to and equal to 12 inches in width: On roof side, corrosion-resistant screw fasteners with neoprene washers spaced 16 inches o.c. On the opposite side, provide a continuous cleat.
      b. Copings over 12 inches in width but less than 24 inches: Provide continuous cleats on each side
   2. Form coping cap with a minimum 1-inch-high double-lock standing seam. Lap coping fascia a minimum of 2 inches at each standing seam. Seal lap with a continuous bead of sealant
   3. Copings shall slope to the roof side a minimum of 1/4 inch per foot
   4. Copings less than or equal to 12 inches in width: The coping shall be secured to the wood nailer with a continuous cleat on the side away from the roof. On the roof side, fasten the coping to the wood nailer or metal wall panels with screws and watertight washers, through elongated holes
   5. Copings greater than 12 inches but less than or equal to 24 inches in width: The coping shall be secured to the wood nailer with a continuous cleat on both sides
   6. All seams and joints shall be sealed
   7. Outside and inside corners shall be formed watertight, welded or mitered, seamed and sealed

I. Roof Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof.
   1. Prepare roof membrane in accordance with manufacturers written instructions.
   2. Coat (prime) roof penetrations all around with M-1 structural sealant to 3 inches above the roof membrane and extend M-1 structural sealant onto the roof membrane all around each penetration.
   3. Prime roof membrane as required by manufacturer. Hold curb flat side up and place a ¼ inch bead of M-1 structural sealant to the entire bottom perimeter. Apply one additional ¼ inch bead of M-1 structural sealant down the center of the section. Do not tool beads flat.
   4. Place each curb section down on the roof surface and press down firmly until M-1 structural sealant extrudes from the outside edges. Seal all scarf joints with M-1 structural sealant. Provide a minimum 1- inch distance between roof penetrations and inside edge of curb. Roof penetrations shall have a minimum 1- inch space between penetrations.
   5. Apply a continuous bead of M-1 structural sealant around the outside base of the curb. Tool sealant to a smooth fillet.
   6. Fill curb with pourable sealer that is compatible with roof membrane.

3.4 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.6 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Roof Curbs for Equipment Support

1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

B. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

D. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
   4. Required clearances.

C. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

B. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   1. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   2. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   3. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

C. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF CURBS FOR EQUIPMENT SUPPORTS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

B. Basis of Design: Subject to compliance with requirements, provide one of the following:
   1. The Pate Co., Model es-2.
   2. Roof Products, Inc., Model RPES-3.
   3. ThyBar, Model TEMS-3.

C. Height: Minimum 12 inches measured from top of roof membrane to top of curb unless otherwise noted.

D. Material: Galvanized steel sheet: ASTM A653 structural quality, Grade 33, G60 hot-dip zinc coating.

E. Construction:

F. Curb Profile: Manufacturer's standard compatible with roofing system.

G. Provide sloping end sections where required.

H. Construction to match roof pitch

I. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

J. Insulation: Install 1-1/2-inch- (38-mm-) thick polyisocyanurate board insulation.

K. Liner: Same material as curb, of manufacturer's standard thickness and finish.

L. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.

2.3 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

D. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

E. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

B. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.

C. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

D. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

E. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

F. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

G. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

3.3 REPAIR AND CLEANING

A. Clean off excess sealants.

B. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Penetration firestopping systems for the following applications:
      a. Penetrations in fire-resistance-rated walls.
      b. Penetrations in horizontal assemblies.
   2. Joint firestopping systems.

1.2 RELATED WORK

A. Section 09 29 00 "Gypsum Board" for head of wall firestop joint sealant materials in non-rated partitions.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Indicate VOC Content.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Interior sealants: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168, Adhesive and Sealant Applications, most current amended version.
   1. Architectural sealants: Maximum VOC content: 250 g/L.
   2. Architectural sealant primers: Maximum VOC content:

a. Nonporous: 250 g/L.
b. Porous: 775 g/L.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."
3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
a. Hilti, Inc.
b. Specified Technologies
c. 3M Fire Protection Products

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall, except where allowed by code.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 JOINT FIRESTOPPING SYSTEMS

A. General: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
3. Provide firestop products that do not contain ethylene glycol.

B. Intumescent Gypsum Wall Framing Gaskets: Applied to steel tracks, runners, and studs prior to framing installation. Provide products with fire, smoke, and acoustical ratings that allow movement of up to 100 percent compression and/or extension when tested in accordance with UL 2079 or ASTM E1966; have an L Rating of less than 1 cfm/ft. when tested in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 when tested in accordance with ASTM E90 or ASTM C919.

C. Perimeter Fire-Barrier System: Provide perimeter fire-barrier system that does not require direct screw attachment to mullions and transoms to support and fasten curtain-wall insulation for aluminum curtain-wall assemblies with one- or two-piece rectangular mullions at least 2-1/2 by 5 inches. System will be tested in accordance with ASTM E2307 for up to two-hour fire resistance and with ASTM E1233/E1233M for wind cycling equivalent to 108 mph wind for 500 cycles.

D. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined in accordance with ASTM E1966 or UL 2079, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.
1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

E. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined in accordance with ASTM E2307.
1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

F. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined in accordance with UL 2079 based on testing at a positive pressure differential of 0.30 inch wg.
   1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

G. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined in accordance with ASTM E84.

2.4 FILL MATERIALS

A. General: Provide components of firestopping systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

D. Firestop Collar: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

F. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Firestop Blocks: Intumescent flexible block designed to seal medium to large size openings.

J. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

K. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

L. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.5 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove

penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

C. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge, so labels are visible to anyone seeking to remove joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174 and ASTM E2393.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."

C. Where FM Approval-approved systems are indicated, they refer to design numbers listed in FM Approval's "Approval Guide" under "Wall and Floor Penetration Fire Stops."

D. Walls: Gypsum Board and Metal Stud Construction
   1. Single Metal Pipe/Conduit or Tubing:
      a. Rating: F, 1 Hour or 2 Hour.
      b. UL Number: WL 1054.
      c. Manufacturer/Product: Hilti Construction Chemicals, Inc./FS-One MAX Intumescent Firestop Sealant.
      d. Annular space around penetration: 0 inch minimum to 2-1/4 inches maximum.
      e. Firestop System: Construct firestop in accordance with UL Design Number.
   2. Multiple Penetrations: Cables, through penetrations
      a. Rating: F, 1 Hour or 2 Hour
      b. UL Number: WL 8013
      c. Manufacturer/Product: Hilti CFS-BL Fire Block, FS-One MAX Intumescent Firestop sealant
      d. Firestop System: Construct firestop in accordance with UL Design Number.
   3. Single or Multiple Penetrations: Cables, through penetrations
      a. Rating: F, 1 hour or 2 hour
      b. UL Number: WL 3065
      c. Manufacturer/Product: Hilti /FS-One MAX Intumescent Firestop Sealant
      d. Annular Space: Minimum 0 inch to maximum 1 inch
      e. Aggregate cross-sectional area of cable in opening to be maximum 45% of the cross-sectional area of the opening. Fill annular space with a minimum of 5/8 inch depth of FS-One firestop sealant on each side of opening for one and two hour rating. Construction firestop in accordance with UL Design Number.
   4. Plastic Pipe
      a. Rating: F, 1 hour or 2 hour
      b. UL Number: WL2078
      c. Manufacturer/Product: Hilti CP643N firestop collar and FS-One MAX Intumescent Firestop Sealant
      d. Install firestop collar to both sides of wall using anchor hooks
      e. Annular space: Minimum 0 inch to maximum ½ inch
   5. Insulated Metal Pipes
      a. Rating: F, 1 hour or 2 hour
      b. UL Number: WL5029
      c. Manufacturer/Product: Hilti Retaining collar with FS-One MAX Intumescent firestop sealant
      d. Annular Space: Minimum 0 inch to maximum 1-7/8 inch
      e. Insulation: Nominal 1 inch, 1-1/2 inches or 2-inch thick glass fiber pipe insulation or maximum 2-inch thick calcium silicate pipe insulation
      f. Firestop system: construct in accordance with UL Design Number

E. Concrete Floors Max 5-inches, Concrete Walls Max 8-inch, CMU Max 8-inch
   1. Single Metal Pipe/Conduit or Tubing:
      a. Rating: F, 3 hour
      b. UL Number: CAJ 1155
         1) At concrete walls and concrete block walls wider than 8 inches, provide an engineering judgement
      c. Manufacturer/Product: Hilti; FS-One MAX Intumescent Firestop Sealant
      d. Annular Space: 0 inches to 2-1/4 inches maximum
      e. Optional Metallic sleeve: Nom. 24 inches diam. (or smaller) Sch. 40 or heavier, steel pipe fabricated and installed in conformance with UL number
      f. Packing Material: Min. 4 inches thickness of min. 4 pcf mineral wool batt insulation, firmly packed into opening. Recess material 1/2 of an inch from both sides of wall

g. Fill annular space at both ends of wall with min. 1/2 inch thickness of fill material. Install fill material around outer perimeter of the steel sleeve

2. Single Metal Pipe/Conduit or Tubing through Firestop Device (floor only)
   a. Rating: F, 3 hour
   b. UL Number: F-B-1026
   c. Manufacturer/Product: Hilti CFS-DID Drip-In-Device
   d. Firestop system: construct in accordance with UL Design Number
3. Multiple Metal Pipes
   a. Rating: F, 3 hour
   b. UL Number: CAJ 1140
      1) At concrete walls and concrete block walls wider than 8 inches, provide an engineering judgement
   c. Manufacturer/Product: Hilti CP637 Firestop Mortar
   d. Firestop system: construct in accordance with UL Design Number
4. Insulated Metal Pipes
   a. Rating: F, 2 hour
   b. UL Number: CAJ 5091
      1) At concrete walls and concrete block walls wider than 8 inches, provide an engineering judgement
   c. Manufacturer/Product: Hilti FS-One MAX Intumescent Firestop Sealant
   d. Annular Spaces: ½ inch to 2-1/4 inch
   e. Pipe Covering: UL labeled ½ inch to max 2-inches thick glass fiber pipe insulation or maximum 2-inches thick calcium silicate pipe insulation
   f. Packing Material: Minimum 4-inches thickness, min 4.0 pcf mineral wool batt insulation firmly packed into opening
      1) Packing Material: Owens Corning Thermafiber Safing FF
   g. Fill annular space with minimum ½ inch thickness of specified sealant on both sides of wall. Construct firestop in accordance with UL Design Number.
5. Cables (Single or Multiple):
   a. Rating: F, 3 hour
   b. UL Number: CAJ3095
      1) At concrete walls and concrete block walls wider than 8 inches, provide an engineering judgement
   c. Manufacturer/Product: Hilti FS-One MAX Intumescent Firestop Sealant
   d. Install Minimum 2-inches thickness, min 4.0 pcf mineral wool batt insulation firmly packed. Install ½-inch depth of sealant flush with both sides of wall. Construct firestop in accordance with UL Design Number.
      1) Owens Corning Thermafiber Safing FF
6. Plastic Pipes:
   a. Rating: F, 2 hour or 3 hour
   b. UL Number: CAJ2109
      1) At concrete walls and concrete block walls wider than 8 inches provide an engineering judgement.
   c. Manufacturer/Product: Hilti CP643N, CP644 collar and FS-One MAX Intumescent Sealant.
   d. Install firestop collar to both sides of wall in accordance with UL design number
   e. Annular Space: Minimum 0 inch to Maximum 1/2 inch for maximum 6-inch pipes. For pipes larger than 6 inches diameter the annular space shall be 0 inch to maximum 1-1/4 inches
   f. Fill annular space with 1/2 inch depth of FS-One firestop sealant. Both sides of wall

F. Concrete Floors with Metal Deck (Steel Floor Unit: Minimum 2-1/2 inches concrete over maximum 3-inch deep fluted metal deck)
   1. Single Metal Pipe/Conduit or Tubing:

a. Rating: F, 2 hour. T, 0 hour
b. UL Number: F-A-1014
c. Manufacturer/Product: Hilti FS-One MAX Firestop Sealant
d. Annular Space: Minimum 0 inch to maximum 1-7/8 inch

2. Plastic Pipe
   a. Rating: F, 2 hour. T, 0 hour
   b. UL Number: F-A-2053
   c. Manufacturer/Product: Hilti CP 680-P/M cast-in firestop device, with deck adapter
   d. Install device in accordance with manufacturer's instructions prior to pouring concrete
3. Single or Multiple Cables
   a. Rating: F, 3 hour. T, ½-hour
   b. UL Number: F-A-3007
   c. Manufacturer/Product: Hilti CP 680-P/M Cast-In Firestop Device
   d. Install device in accordance with manufacturer's instructions prior to pouring concrete
4. Insulated Steel Pipe
   a. Rating: F, 2 hour. T, ¾ and 1-hour
   b. UL Number: F-A-5017
   c. Manufacturer/Product: Hilti CP 680-P/M Cast-In firestop device with adapter
   d. Pipe Insulation: Max 2-inches glass fiber pipe insulation, min. 3.5 pcf
      1) Pipe insulation shall contiain no added formaldehyde and shall comply with CDPH v1.1-2010 for general emissions

G. Concrete Floors Minimum 4-1/2 inches thick reinforced lightweight or normal weight concrete
1. Multiple Metal Pipes, conduits or tubing
   a. Rating: F, 2 hour. T, 2 hour
   b. UL Number: F-A-1127
   c. Manufacturer/Product: Hilti FS-One Max Intumescent Sealant
   d. Duct Wrap Material:
      1) Thermal Ceramics Inc. – Firemaster Fastwrap, Firemaster Fastwrap XL, or Pyroscat Duct Wrap XL.
      2) Unifrax I LLC. – Fyrewrap Duct Insulation or Fyrewrap Duct 1.5 Insulation.
      3) Products shall contain no added formaldeyde and shall comply with CDPH v1.1-2010 for general emissions
2. Single Metal Pipe:
   a. Rating: F, 2-hour. T, 2-hour
   b. UL Number: F-A-1105
   c. Manufacturer/Product: Hilti FS-One Max Intumescent Sealant or CFS-S SIL SL Sealant
   d. Duct Wrap Material:
      1) Thermal Ceramics Inc. – Firemaster Fastwrap XL Duct Insulation
      2) Unifrax I LLC. – Fyrewrap Duct Insulation or Fyrewrap Duct 1.5 Insulation.

H. Head of Wall at Rated Metal Stud and Gypsum Board Walls, Concrete over Metal Deck, Metal Roof Deck
1. Rating: F, 1 hour and 2 hour
2. UL Number: HW-D-0042 and HW-D-0049
   a. Forming Material: Minimum, 4 pcf density mineral wool batt insulation firmly packed into flutes of steel deck for 1 hour and 2 hour rated walls respectively, flush with wall surface, as per UL design requirements
      1) Owens Corning Thermafiber Safing FF Formaldehyde-Free Mineral Wool Safing Insulation
      2) At HW-D-0042 assemblies where studs are 3 1/2 inch and wider provide as an alternate to 1a above Hilti preformed mineral wool plugs, CP777 Speed Plugs
   b. Fill Material: Min 1/8 inch thick (wet) Hilti CFS-SP WB firestop joint spray

I. Head of Wall at Rated Metal Stud and Gypsum Board Walls, Concrete Deck
   1. Rating: F, 1 hour and 2 hour
   2. UL Number: HW-D-0083
      a. Fill Material: Hilti CP606

J. Head of Wall at Rated Metal Stud and Gypsum Board Walls, Pre-Engineered Metal Building Roof
   1. Rating: 1 hour
   2. UL Number: HW-D-0529 and HW-D-0530
   3. Forming Material: Minimum 4 pcf mineral wool batt insulation
      a. Owens Corning Thermafiber Safing FF Formaldehyde-Free Mineral Wool Safing Insulation
   4. At 1-hour shaft wall construction, provide an Engineering Judgement

K. Head of Wall at Rated Shaft Wall at Concrete Deck
   1. Rating: 2 hour
   2. UL Number: HW-D-0342
      a. Fill Material: Hilti CP606

L. Head of Wall at Rated Shaft Wall Steel Deck with Concrete, Steel Roof Deck
   1. Rating: 1 and 2 hour
   2. UL Number: HW-D-0569
   3. Forming Material: Minimum 4 pcf mineral wool batt insulation
      a. Owens Corning Thermafiber Safing FF Formaldehyde-Free Mineral Wool Safing Insulation
      b. Hilti CP 777 Speed Plugs
   4. Fill Material: Hilti CFS-SP WB Firestop Joint Spray

M. Head of Wall at Concrete Block
   1. Rating: 2 hour
   2. UL Number: HW-D-0081
   3. Fill Material: Hilti CP606

N. Control Joints in Rated Gypsum Board and Metal Stud Partitions
   1. Fill Joints with Owens Corning 4.0 pcf Thermafiber Safing FF Formaldehyde-Free Mineral Wool Safing Insulation

O. Floor to Wall at Rated Metal Stud and Gypsum Board Walls
   1. Fill the joint between the floor and edge of gypsum wallboard at rated and non-rated partitions with Hilti CP606

P. Cable Tray through 1- or 2-Hour Gypsum Board Walls
   1. Rating: 1 or 2 hour
   2. UL Number: W-L-4011
   3. Manufacturer/Product: Hilti FS 657 fire blocks, FS-One MAX Intumescent Firestop Sealant
   4. Annular Space: Minimum 0 inch to maximum 4 inches
   5. Open Ladder UL Classified Cable Tray: Maximum 24 inches by 6 inches steel or aluminum
   6. Apply FS-One MAX into interstices of cables, between cables and cable tray and any voids.

Q. Protection of Electrical Boxes in 1- and 2-hour Rated Metal Stud and Gypsum Wallboard Partitions
   1. Hilti CLIV CP617 Firestop Putty Pad
   2. Install around each outlet box located within a fire-rated partition or fire barrier.

R. Curtain Wall

1. Rigid Curtain Wall thermal Insulation: ASTM CD612, Type IVB
   a. Rockwool, Curtainrock 80 mineral curtain wall insulation, dark, unfaced
   b. Thickness/Thermal Resistance:
      1) 2 inches/R8.4
2. Fire Compound: Hilti CP604 Self-Leveling Firestop Compound
3. Integrity Rating: 2 hours
4. UL Design Number: CW-S-2027
   a. Install curtain wall and safing insulation at aluminum curtain wall framing and spandrel panels in accordance with perimeter fire containment systems UL design number, to achieve a smoke-tight installation between floors
   b. Alternate Systems:
      1) Hilti Design No HI/BPF 120-13
      2) Curtain Wall Insulation
      3) Safing Insulation: Owens Corning Thermafiber Safing FF Formaldehyde-Free Mineral Wool Safing Insulation
      4) Firestop Joint Spray: Hilti CFS-SP WB

S. Shaft Wall
   1. Single Metal Pipe/Conduit or Tubing
      a. Rating: F, 1 hour or 2 hour
      b. UL Number: WL-1205
      c. Manufacturer/Product: Hilti FS-One MAX Intumescent Firestop Sealant

T. Shaft Wall (Cables)
   1. Rating: F, 1 hour or 2 hour
   2. UL Number: WL-3161
   3. Manufacturer/Product: Hilti FS-One MAX Intumescent Firestop Sealant

U. Floor to Wall Joint at Concrete Floor to Concrete Wall or Concrete Block Wall
   1. Wall Assembly: Minimum 4 ½ inch reinforced or normal weight concrete or any UL classified fire-rated concrete block Rating: F, 1 hour or 2 hour
   2. Floor Assembly: Min 4 ½ inch thick reinforced lightweight or normal weight concrete
   3. Joint Width: Maximum 4-3/4 inches
   4. Rating: 2 Hour
   5. UL Number: FW-D-1012
      a. Forming Material: Mineral wool insulation
         1) Owens Corning Thermafiber Safing FF Formaldehyde-Free Mineral Wool Safing Insulation
      b. Fill Material: Minimum ½ inch thick Hilti CP606

END OF SECTION

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Schedule of joint firestop systems. Basis of design: Hilti, Inc.

Joint Type	F-Rating (Hr)	Hilti Basis of Design UL System	
		Joint Width Less than or Equal to 2"	Joint Width Greater than 2" Less than or Equal to 6" [4]
Concrete (**Floor to Floor**)	1 OR 2	FF-D-1012, FF-D-1013[1]	FF-D-1012, FF-D-1013
	3	FF-D-1011, FF-D-1026[1]	FF-D-1011, FF-D-1026
	4	FF-D-1047	FF-D-1125
Concrete (**Edge of Floor Slab to Wall)**	1 OR 2	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	3	FW-D-1011	FW-D-1011, FW-D-1021
	4	FW-D-1047	FW-D-1092
Concrete or Block Wall to Flat Concrete Floor (**Top-of-Wall**)	1	HW-D-0268	N/A**
	2	HW-D-0825, HW-D-1070, HW-D-0268, HW-D-1045, HW-D-1009, HW-D-0097[1]	HW-D-1078, HW-D-1070, HW-D-1045, HW-D-1009
	3	HW-D-0929, HW-D-0403, HW-D-1008[1], HW-D-0268	HW-D-1058, HW-D-1008
	4	HW-D-1042	HW-D-1103
Concrete or Block Wall to Concrete Over Fluted Metal Deck (**Top-of-Wall)**	1	HW-D-0098	N/A**
	2	HW-D-0285, HW-D-0155, HW-D-1069, HW-D-1037, HW-D-0080, HW-D-0081, HW-D-0098	HW-D-0225, HW-D-1069, HW-D-1037
	3	N/A**	N/A**
	4	HW-D-0294	N/A**
Gypsum Wall to Flat Concrete Floor (**Top-of-Wall)**	1 OR 2	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	3	HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
Gypsum Shaft Wall to (**Top-of-Wall)**	2	HW-D-0920, HW-D-0342 (FLAT CONCRETE) HW-D-0881, HW-D-0882, HW-D-0541, HW-D-0542 (CONCRETE OVER METAL DECK)	N/A**
Gypsum Shaft Wall to Concrete Floor (**Bottom-of-Wall)**	1 OR 2	BW-S-0070, BW-S-0023	N/A**
			N/A**
Gypsum Wall to Concrete Floor (**Bottom-of-Wall)**	1 OR 2	BW-S-0068, BW-S-0001, BW-S-0002	N/A**
			N/A**
Gypsum Wall to Concrete Over Fluted Metal Deck (**Top-of-Wall)**	1 OR 2	HW-D-0933, HW-D-0925, HW-D-0923*, HW-D-0883, HW-D-0882, HW-D-0881, HW-S-0134*, HW-D-0876, HW-D-0884, HW-D-0875, HW-D-0874, HW-D-0873, HW-D-0872, HW-D-0871, HW-D-0042*, HW-D-0049*, HW-D-0087*, HW-D-0089*, HW-D-0045, HW-D-0046*, HW-D-0076*, HW-D-0077*, HW-D-0154, HW-D-0184*, HW-D-0292, HW-D-0295, HW-D-0538*	HW-D-1067, HW-D-1066, HWD-1011, HWD-1012, HW-D-1020
	3	HW-D-0292, HW-D-0295	HW-D-1011, HWD-1012, HW-D-1020
	4	HW-D-0292, HW-D-0295	N/A**
Concrete (**Wall to Wall**)	2	WW-D-1129, WW-D-0017, WW-D-0032, WW-D-0082	WW-D-1129, WW-D-1080, WW-D-1084

	3	WW-D-1011[1], WW-D-0140, WW-D-0032	WW-D-1011
	4	WW-D-1047	WW-D-1128
Gypsum to Concrete (**Wall to Wall)**	1 OR 2	WW-D-0105, WW-D-0068, WW-D-0040	N/A**
			N/A**

* SEE NOTE 3 ** CONTACT HILTI FOR CURRENT UL-CLASSIFIED SYSTEM OR ENGINEER JUDGMENT DRAWING: 800-879-8000

NOTES:

1. CLASSIFIED SYSTEMS FOR 2" - 6" WIDE JOINTS MAY BE USED FOR JOINTS 2" WIDE AND LESS.
2. CONFIRM THAT MOVEMENT CAPABILITIES OF THE SELECTED UL SYSTEM MEETS OR EXCEEDS THE SPECIFIED MOVEMENT RANGE OF THE PARTICULAR JOINT.
3. SYSTEMS MARKED WITH ASTERIK (*) ARE SUITABLE FOR TOP-OF-WALL JOINTS WHERE THE FLUTED METAL DECK HAS SPRAY-ON MONOKOTE MK-6/HY FIREPROOFING.
4. VERIFY ALLOWABLE JOINT WIDTH ON SPECIFIC UL SYSTEM DRAWING.

Schedule of through penetration firestop systems. Basis of design: Hilti, Inc.

CONCRETE FLOORS			CONCRETE OR BLOCK WALLS		
TYPE OF PENETRANT	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**	**TYPE OF PENETRANT**	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**
CIRCULAR BLANK OPENINGS	1 OR 2	F-A-0048, C-AJ-0055, C-AJ-0090	CIRCULAR BLANK OPENINGS	1 OR 2	C-AJ-0055, C-AJ-0090
	3	F-A-0048, C-AJ-0055, C-AJ-0086		3	C-AJ-0055, C-AJ-0086
SINGLE METAL PIPES OR CONDUIT	1 OR 2	C-AJ-1226, F-A-1028, F-A-1222	SINGLE METAL PIPES OR CONDUIT	1 OR 2	C-AJ-1226, W-J-1067, W-J-1020, W-J-1248
	3	C-AJ-1226, F-A-1222		3	C-AJ-1226, W-J-1041, W-J-1068
	4	C-BJ -1037, C-BJ-1034		4	C-BJ-1034, C-BJ-1037, W-J-1041, W-J-1042, W-J-1068
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	F-A-2025, C-AJ-2109, C-AJ-2098, C-AJ-2271, C-AJ-2167	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1 OR 2	C-AJ-2109, C-AJ-2098, C-AJ-2167, C-AJ-2371, C-AJ-2342
	2	F-A-2103, C-AJ-2098, C-AJ-2271, C-AJ-2167, C-BJ-2021, C-AJ-2371, C-AJ-2342			
	3	F-A-2411, C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342		3	C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342
	4	C-BJ-2016, C-AJ-2017		4	W-J-2057, W-J-2091
SINGLE/CABLE BUNDLES	1	F-A-3091, C-AJ-3095, C-AJ-3180, C-AJ-3283	SINGLE/CABLE BUNDLES	1	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167
	2	F-A-3085, F-A-3087, F-A-3089, F-A-3091, C-AJ-3095,-F-A-3093		2	W-J-3036, C-AJ-3095, W-J-3277, W-J-3278 W-J-3060, W-J-3167, W-J-3189
	3	F-A-3091, C-AJ 3095, C-AJ-3285		3	C-AJ-3095, C-AJ-3180, W-J-3167
				4	W-J-3050
CABLE TRAY	1, 2 OR 3	C-AJ-4034, C-AJ-4035	CABLE TRAY	1 OR 2	W-J-4027, C-AJ-4034, C-AJ-4035
				3	C-AJ-4034, C-AJ-4035
				4	W-J-8007
SINGLE INSULATED PIPES	1 OR 2	C-AJ-5090, C-AJ-5091, C-AJ-5048	SINGLE INSULATED PIPES	1 OR 2	C-AJ-5090, C-AJ-5091, C-AJ 5061, W-J-5042
	3	F-A-5083, C-AJ-5090, F-A-5083		3	C-AJ-5090, C-AJ-5061
	4	C-BJ-5006		4	C-BJ-5006, W-J-5028
ELECTRICAL BUSWAY	1 OR 2	C-AJ-6006, C-AJ-6017, C-AJ-6036	ELECTRICAL BUSWAY	1 OR 2	C-AJ-6006, C-AJ-6017, C-AJ-6036
	3	C-AJ-6006, C-AJ-6017		3	C-AJ-6006, C-AJ-6017
MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1 OR 2	C-AJ-7046, C-AJ-7051, C-AJ-7084	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1 OR 2	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	3	C-AJ-7046, C-AJ-7051		3	C-AJ-7046, C-AJ-7051
MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	N/A**	N/A**	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	1	W-J-7029, W-J-7124
				2	W-J-7091, W-J-7112, W-J-7124
MIXED PENETRANTS	1 OR 2	C-AJ-8099, C-AJ-8056, C-AJ-8143	MIXED PENETRANTS	1 OR 2	C-AJ-8099, C-AJ-8056, W-J-8007, C-AJ-8143
	3	F-A-8069, C-AJ-8099, C-AJ-8056		3	C-AJ-8041, C-AJ-8056, W-J-8007, C-AJ-8099
	4	C-AJ-8095		4	C-AJ-8095, W-J-8007
WOOD FLOORS			**GYPSUM WALLS**		
TYPE OF PENETRANT	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**	**TYPE OF PENETRANT**	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**
METAL PIPES OR CONDUIT	1 OR 2	F-C-1009, F-C-1059, F-C-1168	METAL PIPES OR CONDUIT	1	W-L-1054, W-L-1058, W-L-1164, W-L-1506
				2	W-L-1054, W-L-1058, W-L-1164, W-L-1506
				4	W-L-1110, W-L-1111, W-L-1165
NON-METALLIC PIPE OR CONDUIT	1	F-C-2232, F-C-2030, F-C-2160, F-C-2389	NON-METALLIC PIPE OR CONDUIT	1 OR 2	W-L-2078, W-L-2075, W-L-2128
	2	F-C-2030, F-C-2128, F-C-2160			
				4	W-L-2184, W-L-2245

SINGLE OR BUNDLED CABLES	1	F-C-3012, F-C-3110, F-C-3044	SINGLE OR BUNDLED CABLES	1 OR 2	W-L-3481, W-L-3482, W-L-3483, W-L-3484, W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
	2	F-C-3012, F-C-3110		3	W-L-3334, W-L-3385, W-L-3277
				4	W-L-3139, W-L-3334
INSULATED PIPES	1	F-C-5004, F-C-5037, F-C-5036	CABLE TRAY	1 OR 2	W-L-4011, W-L-4019, W-L-4081
				4	W-L 8014
	2	F-C-5004, F-C-5037	INSULATED PIPES	1 OR 2	W-L-5028, W-L-5029, W-L-5047
				4	W-L-5073
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	F-C-7013	NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1 OR 2	W-L-7040, W-L-7042, W-L-7155
INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	N/A**	INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1 OR 2	W-L-7059, W-L-7153, W-L-7156, W-L-7151
	2	N/A**			
MIXED PENETRANTS	1	F-C-8009, F-C-8014, F-C-8026	MIXED PENETRANTS	1 OR 2	W-L-1095, W-L-8013
				4	W-L-8014

COMPOSITE METALDECK FLOORS			
TYPE OF PENETRANT	FLOOR COVERAGE	F-RATING (HR)	BASIS OF DESIGN UL SYSTEM
CIRCULAR BLANK OPENINGS	2-1/2"	2	F-A-0040
	4-1/2"	2	F-A-0040, F-A-0041
SINGLE METALLIC PIPE OR CONDUIT (STEEL, IRON, COPPER)	2-1/2"	2	F-A-1192, F-A-1193
	4-1/2"	3	F-A-1192, F-A-1193
	4-1/2"	2	F-A-1194
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	2-1/2'	2	F-A-2310, FA-2311
	4-1/2"	2	F-A-2313, F-A-2314, F-A-2315, F-A-2316
	4-1/2"	3	F-A-2310, FA-2311, F-A-2312
SINGLE/CABLE BUNDLES	2-1/2"	3	F-A-3071, F-A-3072
SINGLE INSULATED PIPES	2-1/2"	2	F-A-5069, F-A-5070, F-A-5071
	4-1/2"	3	F-A-5069, F-A-5070, F-A-5071
MIXED PENETRANTS	4-1/2"	3	F-A-8055

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
      a. Dynamic movement type, weathertight seal.
      b. Mildew-resistant type.
      c. Non-staining, residue resistant.
   2. Urethane joint sealants.
   3. Silyl-terminated polyether (STPE) joint sealants.
   4. Butyl joint sealants.
   5. Latex joint sealants.
   6. Preformed joint sealants serving as secondary seal.

1.2 RELATED WORK

A. Perimeter joint sealants specified in this section shall not come in direct contact with components of waterproofing membrane systems or fluid applied membrane air barrier systems specified in Section 07 27 26 “Fluid-Applied Air Barrier Membrane,” Section 07 14 16 "Cold Fluid-Applied Waterproofing," and Section 07 13 26 "Self-Adhering Sheet Waterproofing."

B. Section 09 30 00 "Tiling" for joint sealants approved by setting material manufacturer for Warranty indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Joint-sealants.
   2. Joint sealant backing materials.
   3. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

a. Joint-sealant location and designation.
b. Manufacturer and product name.
c. Type of substrate material.
d. Proposed test.
e. Number of samples required.

2. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:
   a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   b. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
3. 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.
4. For all test results, submit manufacturers' recommendations for application and quality control procedures.

B. For substrates which must support adhesion, submit to the Architect, for record only, sealant manufacturers' reports of adhesion tests conducted in accordance with ASTM C794.

C. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

D. Field Quality-Control Submittals:
   1. Field-Adhesion-Test Reports: For each sealant application tested.

E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Warranty Documentation:
   1. Manufacturers' special warranties.
   2. Installer's special warranties.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Installers: Authorized representative who is trained and approved by manufacturer.
      a. Engage an experienced Installer with five years of experience completing installation of joint sealant in applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
   2. Testing Agency: Qualified in accordance with ASTM C1021 to conduct the testing indicated.
      a. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E329, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.

1.8 MOCKUPS

A. 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.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
   3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.

1.10 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or below 40 degrees Fahrenheit.
   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.

1.11 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period. Include coverage for installed sealants and accessories failing to achieve airtight, watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.
   1. Warranty Period: As follows
      a. Silicone Warranty: 20 years.
      b. Urethane Warranty: 5 years.
      c. Provide 2-year workmanship warranty for all sealants.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Additional Movement Capability: Where additional movement capability is specified in Elastomeric joint sealant data sheet, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

C. VOC Content of Sealant and Primers: Provide joint sealants and sealant primers that comply with SCAQMD Rule 1168 for VOC content.

D. Primer: Type recommended by manufacturer of joint sealant system.

E. Colors: Provide color of exposed to view joint sealants to comply with the following:
   1. At masonry, provide colors to match masonry and mortar colors.
   2. At vertical expansion contraction joints, sealant color shall match masonry and/or stone.
   3. At horizontal joints, sealant color shall match mortar color.
   4. Provide selections made by architect from manufacturer’s full range of standard colors for products of type indicated. Provide custom colors where the manufacturer's standard colors do not match masonry.

2.3 SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Dynamic Movement and Weatherseal: Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning; DOWSIL 790
         1) VOC Content: 23 g/L
      b. Pecora Corp.; 890 NST
         1) VOC Content: 98 g/L
      c. Tremco Inc.; Spectrem 1
         1) VOC Content: 1 g/L
   2. Locations:
      a. Exterior Joints in Vertical Surfaces, including:
         1) Brick expansion joints.
         2) Perimeter joints between brick, concrete, concrete block, decorative masonry units, cement plaster and metal frames
         3) Horizontal joints at relief (shelf) angles
         4) Exposed exterior perimeter joint at exterior aluminum frames, and exposed intrerior joint sealant at exterior aluminum frames.

C. Mildew Resistance: Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning; DOWSIL 786 Silicone Mildew-Resistant
         1) VOC Content: 22 g/L
      b. Pecora Corp.; 898 Sanitary Silicone
         1) VOC Content: 82 g/L
      c. Tremco Inc.; Tremsil 200
         1) VOC Content: 1 g/L
   2. Locations: Sealing around sinks, urinals, bathroom fixtures, waterproofing rimless sinks.

2.4 URETHANE JOINT SEALANTS

A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, Class 2; tested in deionized water unless otherwise indicated

B. Urethane, Immersible, M, P or NS, 25 or 50, T, I (Immersion): Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. Sika MasterSeal SL2
         1) VOC Content: 21 g/L
      b. Pecora Corp.; Dynatred (Slopes between 5% and 12%)
         1) VOC Content: 118 g/L
         2) At slopes less than 5%, use the following product:
            a) Pecora Corp.; Urexpan NR-200
            b) VOC Content: 20 g/L
      c. Tremco Inc.; Dymeric 240FC (Fast Cure) UPDATE PRODUCT
         1) VOC Content: 5 g/L
   2. Locations: Traffic surface joints on slopes up to 12%.

2.5 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
      a. Everkem Diversified Products, Inc.; EvoSeal MS High Performance Hybrid Polymer Sealant
         1) VOC Content: 19 g/L.
      b. Franklin International; Titebond WeatherMaster Sealant
         1) VOC Content: Less than 50 g/L.
      c. Permathane/Acryl-R; ITW Polymers Sealants North America; SM2100
         1) VOC Content: 39.5 g/L.
      d. Polymeric Systems, Inc.; Sil-Thane 803
         1) VOC Content: 18 g/L.
   2. Location: Perimeter of aluminum frames at secondary sealant.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311. Manufacturer's standard one-part, non-sag, solvent-release-curing polymerized butyl sealant complying with ASTM C1311 and formulated with minimum of seventy-five percent (75%) solids to be non-staining, paintable and have a tack-free time of 24 hours or less.
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corp.; BC-158.
         1) VOC content: 208 g/L.
      b. Tremco, Inc.; Tremco Butyl Sealant.
         1) VOC content: 226 g/L.
   2. Locations: Concealed exterior conditions where compatible with in-contact materials.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corp.; AC-20.
         1) VOC Content: 31 g/L.
      b. Tremco, Inc.; Tremflex 834.
         1) VOC Content: 11 g/L.
   2. Locations: Typical interior joint sealant between gypsum board and adjacent materials in non-wet conditioned spaces.

2.8 PREFORMED JOINT SEALANTS

A. Preformed, Precompressed Foam Joint Seals: Acrylic-impregnated polyurethane foam, wall seal with factory-applied adhesive on one side. Factory produced in precompressed sizes in roll form to fit joint widths based on design criteria indicated, with factory-applied adhesive for bonding to substrates.
   1. Basis of Design: Subject to compliance with requirements, provide Backerseal (Greyflex) as manufactured by Sika Emseal Corp.
   2. Design Criteria:
      a. Nominal Joint Width: As indicated on Drawings.
      b. Movement Capability: -25 percent/+25 percent.
   3. Joint Seal Color: As selected by Architect from full range of industry colors.

B. Location: As secondary seal behind joint sealant and backer rod, and where indicated on Drawings.

2.9 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
      a. Adfast
      b. Alcot Plastics Ltd
      c. Construction Foam Products; a Division of Nomaco, Inc
      d. Master Builders Solutions

B. Cylindrical Sealant Backings: ASTM C1330, Types indicated below, and 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.
   1. Type C (closed-cell material with surface skin)
      a. Location: Horizontal joint sealant systems.
   2. Type O (open-cell material)
      a. Location: Secondary vertical joint sealants in exterior envelope.
   3. Type B (bicellular materials with a surface skin)
      a. Location: Primary vertical joint sealants in exterior envelope.

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.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
   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.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 INSTALLATION OF PREFORMED, FOAM JOINT SEALS

A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
   1. Install each length of seal immediately after removing protective wrapping.
   2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
   3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.

4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Field-Adhesion Testing: Test joint sealants in accordance with Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521. Field test joint-sealant adhesion to joint substrates as follows:
      a. Frequency of Testing: Testing per ASTM C1521 Frequency of the destructive pull testing shall be a minimum of one test per 100 linear feet for the first 1000 feet and one test for every 1000 linear feet thereafter.
      b. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
      c. Conduct field tests for each kind of sealant and joint substrate.
      d. Notify Architect seven days in advance of dates and times when test joints will be erected.
      e. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      f. 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.
      g. Inspect tested joints and report on the following:
         1) Whether sealants filled joint cavities and are free of voids.
         2) Whether sealant dimensions and configurations comply with specified requirements.
         3) 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 complies with sealant manufacturer's field-adhesion hand-pull test criteria.
      h. 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 material, sealant configuration, and sealant dimensions.
      i. 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.
   2. Field-Constructed Mock-Ups: Prior to installation of joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution:
      a. Joints in field-constructed mock-ups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants specified in this Section.
   3. 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.

C. Prepare test and inspection reports.

3.6 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.

3.7 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 07 92 19 - ACOUSTICAL JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustical joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Acoustical joint sealants.
   2. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

C. Samples for Verification: For each type and color of acoustical joint sealant required.
   1. Size: 1/2-inch-wide sealant joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Acoustical Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Product Test Reports: For each type of acoustical joint sealant, for tests performed by qualified testing agency.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Warranty Documentation:
   1. Manufacturers' special warranties.
   2. Installer's special warranties.

1.5 WARRANTY

A. Installer's Special Warranty: Installer agrees to repair or replace acoustical 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.

PART 2 PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer’s standard non-sag, paintable, non-staining latex sealant complying with ASTM C834, ASTM C919 and the following requirements.

1. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.
2. Provide sealants that have a maximum VOC content of 250 g/L per SCAQMD Rule 1168, current version.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
1. Basis of Design: Subject to compliance with requirements, provide AC-20 FTR Acoustical and Insulation Sealant, as manufactured by Pecora Corp, or one of the following:
   a. Boss; 824 Acoustical Sound Sealant
      1) VOC content: 50 g/L
   b. Grabber; Acoustical Sound Sealant GSCSF
      1) VOC content: 42.1 g/L
   c. United States Gypsum (USG); Sheetrock Brand Acoustical Sealant
      1) VOC content: 15 g/L
   d. Tremco; Acoustical Sealant
      1) VOC content: 150 g/L
2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

C. Acoustical Spray for Head of Wall Exposed and Concealed Joints: Manufacturer's standard sprayable latex material complying with ASTM C919.
1. Basis of Design: Subject to compliance with requirements, provide CP 572 Smoke and Acoustic Spray as manufactured by Hilti.
2. Sound transmission classification: STC 56.
3. Flame spread/Smoke developed: 10/5.
4. Spray shall be mold and mildew resistant per ASTM G21 with a rating of zero (0) no growth.
5. Spray has a movement capability of 12.5 percent.
6. Provide manufacturers standard filler strips and plugs as required for system installation.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

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 acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. 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 ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

C. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

D. Install acoustic sealant backings of type indicated to support sealant and spray during application in accordance with manufacturer’s written installation instructions

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.
   1. Remove excess acoustic sealant from surfaces adjacent to joint.
   2. Remove excess acoustic spray from surfaces adjacent to joint as indicated on the drawings.
   3. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   4. Provide concave joint configuration per Figure 8A in ASTM C1193, unless otherwise indicated.

F. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 FIELD QUALITY CONTROL

A. Examine acoustic joints and penetrations to ensure proper installation of joint system before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities

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 acoustical joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 07 95 13.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Floor expansion joint covers.
   2. Wall expansion joint covers.
   3. Ceiling expansion joint covers.
   4. Transitions in expansion joint cover assemblies as required for continuity in expansion joint.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
      a. Floor expansion joint covers.
      b. Wall expansion joint covers.
      c. Ceiling expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Samples for Initial Selection: For each type of exposed finish.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.

E. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.

F. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Approved by manufacturer.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of typical expansion joint cover assembly 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.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Loading Characteristics: Standard loading refers to covers that can withstand up to 500 lb. point loads. Heavy duty refers to covers that can withstand up to 2000 lb. point loads. For loading greater than 2,000 lbs., contact manufacturer for custom engineered solution. Metal thickness framing/center plates to be minimum .090" to ensure minimum load carrying and minimize deflection.

B. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 and/or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction. Fire rating not less than the rating of adjacent construction.

2.2 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.3 FLOOR-TO-FLOOR EXPANSION JOINT COVERS

A. Metal-Plate Floor Joint Cover System: Extruded aluminum frame with aluminum plate infill centered between dual gasketing.
   1. Basis of Design: Subject to compliance with requirements, provide GTP-200, as manufactured by Construction Specialties.
   2. Application: Floor to floor.
   3. Installation: As required for top of tile to sit flush with with frame profile.
   4. Load Capacity: Standard Duty
   5. Exposed Metal: Extruded Aluminum.
      a. Aluminum Finish: As selected by Architect from manufacturer's full range.
   6. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
   7. Vapor Barrier: Manufacturer’s Standard.

2.4 FLOOR-TO-WALL EXPANSION JOINT COVERS

A. Floor-to-Wall Joint Systems:
   1. Basis-of-Design Product: Construction Specialties, Inc. Model PCW-2G-S

B. Type: Surface mounted.

C. Exposed Metal: Stainless Steel

D. Attachment Method: Mechanical anchors.

E. Load Capacity: Standard duty.

F. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

2.5 WALL-TO-WALL EXPANSION JOINT COVERS

A. Metal-Plate Wall Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
   1. Basis of Design: Subject to compliance with requirements, provide Model ASM-S, as manufactured by Construction Specialties.
   2. Application: Wall to wall
   3. Fire-Resistance Rating: Not less than that of adjacent construction.
   4. Exposed Metal: Stainless Steel

2.6 WALL-TO-CORNER EXPANSION JOINT SYSTEM

A. Wall Corner Joint Systems: Basis-of-Design Product: Construction Specialties, Inc. ASMC-S

B. Exposed Metal: Stainless Steel

C. Fire-Resistance Rating: Not less than that of adjacent construction.

2.7 WALL-TO-CEILING EXPANSION JOINT COVERS

A. Basis-of-Design Product: Construction Specialties, Inc. ASMC-S

B. Exposed Metal: Stainless Steel

C. Fire-Resistance Rating: Not less than that of adjacent construction.

2.8 CEILING-TO-CEILING EXPANSION JOINT COVERS

A. Elastomeric-Seal Ceiling Joint Cover: Assembly consisting of elastomeric seal anchored to aluminum frames fixed to sides of joint gap.
   1. Basis of Design: Subject to compliance with requirements, provide FCF Series, as manufactured by Construction Specialties.
   2. Application: Ceiling to ceiling.

2.9 ACCESSORIES

A. Manufacturer's stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

B. Vapor Barrier: 7-ply laminate reinforced Polyethylene ASTM E-1745-97, Color – Black, 3” tensile Strength – 275 lbs., ASTM-D882, Puncture Strength -79 lbs., ASTM-4833-PPT Resistance-6 lbs., ASTM D-2582.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
   2. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   6. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
   7. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

D. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION

SECTION 08 11 13 - STANDARD STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Interior standard steel frames.
   2. Interior, non-fire-rated frames for doors, sidelites, transom lites, borrowed lites.
   3. Exterior standard steel doors and frames.

1.2 RELATED WORK

A. Section 08 14 12 "Plastic Laminate Faced Flush Wood Doors" for interior flush wood doors installed in standard steel frames.

B. Section 08 71 00 "Door Hardware"

C. Section 08 80 00 "Glazing" for non-rated glazing types installed as lites in non fire-rated doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for steel 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. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   7. Details of anchorages, joints, field splices, and connections.
   8. Details of accessories.
   9. Details of moldings, removable stops, and glazing.
   10. Include rating of each door and frame product, including UL Listings

C. Concurrent Submittal Requirements: Exterior door hardware must be submitted with exterior doors specified in this section.

D. Samples for Initial Selection: For standard steel doors and frames with factory-applied color finishes.

E. Product Schedule: For standard steel doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated standard steel door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Certificates: Product certificates signed by manufacturer certifying material compliance with specified requirements

C. Field quality control reports.

1.8 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years of documented experience

B. Provide doors complying with ANSI A250.8-2017 (R2014). “Recommended Specifications for Standard Steel Doors and Frames” as specified, and other specifications herein named.

1.9 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver standard steel doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store standard steel doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Frame Construction for Doors, Sidelites, Transoms, Transom/Sidelight: Tested to UL 10C, or NFPA 252 with neutral pressure level in the furnace at 40 inches maximum above sill after 5 minutes into the test

B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

2.2 INTERIOR STANDARD STEEL FRAMES

A. Construct hollow metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
   1. Ceco Door; ASSA ABLOY
   2. Curries; ASSA ABLOY
   3. DCI Hollow Metal
   4. Deansteel Manufacturing Company, Inc.
   5. Mesker Door Inc.
   6. MPI Group, LLC (The)
   7. Pearland Industries, a Division of American Door Products
   8. Pioneer Industries
   9. Republic Doors and Frames
   10. Steelcraft; an Allegion brand

C. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3. ANSI/SDI A250.4, Level A.
   1. Frames:
      a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
      b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
      c. Construction: Full profile welded.
      d. Frame Materials:
         1) Interior Frames:
            a) Material: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
            b) Minimum material thickness: 0.053 inches (16 gauge).
      e. Door Silencers: Except on weatherstripped frames drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
      f. Plaster Guards: Provide minimum 0.0179 inch thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
      g. Reinforce frames over 48 inches with rolled formed steel channels fitted tightly into frame head, flush with top.
   2. Exposed Finish: Prime.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct standard steel doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
   1. Ceco Door; ASSA ABLOY
   2. DCI Hollow Metal
   3. Deansteel Manufacturing Company, Inc.

4. Mesker Door Inc.
5. MPI Group, LLC (The)
6. Pearland Industries, a Division of American Door Products
7. Pioneer Industries
8. Republic Doors and Frames
9. Steelcraft; an Allegion brand

C. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3. ANSI/SDI A250.4, Level A.
   1. Exterior doors shall meet the following requirements (fire-rated doors):
      a. Level: Level 3, extra-heavy-duty.
      b. Model: Model 2, Seamless welded construction.
      c. Physical performance level: Level A, 1,000,000 cycles.
      d. Thickness: 0.053 inches (16 gauge).
      e. Material: Hot-dipped zinc-iron alloy-coated galvannealed steel conforming to ASTM A653.
         1) Coating designation: A60.
   2. Exterior doors shall meet the following requirements (Non fire-rated):
      a. Level: Level 3, extra-heavy-duty.
      b. Model: Model 3, stile and rail.
      c. Physical performance level: Level A, 1,000,000 cycles.
      d. Thickness: 0.053 inches (16 gauge).
      e. Material: Hot-dipped zinc-iron alloy-coated galvannealed steel conforming to ASTM A653.
         1) Coating designation: A60.
   3. Frames:
      a. Frame Construction: Full-profile welded construction.
         1) Weld miter joints between head and jamb faces completely along their length either internally or externally.
         2) Internally weld perimeter profile joints full length of soffit stops and rabbets with hairline seams on external meeting surfaces. Grind and finish face joints smooth
         3) Face joints at meeting mullions or between mullions and other frame members shall be completely externally welded on the faces only. All welds shall be ground and finished smooth
      b. Frame Materials
         1) Exterior Frames:
            a) Material: Hot-dipped zinc-iron alloy-coated galvannealed steel conforming to ASTM A653, coating designation A60.
            b) Minimum material thickness prior to coating: 0.067 inches (14 gauge).
   4. Exposed Finish: Prime for field painting where indicated to receive a painted finish.

2.4 GLAZED LITE MATERIALS

A. Comply with Section 08 80 00 "Glazing" for tempered glazing materials installed in non fire-rated flush wood doors.

B. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.

C. Construction: Full profile welded.

D. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

E. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

F. Glazing Beads: Provide frame glazing beads in interior and exterior glazed openings where fixed glass is indicated in pressed steel frames. Prepare frames for the type of glazing beads required to receive the glass and gaskets indicated. Miter or butt join beads at corners. Glazing beads to be screw-on type. Install glazing beads on the secured side of the space, unless otherwise noted.
   1. At exterior frames, install glazing beads with tamper-proof fasteners on exterior side of rabbet.

G. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:

H. Glazing Tape: Closed-cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapor seal.

2.5 FRAME ANCHORS

A. Jamb Anchors: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated
   1. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
   2. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Frame Anchors: Provide anchors appropriate to floor, wall and frame construction. Provide fasteners, anchor bolts, and expansion shell anchors as required
   1. Dry Wall Type: Frame product for installation in dry-wall partitions shall be provided with steel stud jamb anchors of suitable design, not less than 0.042 in. thickness, securely welded inside each jamb. Jamb anchors shall be placed a maximum of 18 in. from top and bottom of openings. The minimum number spaced at maximum 32 in. on center, near hinges and directly opposite on strike jambs, provided on each jamb, based on the overall frame height, shall be as follows:
      a. Up to 60 inches: Three (3) Anchors
      b. Greater than 60 in. up to 90 in.: Four (4) anchors
      c. Greater than 90 in. up to 96 in.: Five (5) anchors
      d. Greater than 96 in.: Five (5) anchors plus one for each 24 in. or fraction thereof, spaced at 24 in. maximum between anchors

C. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
   1. Floor anchors shall be provided with two holes for fasteners and shall be secured inside jambs with at least four (4) spot welds per anchor.
   2. Where specified or scheduled, adjustable floor anchors, providing not less than 2 in. (50.8 mm) height adjustment, shall be fastened in place with at least four (4) spot welds per anchor.
   3. For applications that do not permit the use of a floor anchor, an additional jamb anchor shall be substituted at a location not to exceed 8 in. (204 mm) from the base of the jamb.
   4. Floor anchor shall be of same material and thickness as frame

D. In cases where electrically or electronically operated hardware is required and indicated on the approved hardware schedule, conduit, hardware enclosures and/or junction boxes shall be provided. Access plates, where required, shall be the same material and thickness as the frame

product and shall be fastened with not less than four (4) #8-32 machine screws or #6 sheet metal screws at a spacing not to exceed 12 inc. on center

E. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.7 FABRICATION

A. Tolerances: Comply with SDI 117 “Manufacturing Tolerances Standard Steel Doors and Frames.”

B. Door Astragals: Provide overlapping astragal 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 or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Doors: Fabricate steel doors to be rigid, neat in appearance and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer’s plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI A250.8 requirements.
   1. For exterior doors: Fabricate doors and panels from galvannealed steel sheet according to SDI 112, galvannealed to ASTM A924 and A653, A60. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.053 inch galvannealed steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration. Include galvannealed components and internal reinforcements.
   2. Internal Construction: Vertical steel stiffeners with foamed in place polyurethane insulation chemically bonded to all interior surfaces.
      a. Provide continuous vertically formed steel section stiffeners which, upon assembly, shall span the full thickness of the interior space between door faces. These stiffeners shall be 0.026 in. minimum thickness, spaced so that the vertical interior webs shall be no more than 6 in. apart and securely fastened to both face sheets by spot welds spaced a maximum of 5 in. o.c. vertically. Spaces between stiffeners shall be filled with foamed in place polyurethane insulation chemically bonded to all interior surfaces

D. Design clearances: Fabricate doors and frames to maintain the following clearances:
   1. The clearance between the door and frame shall be 1/8 inch (3.2 mm) in the case of both single swing and pairs of doors.
   2. The clearance between the meeting edges of pairs of doors shall be 3/16 inch (4.8 mm) plus or minus 1/16 inch (1.6 mm). For fire rated applications, the clearances between the meeting edges of pairs of doors shall be 1/8 inch (3.2 mm) plus or minus 1/16 inch (1.6 mm).
   3. The clearance measured from the bottom of the door to the bottom of the frame (undercut) shall be a maximum of 3/4 inch (19.1 mm) unless otherwise specified. Fire door undercuts shall comply with ANSI/NFPA 80, “Fire Doors and Fire Windows.”
   4. The clearance between the face of the door and the stop shall be 1/16 inch (1.6 mm) to 3/32 inch (2.4 mm).
   5. All clearances shall be, unless otherwise specified in this document, subject to a tolerance of plus or minus 1/32 inch (0.8 mm).

E. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Sidelite 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 welding.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
   4. Plaster Guards: Provide minimum 0.0179 inch thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
   5. Reinforce frames over 48 inches with rolled formed steel channels fitted tightly into frame head, flush with top.
   6. Welded frames shall be provided with two temporary steel spreader bars, welded to the jambs at each rabbet of door openings, for shipping and handling purposes only. These temporary spreader bars shall be removed and setting spreaders, supplied by the installer shall be used for installation of the frame. Refer to ANSI A250.11 – Recommended Erection Instructions for Steel Frames.
   7. Fabricate jambs, heads, mullions, sills and center rails straight and uniform throughout their lengths; square and free of defects, warps or buckles.
   8. Increase depth of backbend return to wall where cove base is scheduled to be installed, in order to allow full profile of cove base to terminate into frame.
   9. Tolerances:
      a. Face widths, door stop heights and jamb depths: 0.031 inch
      b. Throat Openings: 0.063 inch
      c. Door Rabbets: 0.016 inch

F. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing standard steel doors and frames for hardware.
   3. In cases where electrically or electronically operated hardware is required and indicated on the approved hardware schedule, conduit, hardware enclosures and/or junction boxes shall be provided. Access plates, where required, shall be the same material and thickness as the

frame product and shall be fastened with not less than four (4) #8-32 machine screws or #6 sheet metal screws at a spacing not to exceed 12 inc. on center.

G. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
   1. Provide stops and moldings flush with face of door, and with square stops with radiused front edge, unless otherwise indicated.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of standard steel doors and frames.
   4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Frames shall be thoroughly cleaned, and chemically treated to insure maximum paint adhesion. All surfaces of the frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI A250.10 “Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.”.
   2. Apply primers to frames after fabrication. Coordinate primer with field-applied finish coatings as specified in Section 09 91 13 “Exterior Painting,” and Section 09 91 23 “Interior Painting.”

PART 3 EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

C. Fully Templated Mortise Hardware: Factory blank, reinforce, drill and tap frames in accordance with approved shop drawings and templates provided by hardware supplier.
   1. Factory prepare templated holes 0.5 inch diameter and larger, except mounting and through bolt holes.
   2. Factory prepare templated holes less than 0.5 inch diameter when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes overlap function holes.

3.2 INSTALLATION

A. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. At interior door hosted in acoustically rated interior partitions, solidly pack mineral-fiber insulation inside frames.
5. Installation Tolerances: Adjust standard steel frames to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust standard steel doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

D. Where hollow metal framing horizontal frame for borrowed light is intended to be installed at floor level, provide continuous joint sealant on both sides of frame, between metal frame and floor finish, to eliminate gaps resulting from irregularities in floor finish tolerances and to prevent water penetration under the frame.

E. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with standard steel manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION

SECTION 08 14 12 - PLASTIC-LAMINATE-FACED FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid core flush wood doors with plastic-laminate faces (PL-4).
   2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 RELATED WORK

A. Section 08 11 13 "Standard Steel Doors and Frames"

B. Section 08 71 00 "Door Hardware"

C. Section 08 80 00 "Glazing" for non-rated glazing types installed as lites in non fire-rated doors.

D. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.11 Plastic Laminate and Solid Surface February 2024 Update.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Door core materials and construction.
   2. Door edge construction
   3. Door face type and characteristics.
   4. Door trim for openings.
   5. Factory-machining criteria.
   6. Factory-priming specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
   1. Door schedule indicating door location, type, size, fire protection rating, and swing.
   2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
   3. Details of frame for each frame type, including dimensions and profile.
   4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   5. Dimensions and locations of blocking for hardware attachment.
   6. Dimensions and locations of mortises and holes for hardware.
   7. Clearances and undercuts.

C. Samples for Verification:
   1. Plastic laminate, 6 inches (150 mm) square, for each color, texture, and pattern selected.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. Submit copy of Door Inspector's Certified Fire and Egress Door Assembly Inspector (CFDAI) DHI certification.

2. Submit documention of compliance with NFPA 101, Section 7.2.1.15.4 after inspection.

B. Field quality-control reports including humidity and temperature readings at storage site.

1.6 CLOSEOUT SUBMITTALS

A. Finish warranties.

1.7 QUALITY ASSURANCE

A. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022)

B. Identifying Label: Each door shall bear identifying label indicating:
1. Door manufacturer.
2. Order number.
3. Door number.
4. Fire rating, if applicable.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with referenced quality standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.
2. Monitor site for temperature and humidity to verify environmental conditions meet door manufactuer's standards.

1.10 WARRANTY

A. 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. Delamination of veneer.
   b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty also includes 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. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In accordance with WDMA I.S. 1A Custom Grade aesthetic, Extra Heavy Duty performance.
   1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.3 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. Interior Doors, Solid Core: SCLC-HPDL-5, Environmental Structural Composite Lumber Core Door with decorative laminate each side (5-ply), 1-3/4 inches thick
   1. Basis of Design: Subject to compliance with requirements, provide Aspiro Series as manufactured by Forte Opening Solutions (Previously Msonite Architectural), Rep: Amanda Patterson (541) 647-3285 or apatterson@forteopenings.com, or one of the following:
      a. VT Industries
   2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
      a. Colors, Patterns, and Finishes: As indicated on List of Finishes on Drawings.
   3. Exposed Vertical, Top, and Bottom: Plastic laminate that matches faces, applied before faces.
      a. Option for Vertical Edges: Matching 1/8 inch (3.2mm) high impact edge bonded to structural composite lumber.
      b. Option for Top Edges: Clean edge-bond smooth PVC edge band to structural composite lumber (can be both top and bottom)
      c. At Door Pairs with concealed vertical rod egress hardware and/or wall mounted magnetic hold opens with door mounted magnet component: Provide formed steel edges with plastic-laminate faces matching plastic laminate selection for door faces.
   4. Core for Non-Fire-Rated Doors: Structural Composite Lumber
   5. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
      a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
   6. Construction: Five plies, cold-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces and crossbands are applied.

2.4 LITE FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Square wood bead with radiused front edge. Front sits flush with face of door.
      a. Basis of Design: VT Industries; VT1

2.5 GLAZED LITE MATERIALS

A. Comply with Section 08 80 00 "Glazing" for tempered glazing materials installed in non fire-rated flush wood doors.

B. Glazing Tape: Closed-cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapor seal.

C. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression

(total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:

1. Dowsil 795 - Dow Corning Corp.
2. Silglaze-II SCS2800 - General Electric Co.
3. Spectrem 2 - Tremco Inc.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:
   1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
   2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
   3. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails.
   4. 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 08 80 00 "Glazing."

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors that are indicated on Drawings to receive transparent finish.

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 prior to installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge

D. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

F. Provide finished trim edges on notched top edge of panel where required to received concealed vertical rod exit device.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 101.

3.4 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

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SECTION 08 14 73.20 - SLIDING DOOR ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior Aluminum-Framed, Top-Hung Sliding Wood Door Assemblies and Related Hardware. Provide smoke rated systems where indicated on Drawings.
   2. Provide manufacturer's standard inset acid etched glazing panels.

1.2 RELATED WORK

A. Section 06 10 00 "Rough Carpentry"

B. Section 08 14 12 "Plastic-Laminate-Faced Flush Wood Doors"

C. Section 08 71 00 "Door Hardware"

D. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

1.3 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Refer to Division 01 Section "Project Requirements".

1.4 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, door hardware and accessories, and finishes.

B. Shop Drawings: Show details of fabrication and installation, including the following:
   1. Assembly elevations and sections indicating dimensions, tolerances, materials, components, hardware, finishes, options, and accessories.
   2. Door hardware locations, mounting heights, quantities, and installation requirements.
   3. Frame anchorages and wall reinforcement requirements.

C. Samples for Verification: For each type of exposed finish indicated, provide samples below as requested by Architect.
   1. Frame finish sample.
   2. Door veneer sample.

D. Maintenance Data: For top-hung, sliding door assemblies include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Notify manufacturer immediately of any shipping damage.

C. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer’s instructions.
   2. Keep materials in manufacturer’s original, unopened containers and packaging until installation.
   3. Store materials in clean, dry area indoors.

4. Protect materials and finish during storage, handling, and installation to prevent damage.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's written warranty agreeing to repair or replace components of the top-hung, sliding door assemblies that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures.
   2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   3. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   4. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
   5. Failure of operating components to function normally.

C. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

D. General Warranty Period: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Aluminum Frames: Aluminum cased opening perimeter frames manufactured with integral C-channel door cavity and acoustic seals.

B. Closing Mechanism: Soft self-closing mechanism integrated with top track.

C. Door Guide: Concealed type door guide.

D. Accessibility Standards: Comply with applicable provisions in Accessibility Guidelines for Buildings and Facilities ICC (ANSI) A117.1 and requirements of authorities having jurisdiction.

2.2 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, prove ExamSlide sliding door assembly with wood framed door panels with full frosted glazed panel, as manufactured by AD Systems.

2.3 INTERIOR TOP-HUNG, SLIDING DOOR ASSEMBLIES

A. Basis-of-Design Manufacturer:
   1. AD Systems – Exam Slide.

B. Frame and Door Assembly Components:
   1. Single Piece Box Top Track: Extruded aluminum track system with mounting brackets.
   2. Fascia: Extruded aluminum with matching integral end caps.
   3. Integral Soft-Closer: Soft and self-closing damper mechanism.
   4. Concealed Door Bottom Floor Guide.
   5. Seal Sets: Integral to frame.
   6. Operating Hardware.

C. Specified Wall Thickness:
   1. As indicated on Architectural Drawings.

D. Frame Profiles: Extruded aluminum cased frame and trim with integral vertical jamb receiver channel.
   1. 1-1/2" Faces.

E. Fascia Profile:
   1. Standard: Square.

F. Frame Finish:
   1. Standard: Clear Anodized.

G. Framing Anchors and Fastenings: Manufacturer's standard concealed anchors and fastenings.

H. Flush Wood Door Construction:
   1. Comply with Section 08 14 12 “Plastic Laminate-Faced Flush Wood Doors."
   2. Door Style includes full vision panel with acid etched glass inset**.**

I. Glazing at Fixed Panel: Tempered, acid etched glazing panel by manufacturer.

J. Door Preparation. Doors leafs to be factory machined for hardware including pilot and function holes.

K. Door Hardware Components:
   1. General: Heavy-duty, operating door hardware units in sizes, quantities, and types recommended by manufacturer for sliding door assemblies indicated.
   2. Cylinders and Keying: Refer to Division 08 Section "Door Hardware".
   3. Include office function locking and soft opening/closing hardware.

2.4 FABRICATION

A. General: Fabricate top-hung, sliding door assemblies in sizes, profiles, and configurations indicated on Architectural Schedules and Drawings.

B. Factory prepare door assemblies for field installation of door hardware and accessories to greatest extent possible.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions of wall openings.

B. Examine wall openings and conditions, with Installer present, for plumb, level and square, and compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Sliding door operation will be adversely affected by out-of-tolerance framing.

C. Examine surfaces to receive door bottom guide. Floor shall have no height variance throughout the complete sliding operation.

D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DOOR, FRAME AND HARDWARE ASSEMBLY INSTALLATION

A. General: Comply with manufacturer's written installation instructions and approved shop drawings.

B. Install frame components and sliding doors plumb, level, square, and in proper alignment.

C. Anchor sliding door assemblies securely in place to supports according to manufacturer's written installation instructions.

3.3 ADJUSTING AND CLEANING

A. Adjust sliding doors and hardware for smooth operation in accordance with manufacturer's written instructions without binding and with tight fit at contact points and seals. Sliding doors to close against walls without gaps.

B. Repair minor damages to finish in accordance with manufacturer’s written instructions and as approved by Architect.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure sliding door assemblies are without damage or deterioration at the time of Substantial Completion.

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.

3.6 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. Refer to Section 08 71 00, “Door Hardware,” for hardware sets.

END OF SECTION

SECTION 08 31 00 - ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:
   1. Basis of Design: Subject to compliance with requirements, provide Access Door and Frame Style “DW,” as manufactured by Milcor Inc., or comparable products by one of the following
      a. Karp Associates, Inc; KDW
      b. Babcock-Davis; Architectural Access Door
      c. JL Industries; Flush Access Door
      d. Larsen’s Manufacturing Company
   2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
   3. Locations: Wall.
   4. Door Size: As indicated.
   5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gauge, factory primed.
   6. Frame Material: Same material and thickness as door.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Frame Anchors: Same material as door face.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

3.4 ACCESS DOOR SCHEDULE

A. Access Doors and Frames in Walls:
   1. In rated and unrated walls, 14 inches by 14 inches: Plumbing valves, reset buttons, control manometers, etc
   2. In rated and unrated walls, 24 inches by 24 inches: Plumbing fittings at toilets, mechanical filter banks, access hatches, areas requiring work access for the unit replacement, etc

B. Access Doors and Frames in Ceilings:
   1. In gypsum board ceilings, 14 inches by 14 inches: Above ceiling cut-off valves, duct dampers, fire and/or smoke dampers, meters, registers, etc
   2. In gypsum board ceilings, 24 inches by 36 inches: HVAC filter units, remote duct dampers, remote fire dampers, remote electrical J-boxes, access hatches, etc

END OF SECTION

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior, overhead coiling doors, motorized operation.
   2. Interior, non-rated overhead coiling doors, motorized key switch activated push button operation.
   3. Guides, operators, motors, controls, enclosures, hardware and weatherstipping.

1.2 RELATED WORK

A. Section 05 50 00 "Metal Fabrications" for steel tube side supports, unless indicated in Structural Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   3. Include description of automatic-closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include sizing, attachment and location of steel tubes at vertical steel supports for overhead doors.
   3. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   4. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   5. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
   1. Curtain slats.
   2. Bottom bar.
   3. Guides.
   4. Brackets.
   5. Hood.
   6. Locking device(s).
   7. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
   1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
   1. Design Wind Load: As indicated on Drawings.
   2. Testing: According to ASTM E330/E330M.
   3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

B. Accessibility Standard: Comply with applicable provisions in Texas Accessibility Standards (TAS).

2.3 OVERHEAD COILING DOOR ASSEMBLY

A. Overhead coiling door formed with curtain of interlocking flat metal slats.
   1. Basis of Design: Subject to compliance with requirements, provide DuraCoil Select as manufactured by Raynor.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Door Curtain Material: Galvanized steel, 24 gauge, Grade 40 ASTM A 653 Galvanized steel zinc coating.

D. Door Curtain Finish: Manufacturer's standard powder coat.

E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.

F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick with single-contact type bottom astragal. Fabricated from aluminum extrusions and finished to match door.

G. Curtain Jamb Guides: Steel guides, powdercoat to match.

H. Curtain Hood: Match curtain material and finish.
   1. Shape:
      a. Interior: Round.
      b. Exterior: Square.
   2. Mounting: Face of wall.

I. Locking Devices: Equip door with locking device assembly.
   1. Locking Device Assembly: Cremone-type, both jamb sides locking bars, operable from outside with interchangeable core type cylinders to be keyed to building keying system.

J. Electric Door Operator:
   1. Usage Classification: Standard duty.
   2. Operator Location: As indicated on Drawings.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. (2.44 m) or lower.
   4. Motor Electrical Characteristics:
      a. Horsepower: 1/2 hp.
      b. Voltage: 115 V ac, three phase, 60 Hz.
   5. Emergency Manual Operation: Chain type.
   6. Obstruction-Detection Device: Electric safety edge.
   7. Control Station(s): Interior exposure mount, locations indicated on Drawings.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized-steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.

2.6 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   1. Lock Cylinders: As specified in Section 08 71 00 "Door Hardware".
   2. Keys: Three for each cylinder.

2.7 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
   1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic-closing device operates

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Basis of Design (Non-Fire Rated): Subject to compliance with requirements, provide ControlHoist Operator, as manufactured by Raynor Garage Doors.
   2. Comply with NFPA 70.
   3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.
   1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

D. Motors: Reversible-type motor for motor exposure indicated for each door assembly. TENV motor, reversing magnetic controller in NEMA 1 enclosure, planetary gearbox for drive reduction, electric brake and an auxiliary chain operator. Includes UL listed thermal overload protection, rotary limit switches, safety edge circuit and transformer with 24volt control secondary, and delay

on reverse. Pre-wired to a terminal block using color coding of the wires to facilitate troubleshooting.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
    a. Push Button Operation, Key Switch Activated if located in public space.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's heavy duty baked-on finish consisting of prime coat, thermosetting topcoat, and clear powder coated wear coat. Comply with coating

manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

1. Color: Match Existing RAL7030.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

END OF SECTION

SECTION 08 42 29 - AUTOMATIC ENTRANCES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sliding automatic entrances - matching automatic entrances installed at existing building.

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

1.3 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding and folding tracks that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.

C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.

D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access-control system.

E. System Integration: Integrate sliding and folding automatic entrances with other systems as required for a complete working installation.
   1. Provide electrical interface control capability for activation of sliding and folding automatic entrances by security access system on doors with electric locking.
   2. Provide electrical interface to deactivate door operators on activation of fire alarm system.
   3. Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For sliding and folding automatic entrances.
   1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
   2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Indicate locations of activation and safety devices.
   5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color and metal-clad finishes.
   1. Include Samples of hardware and accessories involving color or finish selection.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Delegated Design Submittal: For automatic entrances.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Certified Inspector.

B. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.

C. Product Test Reports: For each type of automatic entrance, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer with Company Certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a Certified Inspector.
   1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

C. Certified Inspector Qualifications: Certified by AAADM.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Faulty operation of operators, controls, and hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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. Power-Operated Door Standard: BHMA A156.10.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design automatic entrances.

D. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7.
1. Wind loads indicated on Structural Drawings.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

F. Operating Temperature Range: Automatic entrances shall operate within minus 20 to plus 122 deg F.

G. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of fixed entrance-system area when tested in accordance with ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft..

H. Opening Force:
1. Power-Operated Doors: Not more than 50 lbf required to manually set door in motion if power fails, and not more than 15 lbf required to open door to minimum required width.
2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf required for a breakaway door or panel to open.

I. Entrapment-Prevention Force:
1. Power-Operated Sliding and folding Doors: Not more than 30 lbf required to prevent stopped door from closing.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extrusions: ASTM B221.
2. Sheet: ASTM B209.

B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.

C. Glazing: Non-fire-rated glazing, comply with Section 08 80 00 "Glazing." Fire-rated glazing, comply with Section 08 88 13 "Fire-Protection-Rated Glazing."

D. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C1107/C1107M; of consistency suitable for application.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.3 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances, including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.

B. Sliding Automatic Entrance:
   1. Basis of Design: Subject to compliance with requirements, provide Horton Automatics Profiler Series 2000B Type 110 Elite Belt Drive.
   2. Configuration: Two bi-parting sliding leaves and two full sidelights.
      a. Traffic Pattern: Two way.
      b. Emergency Breakaway Capability: Sliding leaves only.
      c. Mounting: Between jambs.

C. Framing Members: Manufacturer’s standard extruded aluminum reinforced as required to support imposed loads.

D. Stile and Rail Doors and Sidelights: Manufacturer’s standard 1-3/4 inch thick glazed doors with extruded aluminum tubular stile and rail members. Incorporate concealed tie rods that span full length of top and bottom rails.
   1. Glazing Stops and Gaskets: Snap-on, extruded security aluminum stops and preformed gaskets.
   2. Stile Design: Medium stile.
   3. Bottom Rail Design: Minimum 10 inch nominal height.

E. Glazing: Comply with Section 08 80 00 “Glazing” for IGU1 at exterior entrances, and GL1 at interior entrances not required to be thermally broken. All glazing is required to be tempered and compliant with safety glazing labeling.

F. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

G. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch; consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf. Minimum load wheel diameter shall be 2 1/2 inch; minimum anti-rise roller diameter shall be 2 inch.

H. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless steel, ball-bearing-center roller wheels.

I. Operator Features:
   1. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.

2. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.
   a. Operation: Power opening and power closing.
   b. Features:
      1) Adjustable opening and closing speeds.
      2) Adjustable open check and close check speeds.
      3) Adjustable hold-open time between 0 and 30 seconds.
      4) Obstruction recycle.
      5) On/Off switch to control electric power to operator.
      6) Energy conservation switch that reduces door-opening width.
      7) Closed loop speed control with active braking and acceleration.
      8) Adjustable obstruction recycle time delay.
      9) Self-adjusting stop position.
      10) Self-adjusting closing compression force.
      11) Onboard sensor power supply.
      12) Onboard sensor monitoring.
      13) Optional Switch to open/Switch to close operation.
      14) Fire alarm interface, configurable to safely open or close the entrance on signal from fire alarm system.
   c. Mounting: Concealed.
   d. Drive System: Synchronous belt type.
   e. Electrical service to door operators shall be provided under Division 26 Electrical. Minimum service to be 120 VAC, 5 amps.

J. Electrical Control System:
   1. Electrical control system shall include a microprocessor controller and a high-resolution position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed.
      a. The high-resolution encoder shall have a resolution of not less than 1024 counts per revolution. Systems utilizing external magnets and magnetic switches are not acceptable.
      b. Electrical control system shall include a 24 VDC auxiliary output rated at 1 amp.
   2. Performance Data: The microprocessor shall collect, and store performance data as follows:
      a. Counter: A non-resettable counter to track operating cycles.
      b. Event Reporting: Unit shall include non-volatile event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
      c. LED Display: Display presenting the current operating state of the controller.
   3. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
      a. Automatic Reset Upon Power Up.
      b. Main Fuse Protection.
      c. Electronic Surge Protection.
      d. Internal Power Supply Protection.
      e. Resetable sensor supply fuse protection.
      f. Motor Protection, over-current protection.
   4. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.
   5. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is

encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.

6. Programmable Controller: Microprocessor controller shall be field programmable.
   a. The following parameters may be adjusted:
      1) Operating speeds and forces as required to meet specified ANSI/BHMA standard.
      2) Adjustable and variable features specified.
      3) Reduced opening position.
   b. Manual programming shall be available through local interface which has a two-digit display with a selection control including three push buttons
7. Activation and Safety Devices
   a. Combined Activation and Safety Sensors: Combined activation and safety sensors shall, in a single housing, detect motion and presence in accordance with ANSI/BHMA A156.10. Motion shall be detected using K-band microwave technology, presence by active infrared reflection technology.
      1) Mounting Height: Up to 11.5 feet above finish floor
      2) Temperature Range: Between -31°F and 131°F (-35°C to 55°C) in all environmental conditions
      3) Relays: Form C, 50V at 0.3A for both activation and safety. Hold time of less than 0.5 seconds.
      4) Detection Pattern: When detection is made in the activation zone, and the entrance opens, the safety zone shall extend through the threshold on each side; creating an X-pattern. When activation and safety zones are cleared and the entrance closes the sensor will ignore the X-pattern safety zones.
      5) Combined motion and presence sensors shall be equal to or better than X-Zone Sensor by Optex.

K. Hardware:
   1. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.
   2. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.
      a. Include one adjustable detent device mounted at the top of each breakaway panel to control breakaway force.
         1) Panel Closer: Factory-installed concealed hydraulic door closer.
         2) Limit Arms: Limit swing to 90 degrees, spring loaded with adjustable friction damping.
   3. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch-long throw bolt; BHMA A156.5, Grade 1.
      a. Cylinders: As specified in Section 08 71 00 "Door Hardware."
         1) Keying: Integrate into building master key system.
         2) Keys: Three for each cylinder.
      b. Deadbolts: Steel, mortise type, BHMA A156.5, Grade 1.
   4. Uninterrupted Power Supply: UL 1778, fully integrated unit mounted within header.
      a. Power Interruption: Supply power to operator, controls, activation device, and safety systems of sliding and telescoping automatic door for up to 1.5 hours of normal operation.
      b. Include low-battery shutdown feature to safely open or close door prior to complete battery discharge.
      c. Include audible battery replacement alarm to indicate that battery will no longer accept a charge and replacement is required.
   5. Weather Stripping: Replaceable components.

a. Sliding and telescoping Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.4 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
   1. Form aluminum shapes before finishing.
   2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
   3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
      a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
      b. Reinforce members as required to receive fastener threads.
   4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
   1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
   2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
   3. Form profiles that are sharp, straight, and free of defects or deformations.
   4. Provide components with concealed fasteners and anchor and connection devices.
   5. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
   6. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
   7. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, in accordance with GANA's "Glazing Manual."

F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
   1. Provide sliding and telescoping-type weather stripping, mortised into door, at perimeter of doors.

G. Controls:
   1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
   2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:
      a. Top Beam: 48 inches.
      b. Bottom Beam: 24 inches.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Clear Anodized Aluminum Surfaces: AAMA 611, AA-M10C21A41/AA-M45C22A41 Architectural Class I, clear anodized 0.7 mils anodized coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA A156.10 for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
   1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
   2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
   3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
   1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
   2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
   3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
   4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system.

D. Access-Control Devices: Connect access-control devices to access-control system, as specified in Section 28 13 00 "Access Control Software and Database Management."

E. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

F. Guide Rails: Install rails in accordance with BHMA A156.10, including Appendix A, and manufacturer's written instructions unless otherwise indicated.

G. Glazing: Install glazing as specified in Section 08 80 00 "Glazing" and Section 08 88 13 “Fire-Protection-Rated Glazing.”

H. Sealants: Comply with requirements specified in Section 07 92 00 "Joint Sealants" to provide weathertight installation.

I. Signage: Apply signage on both sides of each door, as required by cited BHMA standard for direction of pedestrian travel.

J. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic entrances will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
   1. Adjust exterior doors for tight closure.

B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

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 Project during other-than-normal occupancy hours for this purpose.

3.5 CLEANING

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
   1. Comply with requirements in Section 08 80 00 "Glazing" for cleaning and maintaining glass.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components,

lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Impact Resistant Tested, glazed aluminum curtain wall systems, captured on four sides, field-glazed with gasket on outside faced and structural sealant on inside face.
   2. Field Testing of Glazed Aluminum Curtain Walls:
      a. Field testing mock-up in accordance with AAMA 503 Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing.
      b. Field testing aluminum storefront windows as selected by Architect, installed in the building façade, in accordance with AAMA 503 Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
      c. The Contractor is responsible for hiring and paying for the testing services as specified in this Section by an AAMA accredited independent laboratory or testing agency or a laboratory or testing agency in full compliance with ISO/IEC 17025 including repairing, retesting and if required forensic testing any specimens that do not comply with the prescribed air leakage and water penetration resistance requirements of this Section.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefronts.
      a. Test Reports must be dated within 5 years of Construction Commencement.
      b. Test Reports must list all components of system approved in Shop Drawing Submittal.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Installer.
   2. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.
   3. Independent Field-Testing Laboratory: Provide the name and contact information of the AAMA LAP-3 Accredited Independent Laboratory or testing agency responsible for performing the initial field testing, retesting and if necessary forensic testing of the storefront system.

B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. An NFRC Component Modeling Approach (CMA) generated label certificates shall be provided by the manufacturer. The label certificate shall be project specific and will contain the thermal performance ratings of the manufacturer’s framing combined with the specified glass, and the glass spacer used in the fenestration of the glass, at NFRC standard test as defined in Table 4-3 in NFRC 100.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors. Installer has completed five project of similar size and scope within five years of construction commencement.
   2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
   3. Independent Testing Agency: Independent Field Testing Agency: The field testing agency shall be AAMA accredited in accordance with LAP-3.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup as part of Integrated Exterior Mockup as specified in Division 01 Section “Mockups”
   2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.

e. Failure of operating units.

C. Structural Loads:
1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 2 for basic protection.
1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.

G. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. There shall be no leakage at a minimum static pressure differential of 12psf.

H. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. There shall be no leakage at an air pressure differential of 12psf..
2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.50 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
2. Solar Heat Gain Coefficient (SHGC):
a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.25 as determined in accordance with NFRC 200.
3. Air Leakage:
a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.

2.2 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

A. Basis of Design: Subject to compliance with requirements, provide 1600 1 Impact Resistant (IR) Wall System, as manufactured by Kawneer Co., Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
2. Glazing System:
a. Retained mechanically with gaskets on four sides.
3. Frame Depth: As required to meet performance criteria, and to fit glazing depth specified in Section 08 80 00 "Glazing" for IGU1, IGU2.
4. Glazing Plane: Front.
5. Finish: Clear Anodized.
6. System: Stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

2.4 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:
1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.5 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Provisions for safety railings mounted between mullions at interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
8. Components curved to indicated radii.

C. Fabricate components to resist water penetration as follows:
1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

D. Curtain-Wall Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.

E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

A. 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 areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.4 ERECTION TOLERANCES

A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL MOCKUP TESTING

A. Comply with requirements in Section 01 43 39 “Mockups”

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
      a. Perform a minimum of three tests in areas as directed by Architect.
      b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
   2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
      a. Perform a minimum of three tests in areas as directed by Architect.
      b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
   3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

DOOR HARDWARE
FACILITY SPECIFICATION GUIDELINE

Specification Sections 087100

The purpose of this document is to support the equivalence of door hardware specifications for the Harris Health Systems. Products detailed herein are the standard of quality to be used on new projects and renovations. Exceptions would include owners request for continuations of existing systems: i.e. – Match existing site door hardware. It is the intent of this document to provide guidelines for the architect's specification section 08710, for product groups and the hardware schedule. These items are to be coordinated to meet the requirements of life safety codes, ADA requirements, and applicable building codes.

All door hardware shall be provided in compliance with this specification guideline, and such shall be noted in sections 08710 and 08410.

Please include the following as a preamble in the Door Hardware specification section 087100

"Prior to installation of hardware, the general contractor shall contact the manufacturers' representatives to arrange and hold a jobsite meeting to instruct and certify the installing contractors' personnel on the proper installation of their respective products. Seminar shall be attended by installers of hardware (including electrical hardware) for aluminum, hollow metal, and wood doors. Training will include the use of installation manuals, hardware schedule, templates and physical product samples. Finish hardware shall be installed in accordance with the reviewed hardware schedule and manufacturer's printed
instructions."

"Upon substantial completion the manufacturer's representative(s) shall inspect and approve the installation of the products they represent. A comprehensive check list shall be provided to the owner, verifying proper function of change, master and grandmaster keys, cylinders, mechanical and electro-mechanical hardware, doors and frames. Any identified installation or product issues shall be directed to the attention of the Architect for the purpose of generating the final punch list."

SECTION 87100 - DOOR HARDWARE

PART 1 - GENERAL

A. SUMMARY

1.02

A. A. Work under this section comprises of furnishing and installing door hardware needed for a complete and operational system, including interface with electrified hardware components and access controls systems supplied by Owner.

B. Section Includes:
1. Hinges - pivots
2. Locksets, latchsets, and cylinders
3. Exit devices
4. Closers
5. Flush bolts
6. Push plates - pulls
7. Kick, mop and protection plates
8. Stops, wall bumpers, overhead holders
9. Electrified hold open devices
10. Thresholds, gaskets, weather seals, and door bottoms
11. Miscellaneous trim and accessories
12. Electro-mechanical hardware devices, access controls, power supplies, and electrical peripherals necessary to meet requirements of security, fire and egress codes

C. Related Sections:
1. Section 08110 Steel Doors and Frames
2. Section 08210 Wood Doors
3. Section 08450 Aluminum -Framed Storefronts
4. Section 08450 All-Glass Entrances
5. Requirements of this section also apply to electrical installations. Refer to work specified in Divisions 16 for other requirements and limitations applicable to electrified hardware items, including, but not limited to:
   a. Conduit
   b. Junction boxes
   c. Wiring
   d. Final connections

1.02 REFERENCES

A. publications listed herein are part of this specification to extent referenced.

B. American National Standards Institute:
1. ANSI A156 Series
2. ANSI A115W Wood Door Hardware Standards; Hardware Preparation
3. ANSI A115 Specifications for Steel Door and Frame Preparation for Hardware
4. ANSI A117.1 Accessible and Usable Buildings and Facilities

C. C. Door and Hardware Institute:
1. DHI Publication - Abbreviations and Symbols
2. DHI Publication - Basic Architectural Hardware

3. DHI Publication - Hardware for Labeled Fire Doors (with supplements)
4. DHI Publication - Hardware Reinforcements on Steel Doors and Frames
5. DHI Publication - Installation Guide for Doors and Hardware
6. DHI Publication - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
7. DHI Publication - WDHS-1 Template Book Criteria for Wood Doors
8. DHI Publication - WDHS-3 Recommended Hardware Locations for Wood Flush Doors
9. DHI Publication - For Processing Hardware Schedules and Templates

D. D. National Fire Protection Association:
1. NFPA 80 Standard for Fire Doors and Windows
2. NFPA 101 Life Safety Code
3. NFPA 105 Recommended Practice for the Installation of Smoke-Control Door Assemblies
4. NFPA 252 Standard Methods of Fire Tests of Door Assemblies

E. Underwriters Laboratories, Inc.
1. UL Standard 10C Fire Tests of Door Assemblies
2. UL Standard 1784 Air Leakage Tests of Door Assemblies
3. UL Building Materials Directory

1.03 DEFINITIONS

A. Mortise Lock Functions:
1. PASSAGE FUNCTION; ANSI F01 - Latch bolt operated from either side at all times.
2. PRIVACY FUNCTION; ANSI F02 - Latch bolt operated by lever from either side. Deadbolt operated by turn from inside and by coin, screwdriver, **or** emergency key key from outside. Outside occupancy indicator preferred. Operating inside lever or closing door unlocks outside lever.
3. OFFICE FUNCTION; ANSI F04 - Latch bolt operated by lever from either side except when outside lever is made inoperative by stop or mechanical means other than a key. When outside lever is locked, latch bolt may be retracted by key from outside or by rotating inside lever. Auxiliary latch deadlocks latch bolt when door is closed.
4. CLASSROOM FUNCTION; ANSI F05 - latch bolt operated by lever from either side except when outside lever is locked from outside by key. When outside lever is locked, latch bolt may be retracted by key from outside or by rotating inside lever. Auxiliary latch deadlocks latch bolt when door is closed.
5. STOREROOM FUNCTION ANSI F07 - Latch bolt operated by key from outside or by rotating inside lever. Outside lever is always inoperative. Auxiliary latch deadlocks latch bolt when door is closed.
6. ENTRANCE FUNCTION; ANSI F20 - Latch bolt operated by lever from either side except when outside lever is made inoperative by a stop or mechanical means other than a key. Deadbolt operated by turn piece inside. Key outside or lever inside operates both bolts simultaneously. Throwing deadbolt automatically locks outside lever. Auxiliary latch deadlocks latch bolt when door is closed.

1.04 SUBMITTALS

A. A. Product Data:
1. Submit manufacturer’s literature describing products to be provided.

B. B. Shop Drawings:
1. Before ordering or delivery of hardware, submit 3 copies of hardware schedule.
   a. Supplier shall assume sole responsibility for provision, proper coordination and function of finish hardware needed for openings, whether or not listed in schedule below.
2. Hardware schedule shall be in a vertical form, organized into hardware sets indicating complete designations of every item needed for each door or opening. Indicate location of hardware set, cross-referenced to indications in Contract Documents, manufacturer's name and product number, finish, and other similar information describing hardware to be provided. Schedule shall include information as follows:
   a. Type, style, function, and size of each item of hardware
   b. Fastenings and other pertinent information
   c. Explanation of abbreviations, symbols, codes, etc. contained in schedule
   d. Mounting locations for hardware
   e. Door and frame materials
3. Provide, as part of Hardware Schedule, a door index listing openings by number with corresponding page and heading numbers.
4. Submit 3 copies of keying schedule prior to ordering hardware.
5. Electro-Mechanical Hardware:
   a. Provide complete point-to-point wiring diagrams for each opening needing electrified hardware, except openings where only magnetic hold-opens are specified. Provide a copy with each hardware schedule submitted.
   b. Electrical components to be listed by opening in hardware submittals.
   c. Provide elevation drawings of electronic hardware and systems identifying locations of system components with respect to their placement in door opening. Provide a copy with each hardware schedule submitted.
6. Shop drawings submittal shall be coordinated with shop drawings submission of related portions of Work, such as:
   a. Metal doors and frames
   b. Wood doors
   c. Entrances and storefronts
7. Hardware schedule shall be prepared under supervision of an Architectural Hardware Consultant (AHC) or Certified Door Consultant (CDC) and shall bear AHC or CDC Seal of Door and Hardware Institute.

C. Samples:
1. Submit samples of door hardware items if requested by Architect. Accepted samples may be incorporated into Work.
2. Samples submitted shall be of production type and shall represent minimum quality of work to be furnished by manufacturer. No work represented by samples shall be fabricated until samples are accepted. Downgrading of quality demonstrated by samples may be cause for rejection of work.

D. Quality Assurance Submittals:
1. Certifications:
   a. Submit information needed to indicate compliance with specifications.
   b. Submit a statement from manufacturer that electronic hardware and systems being supplied comply with operational descriptions exactly as specified.
2. Manufacturer's Instructions:

a. Furnish templates and schedules needed for fabrication of hollow metal doors and frames, wood doors and frames, and other items related to hardware.
b. Submission for templates and template list shall follow procedures established by DHI publication For Processing Hardware Schedules and Templates.

E. E. Close-out Submittals:
1. Wiring Diagrams:
a. Prepare complete point-to-point wiring diagrams for electronic components listed by opening in hardware submittals.
b. Include a copy of wiring diagrams in Operation and Maintenance Data Manual.
2. Elevation Drawings:
a. Prepare elevation drawings for mounting heights and locations of electronic components listed by opening in hardware submittals.
b. Include a copy of operational descriptions in Operation and Maintenance Data Manual.
3. Operational Descriptions:
a. Provide complete operational descriptions of electronic components listed by opening in hardware submittals.
b. Operational descriptions shall detail how each electronic component functions within opening incorporating conditions of ingress and egress.
c. Include a copy of operational descriptions in Operation and Maintenance Data Manual.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Hardware supplier shall be a qualified direct distributor of products to be furnished, specializing in distribution of contract hardware for a period of at least 5 years. Supplier shall maintain a warehouse facility within 75 miles of Project.
2. Supplier shall have on staff a full time employee who is a member in good standing of Door and Hardware Institute and an Architectural Hardware Consultant (AHC) or a person of equivalent experience. Employee shall be made available at reasonable times to consult with Architect, Contractor, and/or Owner regarding matters affecting finish hardware on this Project.
3. Installer shall be trained or qualified by manufacturer in installation techniques and procedures of door hardware and shall demonstrate a minimum of 3 years successful experience in such installation.
4. Regardless of types specified or shown on details, provide gaskets and seals that do not interfere with ratings and proper operation of fire-rated openings and emergency exits. Provide components that comply with requirements of such openings.
5. Single Source Responsibility:
a. To greatest extent possible, obtain each type of hardware (i.e. latchsets, locksets, hinges, closers, etc.) from a single manufacturer.
b. Provide secondary materials that are produced or are specifically recommended by manufacturer to ensure compatibility.

B. Regulatory Requirements:
1. Hardware and installation shall comply with American National Standards Institute (ANSI), National Fire Protection Association (NFPA), Underwriters Laboratories (UL), Builders Hardware Manufacturers Association (BHMA), and Door and

Hardware Institute (DHI) provisions or standards listed below. Provide products complying with these standards as specified elsewhere in this section.

2. Federal Accessibility Regulations:
   a. Americans with Disabilities Act - ADA
   b. Uniform Federal Accessibility Standards - UFAS
   c. ANSI A117.1 Standard for Accessible and Usable Building s and Facilities
3. 3. National Fire Protection Association:
   a. NFPA 80 Standard for Fire Doors and Windows
   b. NFPA 101 Life Safety Code
   c. NFPA 105 Recommended Practice for the Installation of Smoke-Control Door Assemblies
   d. NFPA 252 Standard Methods of Fire Tests of Door Assemblies
4. 4. Underwriters Laboratories Inc.:
   a. UL 10C
   b. UL 1784 Air Leakage Tests of Door Assemblies
5. ANSI/BHMA Standards
   a. A115-W Series
   b. A115 Series
   c. A156 Series:
      1) Butts and Hinges: ANSI A156.1/BHMA 101
      2) Locks & Lock Trim: ANSI A156.2/BHMA 601
      3) Exit Devices: ANSI A156.3/BHMA 701
      4) Door Controls - Closers: ANSI A156.4/BHMA 301
      5) Auxiliary Locks: ANSI A156.5/BHMA 501
      6) Architectural Door Trim: ANSI A156.6/BHMA 1001
      7) Template Hinge Dimensions: ANSI A156.7
      8) Door Controls - Overhead Holders: ANSI A156.8/BHMA 601
      9) Power Operated Pedestrian Doors: ANSI A156.10
      10) Interconnected Locks & Latches: ANSI 156.13/BHMA 621
      11) Mortise Locks & Latches: ANSI A156.13/BHMA 621
      12) Closer Holder Release Devices: ANSI A156.15/BHMA 321
      13) Auxiliary Hardware: ANSI A156.16/BHMA 1201
      14) Materials & Finishes: ANSI A156.18/BHMA 1301
      15) Power Assist and Low Energy Operators: ANSI A156.19
      16) Electro Magnetic Locks: ANSI A156.23
      17) Delayed Egress Locks: ANSI A156.24
6. Door and Hardware Institute:
   a. Abbreviations and Symbols
   b. Basic Architectural Hardware
   c. Hardware for Labeled Fire Doors (with supplements)
   d. Hardware Reinforcements on Steel Doors and Frames
   e. Publication - Installation Guide for Doors and Hardware
   f. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames

C. Certifications:
   1. Hardware used in labeled fire or smoke rated openings shall be listed for those types of openings and bear identifying label or mark indicating UL listing for fire and/or smoke as needed.
   2. Exit devices in non-labeled openings to be listed for panic.

D. Pre-Installation Meetings:
   1. Prior to installation of hardware, including electronic hardware, arrange conference between hardware supplier, hardware installers, and related trades to review materials, procedures and coordinating related work.
   2. Conference attendees shall include Contractor, Owner's representative, Owner's security system provider, Architect, door hardware installers, and representatives of hardware supplier and/or manufacturers.
   3. Topics to be discussed at meeting shall include:
      a. A review of Contract Documents and accepted hardware schedule shall be made and deviations or differences shall be resolved.
      b. Applicable local building code, National Fire Protection Association (NFPA), and Underwriters' Laboratories (UL) requirements shall be reviewed and conflicts in building code, NFPA, or UL requirements and Project conditions shall be resolved.
      c. Review items such as proper installation sequence, adjustments, attachment, and location of door hardware. If a conflict exists between what is considered proper hardware application and Contract Documents, these differences shall be defined.
   4. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
   5. Pre-installation conference shall serve to clarify Contract Documents, application requirements and what work should be completed before hardware installation can begin.
   6. Prepare and submit, to parties in attendance, a written report of pre-installation conference. Report shall be submitted within 3 days following conference.

E. Coordination:
   1. Before ordering materials, carefully examine scale, full size, and shop drawings of work requiring hardware, and verify that material selected will properly fit Work.
   2. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware. Coordinate installation of electric hinges, locks, and security devices with installation of electrical connections.
   3. Should door hardware indicated for use on Project not qualify for appropriate labeling, accessibility, function, or use because of design, or other reason, notify Architect. Hardware items scheduled for fire-rated openings shall comply with UL requirements for entire assembly.
   4. Coordinate with installation of electric strikes, maglocks, and security devices with Owner's security system provider.

1.06 1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Deliver materials in manufacturer's original unopened packaging with labels intact.
   2. Package hardware items separately and mark each to correspond with heading numbers on hardware schedule. Pack each item complete with necessary parts and fasteners.
   3. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.
   4. Supply necessary instructions, wiring diagrams, templates, drawings, and fasteners for proper installation. Include extra fasteners.

5. Control handling and installation of hardware items that are not immediately replaceable so that completion of Work will not be delayed by hardware loses.

B. Storage and Protection:
   1. Store hardware delivered to Project, but not yet installed, in a secure locked area.
   2. Control handling and installation of hardware items that are not immediately replaceable so that Work will not be delayed by hardware losses both before and after installation.

1.07 SEQUENCING

A. Parts of finish hardware needed by frame or door manufacturers or other suppliers in order to produce doors or frames shall be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.08 SPECIAL WARRANTY

A. Furnish a written warranty covering cost to repair or replacement of defective materials or workmanship for periods not less than as indicated from Date of Substantial Completion.
   1. Door closers - 10 years
   2. Door position switches in concealed closers - 2 years
   3. Exit devices - 3 years
   4. Electro-magnetic locks - 5 years

1.09 MAINTENANCE

A. A. Extra Materials:
   1. At completion of Project, supply to Owner items as follows:
      a. One complete bitting list of key cuts
      b. One each of special wrenches and tools needed for installation of each different or special hardware component furnished
   2. Extra materials shall be stored at Site as directed by Owner.

PART 2 - PART 2 PRODUCTS

2.01 MATERIALS

A. A. General Requirements:
   1. Hardware shall be of best grade, entirely free of imperfections in manufacture and finish, and shall satisfactorily perform various functions needed.
   2. Do not use manufacturer’s products which have manufacturer’s name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with UL labels or as otherwise accepted to Architect. Manufacturer’s identification shall be permitted on rim of lock cylinders only.
   3. Furnish necessary screws, bolts, or other fastenings of suitable size and type to anchor hardware in position and match hardware as to material and finish. Provide Phillips flat-head screws except as otherwise indicated.
   4. Do not use through-bolts for installations where bolt head or nut opposite face is exposed in other work. Use of sex bolts shall not be allowed.
   5. Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as indicated. Items of hardware not definitely specified, but needed for satisfactory installation of hardware shall be provided. Such items shall be of type and quality suitable for service needed and comparable to adjacent hardware.
   6. Finishes shall comply with ANSI A156.18/ BHMA 1301.

B. Hinges: ANSI A156.1/ BHMA 101
   1. Provide full mortise, template, 5-knuckle, heavy duty, button tip hinges with non-rising loose pins and ball type bearings.
   2. Out-swinging exterior doors shall be furnished with solid bronze or stainless steel, extra heavy weight hinges with non-removable pins or security studs.
   3. Interior doors with locksets shall be furnished with non-removable pins hinges.
   4. Furnish hinges of sufficient throw where needed to clear trim or permit doors to swing 180°.
   5. For electric hinges, provide sufficient number of concealed wires to accommodate electric function of specified hardware. Locate electric hinge at center location. Provide mortar guard for each electric hinge specified. Provide Molex type standardized plug in connectors to accommodate up to twelve wires.
   6. Products:
      a. Hager - BB1279 BB1168……..BB1199
      b. McKinney - TB2714 T4B3786……T4B3386 (acceptable substitute)
      c. Stanley - HT FBB Series (acceptable substitute)

C. Continuous Hinges:
   1. McKinney
   2. Markar Products
   3. Sargent
      Hager

D. Pivot Sets: ANSI A156.4/ BHMA 301, Grade 1
   1. Provide 3/4” offset [center] hung pivots including top and bottom pivots as needed for use with closer. Provide intermediate pivot when recommended by closer manufacturer for proper function of door hardware.
   2. Electric Pivots, provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide Molex type standardized plug in connectors to accommodate up to twelve wires.
   3. Finish: BHMA #630 (US32D)
   4. Products:
      a. a. Ives - 7230 Series
      b. b. Sargent - 6117 [6153] (acceptable substitute)

E. Locks and Latchsets:
   1. Heavy duty mortise locksets and latchsets, levers shall conform to ANSI A156.13/ BHMA 621 Series 1000, Operational Grade 1. Functions and lever design shall be as listed in schedule.
      a. Latchbolt to be 3/4”, stainless steel with anti-friction tongue and 1” stainless steel deadbolt with hardened steel roller inserts.
      b. Hand of lock is to be easily field reversible without opening lock body case.
      c. Lever trim is to be thru-bolted through door and lock case.
      d. Cylinder collars for mortise locks to be cast.
   2. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. Cylinders shall

be furnished with construction removable cores and construction master keys with the cylinder removable by special key. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.

3. Provide manufacturer's standard wrought box strike for each latchset and lockset with curved lip extended to protect frame. Finish shall match hardware set.
4. Where rabbeted door stiles are indicated, provide special rabbeted front on locksets, latchsets, and bolts.
5. Finish: BHMA #626 US26D
6. Products:
   a. Best Lock – 40H Series (all others require specific approval)

F. Lock Cylinders:
   1. Best (Owner's MX8 – do not substitute)

G. Exit Devices: ANSI A156.3/ BHMA 701, Grade 1
   1. Exit devices shall be listed by UL for accident and hazard. Devices shall conform to applicable requirements of NFPA 80 and NFPA 101 .
   2. Only compression springs are acceptable.
   3. Provide deadlocking latchbolts and roller strikes. Devices shall be capable of electric latch retraction or electric control of outside trim.
   4. Devices mounted on labeled wood doors shall be thru-bolted or per manufacturer's listing instructions.
   5. Trim to be thru-bolted to lock stile case. Lever design to be same as specified with locksets. Exit device lever operating trim shall be rated for a minimum of 1000 foot pounds of pressure without allowing access.
   6. All exit devices equipped with electric latch retraction shall require no more than 1.25A during latch retraction and 150mA to maintain a dogged position. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation.
   7. Finish: BHMA #626(US26D)
   8. Products:
      a. Von Duprin – 98/99, 33a Series
      b. Precision Hardware – Apex series (acceptable substitute)

H. Overhead Closers: ANSI A156.4/ BHMA 301, Grade 1
   1. Surface mounted or concealed overhead closers shall be heavy duty, fully hydraulic, full rack and pinion action with adjustable spring power, and cast iron cylinder.
   2. Surface mounted closers shall project no more than 2 1/8" from mounting surface.
   3. Closers shall be sealed and filled with all-weather fluid.
   4. Supply appropriate forged steel arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on interior side of exterior openings, except where otherwise indicated.
      a. Parallel arm mounted closers shall be factory indexed to insure proper installation.
   5. Closers on exterior openings shall have positive, self-aligning stop arms.
   6. Closers shall be sized in compliance with requirements for accessibility for handicapped and recommendations of manufacturer. Provide barrier free and delayed action features as necessary.
      a. Maximum Opening Force:
         1) Interior Non-Fire Rated Doors: 5.0 lbs.

2) Exterior Non-Fire Rated Doors: 8.5 lbs.
b. b. Estimated Closing Force: (based on 36" door and 60% efficiency)
1) Interior Non-Fire Rated Doors: 3.0 lbs.
2) Exterior Non-Fire Rated Doors: 5.1 lbs.

7. Closers to have adjustable spring power and separate tamper resistant, brass, non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature.
8. Furnish complete with rectangular, full metal covers, necessary brackets and fasteners for top of door surface mounted units.
9. Finish: Powdered coated; custom color to match door finish
10. Products: Surface Mounted Closers Concealed Closers
    a. Glynn-Johnson-LCN - 4010/4110 Series 2010 Series
    b. Sargent - 281 Series 268 Series

I. Floor Closers:
1. Rixon-Firemark
2. Dorma Door Controls Inc.
3. Dor-O-Matic

J. Flushbolts: ANSI A156.16/ BHMA 1201
1. Provide minimum 1/2" diameter rods of brass or stainless steel, with minimum 12" long rods for doors up to 7'-0" in height. Provide longer rods as needed for doors exceeding 7'-0" in height.
2. Provide dustproof strikes for bottom flushbolt applications, except where special threshold construction provides non-recessed strike for bolt.
3. Finish: BHMA #630 (US32D)
4. Products: Wood Doors Hollow Metal Doors
    a. GJ - FB6W FB6
    b. Ives - 358 458
    c. Rockwood -557 555

K. Electrical Push-Button combination lockset
1. Electrical Push-Button Combination Lock: Provide electrical push-button combination locks activated by using keypad to enter personal identification code number.
    a. Provide mechanical key override in event of power failure. Key cylinder to utilize Harris Health-standard small format MX-8 core.
    b. System to provide computerized audit trail of usage and access.
    c. Restroom and other applications requiring privacy are to utilize an integrated privacy lock that shall prevent PIN entry when activated
    d. Products
        1) Kaba Powerplex 2000 series
        2) Kaba Powerplex 2000 series (privacy option)

L. Combination Flushbolts: ANSI A156.16/ BHMA 1201
1. Provide combination flushbolts, using one automatic flushbolt for bottom of door and one constant, self-latching flushbolt for top of door. When active leaf is opened, bottom automatic flushbolt is opened. However inactive leaf stays latched at top until it is manually released. Top bolt engages each time inactive leaf is closed.

2. Provide dust-proof strikes for bottom flushbolt applications.
3. Finish: BHMA #630 (US32D)
4. Products: Wood Doors Automatic Self-Latching
   a. GJ - FB41B FB61T
   b. Ives - 556 356
   c. Rockwood - 1945 1945
   d. Trimco - 3815 3825
5. Products: Hollow Metal Doors Automatic Self-Latching
   a. GJ - FB31B FB51T
   b. Ives - 559 357
   c. Rockwood - 1845 1845
   d. Trimco - 3810 3820

M. Push Plates, Pull Bars, and Grips: ANSI A156.6/ BHMA 1001
1. Provide concealed mounting where possible. Where exposed fasteners are used, they shall be countersunk.
2. Push plates shall be beveled on four edges.
3. Where applicable push plates shall be prepared to receive cylinder locks or thumb turns as scheduled.
4. Finish: BHMA #630 (US32D)
5. Push Plates:
   a. Size: 101mm x 406mm
   b. Thickness (US GA): 18 gauge; .050”
   c. Products:
      1) Hager - 30S
      2) Ives - 8200
      3) Rockwood - 70
      4) Trimco - 1001-1
6. Pull Bars: Offset “D” pull
   a. Size: 3/4” diameter
   b. Projection: 2 1/2”
   c. Mounting: 10” center to center
   d. Products:
      1) Hager - 11J
      2) Rockwood - 151
      3) Trimco - 1191-2

N. Door Protection Devices: ANSI A156.6/ BHMA 1001
1. Plates shall be furnished for concealed mounting where possible. Where exposed fasteners are used, they shall be countersunk.
2. Plates shall be beveled on three edges.
3. Thickness (US GA): 18 gauge; .050”
4. Finish: BHMA #630 (US32D)
5. Kick Plates:
   a. Size: 254mm x door width less 50mm
   b. Products:
      1) Hager - 193S
      2) Ives - 8400
      3) Rockwood - kick plate
6. Mop Plates:
   a. Size: 4” x door width less 2”

b. Products:
   1) Hager - 193S
   2) Ives - 8400
   3) Rockwood - mop plate

O. Auxiliary Hardware: ANSI A156.16/ BHMA 1201
1. Silencers:
   a. Tamper proof resilient cushions designed to absorb shock and noise.
   b. Furnish door silencers at openings without gaskets. Provide 3 silencers per single door, and 2 for pairs of doors.
   c. Products:

	Metal Frames	Wood Frames
1) Hager -	307D	308D
2) Ives -	64	65
3) Rockwood –	608	609
4) Trimco -	1229A	1229B

2. Wall Bumpers: 2 1/2” diameter; 1” nominal projection
   a. Finish: BHMA #626 (US26D)
   b. Products: Ives – 406
3. Floor-Mounted Stops: Dome stops with risers; 1” height
   a. Finish: BHMA #626 (US26D)
   b. Products:
      1) Hager - 241F
      2) Ives - 436
      3) Rockwood - 441
      4) Trimco - 1210
4. Exterior Floor-Mounted Stops: Resilient bumper
   a. Size: 2” (50 mm) diameter; 1 3/4” high
   b. Finish: BHMA #630 (US32D)
   c. Products:
      1) Hager - 269F
      2) Rockwood - 463
      3) Trimco - 1209
5. Concealed Overhead Holders/Stops:
   a. Description: Low profile heavy-duty extruded brass or bronze holders with shock absorber and no plastic parts
   b. Overall channel depth shall not exceed 3/4”.
   c. Finish: BHMA #630 (US32D)
   d. Products:
      1) ABH - 1000 Series
      2) GJ - 100 Series
      3) Sargent - 690 Series
      4) Rixon - Heavy Duty 1 Series
6. Surface Mounted Overhead Holders/Stops:
   a. Description: Heavy-duty extruded brass, bronze, or stainless steel holders with shock absorber and no plastic parts
   b. Finish: BHMA #630 (US32D)
   c. Products:
      1) ABH – 9000 Series
      2) GJ - 90 Series
      3) Rixon - Heavy Duty 9 Series

P. Electro-Magnetic Holders:
1. LCN
2. Rixon-Firemark
3. Sargent

Q. Seals and Gaskets: ANSI A156.22
1. Seals and gaskets shall be continuous and without unnecessary interruptions at door corners and hardware. Provide components which shall not become ineffective as seals due to misalignment at corners, minor out-of-adjustment of doors and frames, temperature variations, and normal wear and aging.
2. Gaskets and Weather Seals:
   a. Provide resilient or flexible weather-seals that are easily replaceable and readily available during projected life of installation.
   b. Products:
      1) NGP - 5050
      2) Pemko - S88
      3) Reese - 797
3. Automatic Drop Seal Door Bottoms:
   a. Provide automatic drop seal unit of manufacturer's standard design, with operating seal bar capable of operating to close a 3/4" gap.
   b. Mounting: Mortised at center of door
   c. Units scheduled to drop onto pile-type carpet flooring shall be provided with a pointed edge (45° bevel from both sides) on bottom of seal contact strip.
   d. d. Products: Wood Doors Hollow Metal Doors
      1) NGP - 422N 320N
      2) Pemko - 434ARL 420A
      3) Reese - 430A 372
4. 4. Door Bottoms: Threshold contact type
   a. a. Metal Housing/Resilient Insert - Neoprene loop
   b. b. Products:
      1) NGP - 118N
      2) Pemko - 210APK
      3) Reese - DB 592 N

R. Thresholds: Extruded aluminum; 6063-T5 alloy; ANSI A156.21
1. Thresholds shall extend full width of opening. Miter both ends of threshold as necessary to suit Project conditions.
2. Products: Egress Doors Non-Egress Doors
   a. NGP - 896 890
   b. Pemko - 2005A 179A
   c. Reese - S483 S486

S. Key Cabinet:
1. Type: Two tag system with triple cross reference
2. Capacity: 50% greater than number of door keys needed
3. Products:
4. Lund - Lund Key Box
5. Key Control - Key Control Major; Walline Cabinet
6. Telkee - Model Aristocrat AWC

2.02 2.03 ELECTRO-MECHANICAL HARDWARE

A. General Requirements:

1. Coordinate installation of electro-mechanical hardware to insure proper size wire is used to power load(s).
   a. Voltage drop shall not exceed 5% of load's stated voltage.
   b. Voltage drop shall be calculated by first determining resistance of load (R=E/I voltage divided by AMP draw). Next, determine resistance of wire (per below chart). Divide this number by resistance of load. If result exceeds 5%, wire thickness shall be increased.
   c. Wire length shall equal distance to load and back to supply (Lock 50 ft. from power supply; wire length = 100 ft.). Two loads powered by one pair of wires draw double current and have half (50%) of resistance.
   d. Wire Size Resistance Per 1,000 Feet
      12 Gauge 1.6 OHM
      14 Gauge 2.5 OHM
      16 Gauge 4.1 OHM
      18 Gauge 6.4 OHM
      20 Gauge 10.1 OHM
      22 Gauge 16.0 OHM
2. Furnish electromechanical hardware with power supply units, junction boxes, and other accessories needed for a complete, efficient installation.
3. Power Supply Units:
   a. Power supply units shall be designed for electromagnetic locks, electric locking or monitoring exit devices, and/or electric strikes as needed.
   b. Output power shall be field selectable for either 24 volts DC at 1 ampere or 12 volts DC at 2 amperes. Input power shall be 120 volts AC at 0.6 ampere, unless otherwise indicated.
   c. Units shall have a terminal block that shall accept 14 gauge stranded wire.
   d. Enclosure shall be not less than 10" x 10" x 4" deep, constructed of 19 gauge steel with a hinged cover. Provide not less than six, 1/2" knock-out holes for conduit connection.
4. Junction Boxes: NEMA 1
   a. Boxes shall be surface mounted units not less than 10" x 10" x 6" deep with a hinged door equipped with a twist turn lock.
   b. Junction boxes shall have a 20 position terminal strip that shall accept from 24 gauge to 12 gauge wire.
5. Power Transfer Devices:
   a. Provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2" x 4 1/2" butt hinges or 3/4" offset pivots. When door is in closed position, transfer unit shall be concealed.
   b. Transfer units shall contain ten 24 AWG UL approved conductors.
   c. Rating: 10 Amps at 24 VDC (Class 1 low voltage)

B. Electro-Mechanical Locksets:
1. Electro-mechanical locks shall comply with requirements for size, quantity, type, etc., as set forth for non-electric locks and shall conform to ANSI A156.23. Locks shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical locks shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation

a. Power Requirements: 1.0 amps; 24 VAC/DC
3. Provide fail secure function, operates as storeroom function set when energized, unless otherwise indicated or required by Life Safety Code.
4. Products:
a. Best (40H series)

C. Electro-Mechanical Exit Devices:
1. Electro-mechanical exit devices shall comply with requirements for size, quantity, type, etc., as set forth for non-electric devices. Exit devices shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical locks shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation
a. Power Requirements: 24 VDC
3. Provide following functions as scheduled:
a. Fail Secure Function: Operates as storeroom function set when de-energized
b. Latch Retraction: Upon signal units latch retracted (unlocks)
4. Products:
a. Von Duprin QEL

D. Control Console:
1. Contractor to supply one custom wall mounted control console similar to Folger Adam #320. Console to have three-position rocker switches with red & green LED's and built in audible alarm with volume control. Unit to have on-board circuit breakers, solid state logic controls and be able to perform functions such as line supervision, latching alarm, interlocking, interlocking override, momentary and alternate action switches. Face plate to be stainless steel.

2.03 CYLINDERS, KEYING SYSTEMS AND KEY CONTROL

A. All cylinders shall be based on the Owner's Best MX-8 keyway.

B. **Best-Cormax** representatives shall meet with Architect and Owner to finalize keying requirements and obtain keying instructions in writing as outlined. Locks, cylinders and keys shall be furnished with Best MX-8 full size key sections.

C. Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Owner's Representative prior to occupancy. The Owner or Owner's Security Agent will void the operation of the construction keys.

D. Permanent cylinders shall be keyed by the Stanley Best Service Center or factory, combinated in sets or subsets, master keyed or great grand master keyed, as directed by Owner. Permanent keys and cylinders shall be marked with the applicable blind code for identification. These visual key control marks or codes will not include the actual key cuts. Keys and cylinder identification stamping to be approved by Architect and Owner. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.
1. Permanent IC lock cylinders shall be stamped as follows:
a. Face – One to three digit master coding
b. Side – full core mark identifying number

2. Keys shall be stamped with both the core mark identifying number and the sequential key number

E. Equip locks and cylinders with patent protected, full size cylinders with five nickel silver finger pins. Provide a minimum of six pins with nickel silver bottom pins. Cylinders must allow for multiplex master keying, combinated to Owner's instructions.

F. Supplier shall furnish one Keystone Stanley factory service program that will provide importing and appending information to the owner's current system. Information provided should include data key control system complete with indexed door numbers, key codes, bittings, building numbers, room numbers, lock function, design, and finish. In addition, include model numbers, handing, design, and functions of exit devices and door closers. All documents associated with the key records are to be transmitted to the Owner by secure carrier, return receipt requested.

G. Deliver all end user exclusive permanent key blanks and other security keys direct to Owner's representative from Stanley Best Service Center or factory by secure courier, return receipt requested. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.

H. Key Material: Provide manufacturer's standard embossed keys of nickel silver to ensure durability. Key Quantity: Furnish keys in the following quantities:

1)	25 each	Temporary construction keys.
2)	5 each	Master keys per master group.
3)	3 each	Change keys per cylinder or keyed alike group.

I. Available manufacturers: Subject to compliance with requirements, manufacturers offering the products which may be incorporated in the work include:
1. Stanley-Best Access Systems – Best MX-8 Patented Cylinders

PART 3 - PART 3 EXECUTION

3.01 3.01 EXAMINATION

A. Site Verification of Conditions:
1. Examine doors, frame, and related items for conditions that would prevent proper application of hardware.
2. Correct conditions detrimental to timely and proper execution of Work.
3. Do not proceed until unsatisfactory conditions have been corrected.
4. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.02 3.02 INSTALLATION

A. General Requirements:
1. Securely install finish hardware items in compliance with accepted schedule and templates furnished with hardware.
2. Provide metal fasteners of type and size which will not work loose as a result of normal door use, and which are compatible with metal materials of hardware item and doors and frames. Provide only smooth exposed fastener heads, which do not constitute a snagging hazard to clothing. Finish of exposed fasteners shall match finish of hardware item.
3. Install mortised items flush with adjacent surfaces.

4. Install locksets, surface mounted closers, and trim after finishing of doors and frames is complete. Wherever cutting and fitting is needed to install hardware onto or into surfaces which are later to be finished, install each item completely and then remove and store in a secure place during finish application. After completion of finishes, reinstall each item.
5. Locate items in compliance with Door and Hardware Institute publication WDHS.3 Recommended Hardware Locations for Wood Flush Doors. Mounting heights shall be measured from finish floor, except top butt.
   a. a. Butts:
      1) Top: 9 5/8" center of butt to top of door
      2) Intermediate: Equal distance between top and bottom butts
      3) Bottom: 10 3/8" to center of butt
   b. Locksets and Latchsets: 40 5/16" to center of strike
   c. Deadlocks: 60" to center of strike
   d. Exit Devices: 40 5/16" to center of strike
   e. Push Plates: 45" to center
   f. Pull Bars (Grips): 42" to center

B. B. Interior Stops:
1. Door stops shall be furnished for every door leaf. Install floor-mounted or wall-mounted stops, as scheduled. Overhead door holder shall be provided where floor or wall stops cannot be used. Special arms on door closers do not constitute door stops.
   Place door stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.
2. Floor stops shall be installed with risers as needed to accommodate finish flooring materials for proper relationship to door.

C. Sliding/Pocket Door Track and Trucks:
1. Sliding doors shall be manually operated sliding door panels. Provide continuous tracks for each sliding door panel. Tracks shall be secured to framing by use of overhead mounting brackets spaced not to exceed 30" (750 mm) on center.
2. Place end blinds over end of track and slide track into mounting bracket.
3. Sliding door panels shall be hung from tracks with one pair of trucks for each sliding panel.
4. Each sliding door panel shall be fitted with two floor guides; one at each end of panel to maintain proper alignment and operation of sliding door panel.
5. Floor guides shall be installed on floor, centered under sliding door panels. Shim and level as needed for smooth operation of sliding door panels.

D. Electro-Mechanical Hardware:
1. Comply with manufacturer's instructions for wiring, grounding, and shielding.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service:
1. Supplier of door hardware shall make periodic visits to Site during and at completion of hardware installation for purposes of monitoring compliance with manufacturer's installation requirements
2. Prepare and submit, to Contractor, Architect, and Owner, a written report of each periodic and final site visits. Report shall be submitted within 3 days following site visits.

B. Operational Test:
   1. After installation of fire doors is completed, operational tests shall be conducted on each door.
   2. Tests shall be adequate to determine that system has been installed and functions as intended.

3.04 ADJUSTING

A. Final Adjustment:
   1. Before final completion, adjust hardware so doors operate in perfect order. Test and adjust hardware for quiet, smooth operation, free of sticking, binding, or rattling. Adjust closers for proper, smooth operation.
   2. Exposed hardware shall be carefully cleaned by methods not injurious to finish, immediately preceding occupancy. Replace defective, damaged, or missing hardware.
   3. At final completion, properly tag and identify keys and deliver to Owner.

3.05 HARDWARE SCHEDULE

A.

END

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 PREAMBLE

A. Prior to installation of hardware, the general contractor shall contact the manufacturers' representatives to arrange and hold a jobsite meeting to instruct and certify the installing contractors' personnel on the proper installation of their respective products. Seminar shall be attended by installers of hardware (including electrical hardware) for aluminum, hollow metal, and wood doors. Training will include the use of installation manuals, hardware schedule, templates and physical product samples. Finish hardware shall be installed in accordance with the reviewed hardware schedule and manufacturer's printed instructions.

B. Upon substantial completion the manufacturer's representative(s) shall inspect and approve the installation of the products they represent. A comprehensive check list shall be provided to the owner, proper function of change, master and grandmaster keys, cylinders, mechanical and electro-mechanical hardware, doors and frames. Any identified installation or product issues shall be directed to the attention of the Architect for the purpose of generating the final punchlist.

1.2 SUMMARY

A. Work under this section comprises of furnishing and installing door hardware needed for a complete and operational system, including interface with electrified hardware components and access controls systems supplied by Owner.

B. Section Includes:

1. Hinges – pivots
2. Locksets, latchsets, and cylinders
3. Exit devices
4. Closers
5. Flush bolts
6. Push plates – pulls
7. Kick, mop and protection plates
8. Stops, wall bumpers, overhead holders
9. Thresholds, gaskets, weather seals, and door bottoms
10. Miscellaneous trim and accessories
11. Electro-mechanical hardware devices, access controls, power supplies, and electrical peripherals necessary to meet requirements of security, fire and egress codes

C. Related Sections:

1. Section 08110 Steel Doors and Frames
2. Section 08210 Wood Doors
3. Section 08450 Aluminum -Framed Storefronts
4. Section 08450 All-Glass Entrances
5. Requirements of this section also apply to electrical installations. Refer to work specified in Divisions 16 for other requirements and limitations applicable to electrified hardware items, including, but not limited to:

a) Conduit
b) Junction boxes
c) Wiring
d) Final connections

1.3 REFERENCES

A. Publications listed herein are part of this specification to extent referenced.
B. American National Standards Institute:

1. ANSI A156 Series
2. ANSI A115W Wood Door Hardware Standards; Hardware Preparation
3. ANSI A115 Specifications for Steel Door and Frame Preparation for Hardware
4. ANSI A117.1 Accessible and Usable Buildings and Facilities

C. Door and Hardware Institute:

1. DHI Publication - Abbreviations and Symbols
2. DHI Publication – Hardware for Labeled Fire Doors (with supplements)
3. DHI Publication – Hardware Reinforcements on Steel Doors and Frames
4. DHI Publication - Basic Architectural HardwareDHI Publication - Hardware for Labeled Fire Doors (with supplements)
5. DHI Publication - Installation Guide for Doors and Hardware
6. DHI Publication - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
7. DHI Publication - WDHS-1 Template Book Criteria for Wood Doors
8. DHI Publication - WDHS-3 Recommended Hardware Locations for Wood Flush Doors
9. DHI Publication - For Processing Hardware Schedules and Templates

D. National Fire Protection Association:

1. NFPA 80 Standard for Fire Doors and Windows
2. NFPA 101 Life Safety Code
3. NFPA 105 Recommended Practice for the Installation of Smoke-Control Door Assemblies
4. NFPA 252 Standard Methods of Fire Tests of Door Assemblies

E. Underwriters Laboratories, Inc.

1. UL Standard 10C Fire Tests of Door Assemblies
2. UL Standard 1784 Air Leakage Tests of Door Assemblies
3. UL Building Materials Directory

1.4 DEFINITIONS

A. Mortise Lock Functions:

1. PASSAGE FUNCTION; ANSI F01 - Latch bolt operated from either side at all times.
2. PRIVACY FUNCTION; ANSI F02 - Latch bolt operated by lever from either side. Deadbolt operated by turn from inside and by emergency key from outside. Operating inside lever or closing door unlocks outside lever.
3. OFFICE FUNCTION; ANSI F04 - Latch bolt operated by lever from either side except when outside lever is made inoperative by stop or mechanical means other than a key. When outside lever is locked, latch bolt may be retracted by key from

outside or by rotating inside lever. Auxiliary latch deadlocks latch bolt when door is closed.

4. CLASSROOM FUNCTION; ANSI F05 - latch bolt operated by lever from either side except when outside lever is locked from outside by key. When outside lever is locked, latch bolt may be retracted by key from outside or by rotating inside lever. Auxiliary latch deadlocks latch bolt when door is closed.
5. STOREROOM FUNCTION ANSI F07 - Latch bolt operated by key from outside or by rotating inside lever. Outside lever is always inoperative. Auxiliary latch deadlocks latch bolt when door is closed.
6. ENTRANCE FUNCTION; ANSI F20 - Latch bolt operated by lever from either side except when outside lever is made inoperative by a stop or mechanical means other than a key. Deadbolt operated by turn piece inside. Key outside or lever inside operates both bolts simultaneously. Throwing deadbolt automatically locks outside lever. Auxiliary latch deadlocks latch bolt when door is closed.

1.5 SUBMITTALS

A. Product Data:

1. Submit manufacturer's literature describing products to be provided.

B. Shop Drawings:

1. Before ordering or delivery of hardware, submit 3 copies of hardware schedule.

a) Supplier shall assume sole responsibility for provision, proper coordination and function of finish hardware needed for openings, whether or not listed in schedule below.

2. Hardware schedule shall be in a vertical form, organized into hardware sets indicating complete designations of every item needed for each door or opening. Indicate location of hardware set, cross-referenced to indications in Contract Documents, manufacturer's name and product number, finish, and other similar information describing hardware to be provided. Schedule shall include information as follows:

a) Type, style, function, and size of each item of hardware
b) Fastenings and other pertinent information
c) Explanation of abbreviations, symbols, codes, etc. contained in schedule
d) Mounting locations for hardware
e) Door and frame materials

3. Provide, as part of Hardware Schedule, a door index listing openings by number with corresponding page and heading numbers.
4. Submit 3 copies of keying schedule prior to ordering hardware.
5. Electro-Mechanical Hardware:

a) Provide complete point-to-point wiring diagrams for each opening needing electrified hardware, except openings where only magnetic hold-opens are specified. Provide a copy with each hardware schedule submitted.
b) Electrical components to be listed by opening in hardware submittals.
c) Provide elevation drawings of electronic hardware and systems identifying locations of system components with respect to their placement in door opening. Provide a copy with each hardware schedule submitted.

6. Shop drawings submittal shall be coordinated with shop drawings submission of related portions of Work, such as:
    a) Metal doors and frames
    b) Wood doors
    c) Entrances and storefronts
7. Hardware schedule shall be prepared under supervision of an Architectural Hardware Consultant (AHC) or Certified Door Consultant (CDC) and shall bear AHC or CDC Seal of Door and Hardware Institute.

C. Samples:
1. Submit samples of door hardware items if requested by Architect. Accepted samples may be incorporated into Work.
2. Samples submitted shall be of production type and shall represent minimum quality of work to be furnished by manufacturer. No work represented by samples shall be fabricated until samples are accepted. Downgrading of quality demonstrated by samples may be cause for rejection of work.

D. Quality Assurance Submittals:
1. Certifications:
    a) Submit information needed to indicate compliance with specifications.
    b) Submit a statement from manufacturer that electronic hardware and systems being supplied comply with operational descriptions exactly as specified.
2. Manufacturer's Instructions:
    a) Furnish templates and schedules needed for fabrication of hollow metal doors and frames, wood doors and frames, and other items related to hardware.
    b) Submission for templates and template list shall follow procedures established by DHI publication For Processing Hardware Schedules and Templates.

E. Close-out Submittals:
1. Wiring Diagrams:
    a) Prepare complete point-to-point wiring diagrams for electronic components listed by opening in hardware submittals.Include a copy of wiring diagrams in Operation and Maintenance Data Manual.
2. Elevation Drawings:
    a) Prepare elevation drawings for mounting heights and locations of electronic components listed by opening in hardware submittals.
    b) Include a copy of operational descriptions in Operation and Maintenance Data Manual.
3. Operational Descriptions:
    a) Provide complete operational descriptions of electronic components listed by opening in hardware submittals.
    b) Operational descriptions shall detail how each electronic component functions within opening incorporating conditions of ingress and egress.
    c) Include a copy of operational descriptions in Operation and Maintenance Data Manual.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Hardware supplier shall be a qualified direct distributor of products to be furnished, specializing in distribution of contract hardware for a period of at least 5 years. Supplier shall maintain a warehouse facility within 75 miles of Project.
2. Supplier shall have on staff a full time employee who is a member in good standing of Door and Hardware Institute and an Architectural Hardware Consultant (AHC) or a person of equivalent experience. Employee shall be made available at reasonable times to consult with Architect, Contractor, and/or Owner regarding matters affecting finish hardware on this Project.
3. Installer shall be trained or qualified by manufacturer in installation techniques and procedures of door hardware and shall demonstrate a minimum of 3 years successful experience in such installation.
4. Regardless of types specified or shown on details, provide gaskets and seals that do not interfere with ratings and proper operation of fire-rated openings and emergency exits. Provide components that comply with requirements of such openings.
5. Single Source Responsibility:
    a) To greatest extent possible, obtain each type of hardware (i.e. latchsets, locksets, hinges, closers, etc.) from a single manufacturer.
    b) Provide secondary materials that are produced or are specifically recommended by manufacturer to ensure compatibility.

B. Regulatory Requirements:

1. Hardware and installation shall comply with American National Standards Institute (ANSI), National Fire Protection Association (NFPA), Underwriters Laboratories (UL), Builders Hardware Manufacturers Association (BHMA), and Door and Hardware Institute (DHI) provisions or standards listed below. Provide products complying with these standards as specified elsewhere in this section.
2. Federal Accessibility Regulations:
    a) Americans with Disabilities Act – ADA
    b) Uniform Federal Accessibility Standards – UFAS
    c) ANSI A117.1 Standard for Accessible and Usable Building s and Facilities
3. National Fire Protection Association:
    a) NFPA 80 Standard for Fire Doors and Windows
    b) NFPA 101 Life Safety Code
    c) NFPA 105 Recommended Practice for the Installation of Smoke-Control Door Assemblies
    d) NFPA 252 Standard Methods of Fire Tests of Door Assemblies
4. Underwriters Laboratories Inc.:
    a) UL 10C
    b) UL 1784 Air Leakage Tests of Door Assemblies
5. ANSI/BHMA Standards
    a) A115-W Series
    b) A115 Series
    c) A156 Series:

1) Butts and Hinges: ANSI A156.1/BHMA 101
2) Locks & Lock Trim: ANSI A156.2/BHMA 601
3) Exit Devices: ANSI A156.3/BHMA 701
4) Door Controls - Closers: ANSI A156.4/BHMA 301
5) Auxiliary Locks: ANSI A156.5/BHMA 501
6) Architectural Door Trim: ANSI A156.6/BHMA 1001
7) Template Hinge Dimensions: ANSI A156.7
8) Door Controls - Overhead Holders: ANSI A156.8/BHMA 601
9) Power Operated Pedestrian Doors: ANSI A156.10
10) Interconnected Locks & Latches: ANSI 156.13/BHMA 621
11) Mortise Locks & Latches: ANSI A156.13/BHMA 621
12) Closer Holder Release Devices: ANSI A156.15/BHMA 321
13) Auxiliary Hardware: ANSI A156.16/BHMA 1201
14) Materials & Finishes: ANSI A156.18/BHMA 1301
15) Power Assist and Low Energy Operators: ANSI A156.19
16) Electro Magnetic Locks: ANSI A156.23
17) Delayed Egress Locks: ANSI A156.24

6. Door and Hardware Institute:

a) Abbreviations and Symbols
b) Basic Architectural Hardware
c) Hardware for Labeled Fire Doors (with supplements)
d) Hardware Reinforcements on Steel Doors and Frames
e) Publication - Installation Guide for Doors and Hardware
f) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames

C. Certifications:

1. Hardware used in labeled fire or smoke rated openings shall be listed for those types of openings and bear identifying label or mark indicating UL listing for fire and/or smoke as needed.
2. Exit devices in non-labeled openings to be listed for panic.

D. Pre-Installation Meetings:

1. Prior to installation of hardware, including electronic hardware, arrange conference between hardware supplier, hardware installers, and related trades to review materials, procedures and coordinating related work.
2. Conference attendees shall include Contractor, Owner's representative, Owner's security system provider, Architect, door hardware installers, and representatives of hardware supplier and/or manufacturers.
3. Topics to be discussed at meeting shall include:

a) A review of Contract Documents and accepted hardware schedule shall be made and deviations or differences shall be resolved.
b) Applicable local building code, National Fire Protection Association (NFPA), and Underwriters' Laboratories (UL) requirements shall be reviewed and conflicts in building code, NFPA, or UL requirements and Project conditions shall be resolved.
c) Review items such as proper installation sequence, adjustments, attachment, and location of door hardware. If a conflict exists between what is considered proper hardware application and Contract Documents, these differences shall be defined.

4. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
5. Pre-installation conference shall serve to clarify Contract Documents, application requirements and what work should be completed before hardware installation can begin.
6. Prepare and submit, to parties in attendance, a written report of pre-installation conference. Report shall be submitted within 3 days following conference.

E. Coordination:

1. Before ordering materials, carefully examine scale, full size, and shop drawings of work requiring hardware, and verify that material selected will properly fit Work.
2. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware. Coordinate installation of electric hinges, locks, and security devices with installation of electrical connections.
3. Should door hardware indicated for use on Project not qualify for appropriate labeling, accessibility, function, or use because of design, or other reason, notify Architect. Hardware items scheduled for fire-rated openings shall comply with UL requirements for entire assembly.
4. Coordinate with installation of electric strikes, maglocks, and security devices with Owner's security system provider.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Deliver materials in manufacturer's original unopened packaging with labels intact.
2. Package hardware items separately and mark each to correspond with heading numbers on hardware schedule. Pack each item complete with necessary parts and fasteners.
3. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.
4. Supply necessary instructions, wiring diagrams, templates, drawings, and fasteners for proper installation. Include extra fasteners.
5. Control handling and installation of hardware items that are not immediately replaceable so that completion of Work will not be delayed by hardware loses.

B. Storage and Protection:

1. Store hardware delivered to Project, but not yet installed, in a secure locked area.
2. Control handling and installation of hardware items that are not immediately replaceable so that Work will not be delayed by hardware losses both before and after installation.

1.8 SEQUENCING

A. Parts of finish hardware needed by frame or door manufacturers or other suppliers in order to produce doors or frames shall be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.9 SPECIAL WARRANTY

A. Furnish a written warranty covering cost to repair or replacement of defective materials or workmanship for periods not less than as indicated from Date of Substantial Completion.

1. Door closers - 10 years
2. Door position switches in concealed closers - 2 years
3. Exit devices - 3 years
4. Electro-magnetic locks - 5 years

1.10 MAINTENANCE

A. Extra Materials:

1. At completion of Project, supply to Owner items as follows:

a) One complete bitting list of key cuts
b) One each of special wrenches and tools needed for installation of each different or special hardware component furnished

2. Extra materials shall be stored at Site as directed by Owner.

PART 2 - PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS (listed in order of preference)

A. Hinges:

1. McKinney
2. Hager
3. Stanley Works
4. Ives

B. Pivot Sets:

1. Rixson
2. Ives
3. McKinney
4. Sargent

C. Locksets and Latchsets:

1. Sargent (8200 series)
2. Schlage
3. Best (cylinders – do not substitute)

D. Lock Cylinders:

1. Best (Owner’s MX8 – do not substitute)

E. Electrical Push-Button combination lockset

1. :Kaba/Assa Abloy.
2. Alarm Lock Trilogy

F. Exit Devices:

1. Von Duprin
2. Precision

G. Overhead Closers:

1. LCN

2. Sargent

H. Push Plates, Pull Bars, and Grips:

1. McKinney
2. Ives
3. Rockwood
4. Trimco/Builders Brass Works – BBW
5. Hager

I. Door Protection Devices:

1. McKinney
2. Ives
3. Rockwood
4. Trimco/Builders Brass Works – BBW
5. Hager

J. Stops, Silencers, Auxiliary Items, and Miscellaneous Hardware:

1. Sargent
2. Rixson
3. Glynn-Johnson – GJ
4. Hager
5. Ives
6. Rockwood
7. Trimco/Builders Brass Works – BBW

K. Overhead Holders/Stops:

1. Sargent
2. Rixson
3. Glynn-Johnson – GJ
4. Sargent

L. Thresholds, Door Bottoms, Seals and Stripping:

1. McKinney
2. Pemko Manufacturing co.
3. Reese Enterprises Inc.
4.

M. Key Cabinet:

1. Lund Equipment Co.
2. Key Control Systems, Inc.
3. Telkee Inc.
4. Detention Locks:
5. Folger Adam Co. FOL
6. Southern Steel
7. Adtec
8. Von Duprin

2.2 MATERIALS

A. General Requirements:

1. Hardware shall be of best grade, entirely free of imperfections in manufacture and finish, and shall satisfactorily perform various functions needed.

2. Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with UL labels or as otherwise accepted to Architect. Manufacturer's identification shall be permitted on rim of lock cylinders only.
3. Furnish necessary screws, bolts, or other fastenings of suitable size and type to anchor hardware in position and match hardware as to material and finish. Provide Phillips flat-head screws except as otherwise indicated.
4. Do not use through-bolts for installations where bolt head or nut opposite face is exposed in other work. Use of sex bolts shall not be allowed.
5. Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as indicated. Items of hardware not definitely specified, but needed for satisfactory installation of hardware shall be provided. Such items shall be of type and quality suitable for service needed and comparable to adjacent hardware.
6. Finishes shall comply with ANSI A156.18/ BHMA 1301.

B. Hinges: ANSI A156.1/ BHMA 101

1. Provide full mortise, template, 5-knuckle, heavy duty, button tip hinges with non-rising loose pins and ball type bearings.
2. Out-swinging exterior doors shall be furnished with solid bronze or stainless steel, extra heavy weight hinges with non-removable pins or security studs.
3. Interior doors with locksets shall be furnished with non-removable pins hinges.
4. Furnish hinges of sufficient throw where needed to clear trim or permit doors to swing 180°.
5. For electric hinges, provide sufficient number of concealed wires to accommodate electric function of specified hardware. Locate electric hinge at center location. Provide mortar guard for each electric hinge specified. Provide Molex type standardized plug in connectors to accommodate up to twelve wires.
6. Products:

    a) Hager - BB1279 BB1168……..BB1199
    b) McKinney - TB2714 T4B3786……T4B3386
    c) Stanley - FBB179 FBB168……FBB199

C. Pivot Sets: ANSI A156.4/ BHMA 301, Grade 1

1. Provide 3/4" offset [center] hung pivots including top and bottom pivots as needed for use with closer. Provide intermediate pivot when recommended by closer manufacturer for proper function of door hardware.
2. Electric Pivots, provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide Molex type standardized plug in connectors to accommodate up to twelve wires.
3. Finish: BHMA #630 (US32D)
4. Products:

    a) GJ - 7220 [7250] Series
    b) Sargent - 6117 [6153]

D. Locks and Latchsets:

1. Heavy duty mortise locksets and latchsets, levers shall conform to ANSI A156.13/ BHMA 621 Series 1000, Operational Grade 1. Functions and lever design shall be as listed in schedule.

    a) Latchbolt to be 3/4", stainless steel with anti-friction tongue and 1" stainless steel deadbolt with hardened steel roller inserts.

b) Hand of lock is to be easily field reversible without opening lock body case.
c) Lever trim is to be thru-bolted through door and lock case.
d) Cylinder collars for mortise locks to be cast.

2. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. Cylinders shall be furnished with construction removable cores and construction master keys with the cylinder removable by special key. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.
3. Provide manufacturer's standard wrought box strike for each latchset and lockset with curved lip extended to protect frame. Finish shall match hardware set.
4. Where rabbeted door stiles are indicated, provide special rabbeted front on locksets, latchsets, and bolts.
5. Finish: BHMA #626 US26D
6. Products:

a) Schlage - L Series
b) Sargent – 8200 Series
c) Best Lock – 36H Series

E. Exit Devices: ANSI A156.3/ BHMA 701, Grade 1

1. Exit devices shall be listed by UL for accidents and hazard. Devices shall conform to applicable requirements of NFPA 80 and NFPA 101.
2. Only compression springs are acceptable.
3. Provide deadlocking latchbolts and roller strikes. Devices should be capable of electric latch retraction or electric control of outside trim.
4. Devices mounted on labeled wood doors shall be thru-bolted or per manufacturer's listing instructions.
5. Trim to be thru-bolted to lock stile case. Lever design to be same as specified with locksets. Exit device lever operating trim shall be rated for a minimum of 1000 foot pounds of pressure without allowing access.
6. All exit devices equipped with electric latch retraction shall require no more than 1.25A during latch retraction and 150mA to maintain a dogged position.
7. Finish: BHMA #626(US26D)
8. Products:

a) Sargent 80 Series

b) Von Duprin - 99 Series

c) Precision

F. Overhead Closers: ANSI A156.4/ BHMA 301, Grade 1

1. Surface mounted or concealed overhead closers shall be heavy duty, fully hydraulic, full rack and pinion action with adjustable spring power, and cast-iron cylinder.
2. Surface mounted closers shall project no more than 2 1/8" from mounting surface.
3. Closers shall be sealed and filled with all-weather fluid.
4. Supply appropriate forged steel arm assembly for each closer so that closer body

and arm are mounted on non-public side of door opening and on interior side of exterior openings, except where otherwise indicated.

a) Parallel arm mounted closers shall be factory indexed to insure proper installation.

5. Closers on exterior openings shall have positive, self-aligning stop arms.
6. Closers shall be sized in compliance with requirements for accessibility for handicapped and recommendations of manufacturer. Provide barrier free and delayed action features as necessary.

   a) Maximum Opening Force:
      1) Interior Non-Fire Rated Doors: 5.0 lbs.
      2) Exterior Non-Fire Rated Doors: 8.5 lbs.

   b) Estimated Closing Force: (based on 36" door and 60% efficiency)
      1) Interior Non-Fire Rated Doors: 3.0 lbs.
      2) Exterior Non-Fire Rated Doors: 5.1 lbs.

7. Closers to have adjustable spring power and separate tamper resistant, brass, non-critical regulating screw valves for closing speed, latching speed and back- check control as a standard feature.
8. Furnish complete with rectangular, full metal covers, necessary brackets and fasteners for top of door surface mounted units.
9. Finish: Powdered coated; custom color to match door finish
10. Products: Surface Mounted Closers Concealed Closers

    a) LCN - 4010/4110 Series 2010 Series
    b) Sargent - 281 Series 268 Series

G. Flushbolts: ANSI A156.16/ BHMA 1201

1. Provide minimum 1/2" diameter rods of brass or stainless steel, with minimum 12" long rods for doors up to 7'-0" in height. Provide longer rods as needed for doors exceeding 7'-0" in height.
2. Provide dustproof strikes for bottom flushbolt applications, except where special threshold construction provides non-recessed strike for bolt.
3. Finish: BHMA #630 (US32D)
4. Products: Wood Doors Hollow Metal Doors

   a) GJ - FB6W FB6
   b) Ives - 358 458
   c) Rockwood -557 555

H. Combination Locksets

1. Electrical Push-Button Combination Lock: Provide electrical push-button combination locks activated by using keypad to enter personal identification code number.

   a) Provide mechanical key override in event of power failure. Key cylinder to utilize HCHD-standard small format MX-8 core.
   b) System to provide computerized audit trail of usage and access.
   c) Restroom and other applications requiring privacy are to utilize an integrated privacy lock that shall prevent PIN entry when activated
   d) Products
      1) Kaba/Assa Abloy (Powerplex 2000 series – standard for ACS clinics)
      2) Kaba Eplex 5000 (Kaba Eplex 5X51 privacy)
      3) Alarm Lock Trilogy (DL2700)

I. Combination Flushbolts: ANSI A156.16/ BHMA 1201

1. Provide combination flushbolts, using one automatic flushbolt for bottom of door and one constant, self-latching flushbolt for top of door. When active leaf is opened, bottom automatic flushbolt is opened. However inactive leaf stays latched at top until it is manually released. Top bolt engages each time inactive leaf is closed.
2. Provide dust-proof strikes for bottom flushbolt applications.
3. Finish: BHMA #630 (US32D)
4. Products: Wood Doors Automatic Self-Latching

   a) GJ - FB41B FB61T
   b) Ives - 556 356
   c) Rockwood -1945 1945
   d) Trimco - 3815 3825

5. Products: Hollow Metal Doors Automatic Self-Latching

   a) GJ - FB31B FB51T
   b) Ives - 559 357
   c) Rockwood -1845 1845
   d) Trimco - 3810 3820

J. Push Plates, Pull Bars, and Grips: ANSI A156.6/ BHMA 1001

1. Provide concealed mounting where possible. Where exposed fasteners are used, they shall be countersunk.
2. Push plates shall be beveled on four edges.
3. Where applicable push plates shall be prepared to receive cylinder locks or thumb turns as scheduled.
4. Finish: BHMA #630 (US32D)
5. Push Plates:

   a) Size: 101mm x 406mm
   b) Thickness (US GA): 18 gauge; .050”
   c) Products:
      1) Hager - 30S
      2) Ives – 8200
      3) Rockwood - 70 4)
      4) Trimco - 1001-1

6. Pull Bars: Offset “D” pull

   a) Size: 3/4” diameter
   b) Projection: 2 1/2”
   c) Mounting: 10” center to center
   d) Products:
      1) Hager - 11J
      2) Rockwood - 151 3)
      3) Trimco - 1191-2

K. Door Protection Devices: ANSI A156.6/ BHMA 1001

1. Plates shall be furnished for concealed mounting where possible. Where exposed fasteners are used, they shall be countersunk.
2. Plates shall be beveled on three edges.
3. Thickness (US GA): 18 gauge; .050”
4. Finish: BHMA #630 (US32D)

5. Kick Plates:

   a) Size: 254mm x door width less 50mm
   b) Products:
      1) Hager - 193S
      2) Ives – 8400
      3) Rockwood - kick plate

6. Mop Plates:

   a) Size: 4” x door width less 2”
   b) Products:
      1) Hager - 193S
      2) Ives – 8400
      3) Rockwood - mop plate

L. Auxiliary Hardware: ANSI A156.16/ BHMA 1201

1. Silencers:

   a) Tamper proof resilient cushions designed to absorb shock and noise.
   b) Furnish door silencers at openings without gaskets. Provide 3 silencers per single door, and 2 for pairs of doors.
   c) Products: Metal Frames Wood Frames
      1) Hager - 307D 308D 2)
      2) Ives - 64 65
      3) Rockwood – 608 609
      4) Trimco - 1229A 1229B

2. Wall Bumpers: 2 1/2” diameter; 1” nominal projection

   a) Finish: BHMA #626 (US26D)
   b) Products: Ives 406

3. Floor-Mounted Stops: Dome stops with risers; 1” height

   a) Finish: BHMA #626 (US26D)
   b) Products:
      1) Hager - 241F
      2) Ives 436
      3) Rockwood 441
      4) Trimco 1210

4. Exterior Floor-Mounted Stops: Resilient bumper

   a) Size: 2” (50 mm) diameter; 1 3/4” high
   b) Finish: BHMA #630 (US32D)
   c) Products:
      1) Hager - 269F
      2) Rockwood 463
      3) Trimco 1209

5. Concealed Overhead Holders/Stops:

   a) Description: Low profile heavy-duty extruded brass or bronze holders with shock absorber and no plastic parts
   b) Overall channel depth shall not exceed 3/4”.
   c) Finish: BHMA #630 (US32D)
   d) Products:

1) ABH - 1000 Series
2) GJ - 100 Series
3) Sargent - 690 Series
4) Rixon - Heavy Duty 1 Series

6. Surface Mounted Overhead Holders/Stops:

a) Description: Heavy-duty extruded brass, bronze, or stainless steel holders with shock absorber and no plastic parts
b) Finish: BHMA #630 (US32D)
c) Products:
1) ABH – 9000 Series
2) GJ - 90 Series
3) Rixon - Heavy Duty 9 Series

M. Seals and Gaskets: ANSI A156.22

1. Seals and gaskets shall be continuous and without unnecessary interruptions at door corners and hardware. Provide components which shall not become ineffective as seals due to misalignment at corners, minor out-of-adjustment of doors and frames, temperature variations, and normal wear and aging.
2. Gaskets and Weather Seals:

a) Provide resilient or flexible weather-seals that are easily replaceable and readily available during projected life of installation.
b) Products:
1) NGP – 5050
2) Pemko - S88
3) Reese – 797
4) Zero – 188S

3. Automatic Drop Seal Door Bottoms:

a) Provide automatic drop seal unit of manufacturer's standard design, with operating seal bar capable of operating to close a 3/4" gap.
b) Mounting: Mortised at center of door
c) Units scheduled to drop onto pile-type carpet flooring shall be provided with a pointed edge (45° bevel from both sides) on bottom of seal contact strip.
d) Products:

	Wood Doors	Hollow Metal Doors
1) NGP -	422N	320N
2) Pemko -	434ARL	420A
3) Reese - 430A	372	
4) Zero –	360AA	355A

4. Door Bottoms: Threshold contact type

a) Metal Housing/Resilient Insert - Neoprene loop
b) Products:
1) NGP - 118N
2) Pemko - 210APK
3) Reese - DB 592 N
4) Zero – 52A

N. Thresholds: Extruded aluminum; 6063-T5 alloy; ANSI A156.21

1. Thresholds shall extend full width of opening. Miter both ends of threshold as necessary to suit Project conditions.

2. Thresholds shall extend full width of opening. Miter both ends of threshold as necessary to suit Project conditions.
3. Products:

		Egress Doors	Non Egress Doors
a)	NGP -	896	890
b)	Pemko -	2005A	179A
c)	Reese - S483	S486	
d)	Zero -	65A	560A

O. Key Cabinet:

1. Type: Two tag system with triple cross reference
2. Capacity: 50% greater than number of door keys needed
3. Products:

   a) Lund - Lund Key Box

4. Key Control - Key Control Major; Walline Cabinet
5. Telkee - Model Aristocrat AWC

2.3 ELECTRO-MECHANICAL HARDWARE

A. General Requirements:

1. Coordinate installation of electro-mechanical hardware to insure proper size wire is used to power load(s).

   a) Voltage drop shall not exceed 5% of load's stated voltage.
   b) Voltage drop shall be calculated by first determining resistance of load (R=E/I voltage divided by AMP draw). Next, determine resistance of wire (per below chart). Divide this number by resistance of load. If result exceeds 5%, wire thickness shall be increased.
   c) Wire length shall equal distance to load and back to supply (Lock 50 ft. from power supply; wire length = 100 ft.). Two loads powered by one pair of wires draw double current and have half (50%) of resistance.
   d)

Wire Size	Resistance Per 1,000 Feet
12 Gauge	1.6 OHM
14 Guage	2.5 OHM
16 Guage	4.1 OHM
18 Guage	6.4 OHM
20 Guage	10.1 OHM
22 Guage	16.0 OHM

2. Furnish electromechanical hardware with power supply units, junction boxes, and other accessories needed for a complete, efficient installation.
3. Power Supply Units:

   a) Power supply units shall be designed for electromagnetic locks, electric locking or monitoring exit devices, and/or electric strikes as needed.
   b) Output power shall be field selectable for either 24 volts DC at 1 ampere or 12 volts DC at 2 amperes. Input power shall be 120 volts AC at 0.6 ampere, unless otherwise indicated.
   c) Units shall have a terminal block that shall accept 14 gauge stranded wire.
   d) Enclosure shall be not less than 10" x 10" x 4" deep, constructed of 19 gauge steel with a hinged cover. Provide not less than six, 1/2" knock-out holes for conduit connection.

4. Junction Boxes: NEMA 1

   a) Boxes shall be surface mounted units not less than 10” x 10” x 6” deep with a hinged door equipped with a twist turn lock.
   b) Junction boxes shall have a 20 position terminal strip that shall accept from 24 gauge to 12 gauge wire.

5. Power Transfer Devices:

   a) Provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2” x 4 1/2” butt hinges or 3/4” offset pivots. When door is in closed position, transfer unit shall be concealed.
   b) Transfer units shall contain ten 24 AWG UL approved conductors.
   c) Rating: 10 Amps at 24 VDC (Class 1 low voltage)

B. Electro-Mechanical Locksets:

1. Electro-mechanical locks shall comply with requirements for size, quantity, type, etc., as set forth for non-electric locks and shall conform to ANSI A156.23. Locks shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical locks shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty.

   a) Power Requirements: 1.0 amps; 24 VAC/DC

3. Provide fail secure function, operates as passage set when energized, unless otherwise indicated.

C. Electro-Mechanical Exit Devices:

1. Electro-mechanical exit devices shall comply with requirements for size, quantity, type, etc., as set forth for non-electric devices. Exit devices shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical locks shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty.

   a) Power Requirements: 24 VDC

3. Provide following functions as scheduled:

   a) Fail Safe Function: Operates as passage set when de-energized
   b) Latch Retraction: Upon signal units latch retracted (unlocks)

4. Products: Refer to Hardware Schedule below

D. Control Console:

1. Contractor to supply one custom wall mounted control console similar to Folger Adam #320. Console to have three-position rocker switches with red & green LED's and built in audible alarm with volume control. Unit to have on-board circuit breakers, solid state logic controls and be able to perform functions such as line supervision, latching alarm, interlocking, interlocking override, momentary and alternate action switches. Face plate to be stainless steel.

2.4 CYLINDERS, KEYING SYSTEMS AND KEY CONTROL

A. All cylinders shall be based on the Owner’s Best MX-8 keyway.

B. IR-SSC Representatives shall meet with Architect and Owner to finalize keying requirements and obtain keying instructions in writing as outlined. Locks, cylinders and keys shall be furnished with Best MX-8 full size key sections.

C. Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Owner's Representative prior to occupancy. The Owner or Owner's Security Agent will void the operation of the construction keys.

D. Permanent cylinders shall be keyed by the Stanley Best Service Center or factory, combinated in sets or subsets, master keyed or great grand master keyed, as directed by Owner. Permanent keys and cylinders shall be marked with the applicable blind code for identification. These visual key control marks or codes will not include the actual key cuts. Keys and cylinder identification stamping to be approved by Architect and Owner. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.

1. Permanent IC lock cylinders shall be stamped as follows:

a) Face – One to three digit master coding
b) Side – full core mark identifying number

2. Keys shall be stamped with both the core mark identifying number and the sequential key number

E. Equip locks and cylinders with patent protected, full size cylinders with five nickel silver finger pins. Provide a minimum of six pins with nickel silver bottom pins. Cylinders must allow for multiplex master keying, combinated to Owner's instructions.

F. Supplier shall furnish one Keystone Stanley factory service program that will provide importing and appending information to the owner's current system. Information provided should include data key control system complete with indexed door numbers, key codes, bittings, building numbers, room numbers, lock function, design, and finish. In addition, include model numbers, handing, design, and functions of exit devices and door closers. All documents associated with the key records are to be transmitted to the Owner by secure carrier, return receipt requested.

G. Deliver all end user exclusive permanent key blanks and other security keys direct to Owner's representative from Stanley Best Service Center or factory by secure courier, return receipt requested. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.

H. Key Material: Provide manufacturer's standard embossed keys of nickel silver to ensure durability. Key Quantity: Furnish keys in the following quantities:

1. 25 each Temporary construction keys.
2. 5 each Master keys per master group.
3. 3 each Change keys per cylinder or keyed alike group.

I. Available manufacturers: Subject to compliance with requirements, manufacturers offering the products which may be incorporated in the work include:

1. Stanley-Best Access Systems – Best MX-8 Patented Cylinders

PART 3 - PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:

1. Examine doors, frame, and related items for conditions that would prevent proper application of hardware.
2. Correct conditions detrimental to timely and proper execution of Work.
3. Do not proceed until unsatisfactory conditions have been corrected.
4. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.2 INSTALLATION

A. Prior to installation of hardware, the general contractor shall contact the manufacturers' representatives to arrange and hold a jobsite meeting to instruct and certify the installing contractors' personnel on the proper installation of their respective products. Seminar shall be attended by installers of hardware (including electrical hardware) for aluminum, hollow metal, and wood doors. Training will include the use of installation manuals, hardware schedule, templates and physical product samples. Finish hardware shall be installed in accordance with the reviewed hardware schedule and manufacturer's printed instructions.

B. Upon substantial completion of the manufacturers' representative(s) shall inspect and approve the installation of the products they represent. A comprehensive check list shall be provided to the owner, verifying proper function of change, master and grandmaster keys, cylinders, mechanical and electro=mechanical hardware, doors and frames. Any identified installation or product issues shall be directed to the attentions of the Architect for the purpose of generating the final punch list.

C. General Requirements:

1. Securely install finish hardware items in compliance with accepted schedule and templates furnished with hardware.
2. Provide metal fasteners of type and size which will not work loose as a result of normal door use, and which are compatible with metal materials of hardware item and doors and frames. Provide only smooth exposed fastener heads, which do not constitute a snagging hazard to clothing. Finish of exposed fasteners shall match finish of hardware item.
3. Install mortised items flush with adjacent surfaces.
4. Install locksets, surface mounted closers, and trim after finishing of doors and frames is complete. Wherever cutting and fitting is needed to install hardware onto or into surfaces which are later to be finished, install each item completely and then remove and store in a secure place during finish application. After completion of finishes, reinstall each item.
5. Locate items in compliance with Door and Hardware Institute publication WDHS.3 Recommended Hardware Locations for Wood Flush Doors. Mounting heights shall be measured from finish floor, except top butt.

    a) Butts:
        1) Top: 9 5/8" center of butt to top of door
        2) Intermediate: Equal distance between top and bottom butts
        3) Bottom: 10 3/8" to center of butt

    b) Locksets and Latchsets: 40 5/16" to center of strike
    c) Deadlocks: 60" to center of strike
    d) Exit Devices: 40 5/16" to center of strike
    e) Push Plates: 45" to center
    f) Pull Bars (Grips): 42" to center

D. Interior Stops:

1. Door stops shall be furnished for every door leaf. Install floor-mounted or wall-mounted stops, as scheduled. Overhead door holder shall be provided where floor or wall stops cannot be used. Special arms on door closers do not constitute door stops.
2. Place door stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.
3. Floor stops shall be installed with risers as needed to accommodate finish flooring materials for proper relationship to door.

E. Sliding/Pocket Door Track and Trucks:

1. Sliding doors shall be manually operated sliding door panels. Provide continuous tracks for each sliding door panel. Tracks shall be secured to framing by use of overhead mounting brackets spaced not to exceed 30” (750 mm) on center.
2. Place end blinds over end of track and slide track into mounting bracket.
3. Sliding door panels shall be hung from tracks with one pair of trucks for each sliding panel.
4. Each sliding door panel shall be fitted with two floor guides; one at each end of panel to maintain proper alignment and operation of sliding door panel.
5. Floor guides shall be installed on floor, centered under sliding door panels. Shim and level as needed for smooth operation of sliding door panels.

F. Electro-Mechanical Hardware:

1. Comply with manufacturer’s instructions for wiring, grounding, and shielding.

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service:

1. Supplier of door hardware shall make periodic visits to Site during and at completion of hardware installation for purposes of monitoring compliance with manufacturer’s installation requirements
2. Prepare and submit, to Contractor, Architect, and Owner, a written report of each periodic and final site visits. Report shall be submitted within 3 days following site visits.

B. Operational Test:

1. After installation of fire doors is completed, operational tests shall be conducted on each door.
2. Tests shall be adequate to determine that system has been installed and functions as intended.

3.4 ADJUSTING

A. Final Adjustment:

1. Before final completion, adjust hardware so doors operate in perfect order. Test and adjust hardware for quiet, smooth operation, free of sticking, binding, or rattling. Adjust closers for proper, smooth operation.
2. Exposed hardware shall be carefully cleaned by methods not injurious to finish, immediately preceding occupancy. Replace defective, damaged, or missing hardware.
3. At final completion, properly tag and identify keys and deliver to Owner.

3.5 HARDWARE SCHEDULE

1. MK - McKinney
2. RO - Rockwood
3. SA - SARGENT
4. BE - BEST Locks & Closers
5. HS - HES
6. RF - Rixson
7. NO - Norton
8. PE - Pemko
9. OT - Other
10. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 1040
Description: EXTERIOR EXIT W/ CARD READER

2	Hinge, Full Mortise, Hvy Wt	H T4A3786	US26D	MK
1	Hinge, Full Mortise, Hvy Wt	H T4A3786 QCxx	US26D	MK
1	Rim Exit Device, Storeroom	SG 55 56 72 8804 ETP	US32D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 CPS	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346C		PE
1	Sweep	315CN		PE
1	Threshold	2005AV		PE
1	ElectroLynx Harness	QC-Cxxx		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	by security		OT
1	Power Supply	AQL Series as Required		SU

Notes: Door is normally closed and locked.
When presented with valid credentials, reader unlocks door.
During power failure or fire alarm, door remains locked (fail secure).
REX switch within lock allows free egress at all times.

Set: 2.0

Doors: 1070B
Description: EXTERIOR EXIT W/ CARD READER

2	Hinge, Full Mortise, Hvy Wt	H T4A3786	US26D	MK

1	Hinge, Full Mortise, Hvy Wt	H T4A3786 QCxx	US26D	MK
1	Rim Exit Device, Storeroom	SG 55 56 72 8804 ETP	US32D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 CPS	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346C		PE
1	Sweep	315CN		PE
1	Threshold	2005AV		PE
1	ElectroLynx Harness	QC-Cxxx		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	by security		OT
1	Power Supply	AQL Series as Required		SU

Set: 3.0

Doors: 1072

Description: EXTERIOR STOREROOM LOCK W/ CARD READER

2	Hinge, Full Mortise, Hvy Wt	H T4A3786	US26D	MK
1	Hinge, Full Mortise, Hvy Wt	H T4A3786 QCxx	US26D	MK
1	Fail Secure Lock	LX RX SG 72 8271-24V LNP	US26D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 CPS	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346C		PE
1	Sweep	315CN		PE
1	Threshold	2005AV		PE
1	ElectroLynx Harness	QC-Cxxx		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	by security		OT
1	Power Supply	AQL Series as Required		SU

Set: 4.0

Doors: 1050

Description: CORRIDOR EXIT W/ CARD READER

2	Hinge, Full Mortise, Hvy Wt	H T4A3786	US26D	MK
1	Hinge, Full Mortise, Hvy Wt	H T4A3786 QCxx	US26D	MK
1	Rim Exit Device, Storeroom	SG 55 56 72 8804 ETP	US32D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 CPS	EN	SA

1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-Cxxx		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	by security		OT
1	Power Supply	AQL Series as Required		SU

Notes: Door is normally closed and locked.
When presented with valid credentials, reader unlocks door.
During power failure or fire alarm, door remains locked (fail secure).
REX switch within lock allows free egress at all times.

Set: 4.1

Doors: 1070A
Description: CORRIDOR EXIT W/ 2 CARD READERS

2	Hinge, Full Mortise, Hvy Wt	H T4A3786	US26D	MK
1	Hinge, Full Mortise, Hvy Wt	H T4A3786 QCxx	US26D	MK
1	Rim Exit Device, Storeroom	SG 56 72 8804 ETP	US32D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 CPS	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-Cxxx		MK
1	ElectroLynx Harness	QC-C1500P		MK
2	Card Reader	by security		OT
1	Power Supply	AQL Series as Required		SU

Notes: Door is normally closed and locked.
When presented with valid credentials, reader unlocks door.
During power failure or fire alarm, door remains locked (fail secure).
Card reader on non-keyed side allows authorized egress.

Set: 5.0

Doors: 1002, 1013, 1014, 1016, 1026, 1030, 1031,1033,1036, 1038, 1062, 1064, 1066, 1074, 1087
Description: FAIL SECURE LOCK

2	Hinge, Full Mortise	H TA2714	US26D	MK
1	Hinge, Full Mortise	H TA2714 QCxx	US26D	MK
1	Fail Secure Lock	LX RX SG 72 74 8271-24V LNP	US26D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 O / P10	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US26D	RO
3	Silencer	608-RKW		RO

1 ElectroLynx Harness	QC-Cxxx		MK
1 ElectroLynx Harness	QC-C1500P		MK
1 Card Reader	by security		OT
1 Power Supply	AQL Series as Required		SU

Notes: Door is normally closed and locked.
When presented with valid credentials, reader unlocks door.During power failure or fire alarm, door remains locked (fail secure).
REX switch within lock allows free egress at all times.

Set: 6.0

Doors: 1089

Description: STOREROOM LOCK PAIR

6 Hinge, Full Mortise	H TA2714	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	555	US26D	RO
1 Storeroom/Closet Lock	SG 72 8204 LNP	US26D	SA
1 SFIC CORE	by owner		BE
2 Surf Overhead Stop	10-x36	630	RF
2 Silencer	608-RKW		RO

Set: 7.0

Doors: 1076

Description: STOREROOM LOCK W/ CLOSER

3 Hinge, Full Mortise	H TA2714	US26D	MK
1 Storeroom/Closet Lock	SG 72 8204 LNP	US26D	SA
1 SFIC CORE	by owner		BE
1 Surface Closer	281 O / P10	EN	SA
1 Kick Plate	K1050 10" x 2" LDW	US32D	RO
1 Wall Stop	409	US26D	RO
3 Silencer	608-RKW		RO

Set: 8.0

Doors: 1021, 1023, 1025, 1027, 1029, 1031, 1044, 1056, 1058, 1078, 1082, 1083, 1084, 1086, 1088, 1090, 1092

Description: BARN DOORS

1 Hardware	by AD Systems	OT

Set: 9.0

Doors: 1010A, 1010B, 1043

Description: FAIL SECURE LOCK W/ CLOSER

2	Hinge, Full Mortise	H TA2714	US26D	MK
1	Hinge, Full Mortise	H TA2714 QCxx	US26D	MK
1	Fail Secure Lock	LX RX SG 72 8271-24V LNP	US26D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 O / P10	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US26D	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-Cxxx		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	by security		OT
1	Power Supply	AQL Series as Required		SU

Set: 10.0

Doors: 1052, 1054
Description: PRIVACY LOCK W/ CLOSER

3	Hinge, Full Mortise	H TA2714	US26D	MK
1	Privacy Lock	SG V20 74 8265 LNP	US26D	SA
1	Surface Closer	281 O / P10	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US26D	RO
3	Silencer	608-RKW		RO

Set: 10.1

Doors: 1012, 1024, 1028
Description: PRIVACY LOCK W/ AUTO OPENER

3	Hinge, Full Mortise	H TA2714	US26D	MK
1	Privacy Lock	SG V20 74 8265 LNP	US26D	SA
1	Electric Strike	1600-CS	630	HS
1	Automatic Opener	6000 Series as Required	689	NO
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US26D	RO
3	Silencer	608-RKW		RO
2	Door Switch	505		NO
1	Power Supply	AQL Series as Required		SU

Set: 11.0

Doors: 1042
Description: PASSAGE LATCH W/ CLOSER

3	Hinge, Full Mortise	H TA2714	US26D	MK
1	Passage Latch	SG 8215 LNP	US26D	SA
1	Surface Closer	281 O / P10	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US26D	RO
3	Silencer	608-RKW		RO

Set: 12.0
Doors: 1015
Description: CLASSRM W/ CLOSER

3	Hinge, Full Mortise	H TA2714	US26D	MK
1	Classroom Lock	SG 72 8237 LNP	US26D	SA
1	SFIC CORE	by owner		BE
1	Surface Closer	281 O / P10	EN	SA
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US26D	RO
3	Silencer	608-RKW		RO

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass products.
      a. Clear Monolithic (GL1).
   2. Insulating, laminated glazing (exterior).
      a. IGU1: Clear, Insulated, Laminated.
         1) Windborne Debris Impact Resistant.
         2) Building-Security: Resistance against Manual Attack.
      b. IGU2: Frosted, Insulated, Laminated.
         1) Windborne Debris Impact Resistant.
         2) Building-Security: Resistance against Manual Attack.
   3. Glazing sealants.
   4. Glazing tapes.
   5. Miscellaneous glazing materials.

1.2 RELATED WORK

A. Section 08 11 13 "Standard Steel Doors and Frames"

B. Section 08 14 12 "Plastic-Laminate-Faced Flush Wood Doors"

C. Section 08 44 13 "Glazed Aluminum Curtain Walls" for impact resistant curtain wall frames.

D. Section 08 14 73.40 "Sliding Door Assemblies"

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each of the glazing types indicated on this project; 12 inches square.

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, glass testing agency and sealant testing agency.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
   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. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

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 C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Install glazing in mockups specified in Division 01 Section “Mockups,” Section 08 41 13 "Aluminum-Framed Entrances and Storefronts," to match glazing systems required for Project, including glazing methods.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Use ASTM C1087 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.
   2. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Flat Glass Products: Manufacturer agrees to replace glass units that are defective as the result of the material manufacturing and/or the fabrication process.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 12 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: 12 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 12 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Low-E Coated Insulated Laminated Glazing Unit Product:
   1. Viracon; VRE1-4725

B. Glass Fabricators of Flat Glass Materials:
   1. Cristacurva
   2. Oldcastle Glass
   3. Tristar Glass, Inc
   4. Trulite

C. Source Limitations for Glass: Obtain each type of glass from single fabricator.

D. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
   1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.
      a. Wind Design Data: As indicated on Drawings.
   2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/175 times the short-side length or 1 inch, whichever is less.
   3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

D. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 2 for basic protection.
   1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.

E. Forced Entry Protection: ASTM F1233 Standard Test Method for Security Glazing Materials and Systems for Forced Entry. Class 1.4, minimum.
   1. Class 1.4, minimum.

F. Security Glazing: Glass in Building-Security Glazing-Testing and Classification of Resistance against Manual Attack.
   1. EN356 Level 6.

G. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

H. Thermal Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
   5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.

I. Optical Performance Properties:
   1. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.
   2. Optical Distortion Limits:

a. Milli-Diopter (mD) flatness criterion where 95 percent of glass surface is not to exceed +/- 100 millidiopters. 95th percentile reporting maximum allowable values are as follows:
   1) 95 / 100A for 1/4″ to 3/8″ clear and low-iron substrates.
   2) 95 / 125A for other substrates.
b. Alternate Criterion:
   1) Maximum peak-to-valley roll wave 0.003 inch (0.08 mm) in the central area of the glass lite, and 0.008 inch (0.20 mm) within 12 inches (305 mm) of the leading and trailing edge of the lite, measured in accordance with ASTM C 1651.
   2) Maximum center-kink of 0.001 inch (0.025 mm) when roll wave is measured over the surface of the glass perpendicular to the direction of travel through the heat treatment furnace.
   3) Maximum localized and overall bow (warp) per lite shall each be one-half of maximum allowed by ASTM C 1048.
   4) Measure glass lites for optical distortion using Osprey® (version 7 or higher, by Lite Sentry) online distortion measurement system (or equivalent approved in writing by industrial coated glass supplier). Retain test reports for three years following substantial completion. Submit test reports upon Architect's request.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 6 mm.

E. Strength: Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
   1. Location: Plies of laminated glazing, where assembly complies with 16 CFR 1201, Category II.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. Comply with performance requirements for Optical Distortion Limits.
   3. Do not heat-soak tempered glass.

C. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Products: Subject to compliance with requirements, provide SentryGlas, as manufactured by Kuraray America, Inc.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with performance requirements, and to maintain overall unit thickness parameters required for framing system indicated.
   3. Interlayer Color: Clear, except where indicated to be translucent to meet privacy intent.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
   2. Perimeter Spacer: Thermally broken aluminum.
   3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:
   1. EPDM with Shore A durometer hardness of 85, plus or minus 5.
   2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:
   1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:
   1. EPDM with Shore A durometer hardness per manufacturer's written instructions.
   2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 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, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove non-permanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. GL1: Clear Glass: Fully tempered float glass
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required

3.9 INSULATING-LAMINATED-GLASS SCHEDULE

A. IGU1: Low-E-Coated, Clear Insulating Laminated Glass
   1. Overall Unit Thickness: 1-1/2 inch.
   2. Outdoor Lite: Clear, fully-tempered glass.
      a. Minimum Thickness of Outdoor Lite: 6 mm.
      b. Surface #2: Low-e coating.
   3. Interspace Content: Argon.
   4. Thermal Spacer: 1/2 inch.
   5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
      a. Minimum Thickness of Each Glass Ply: 6 mm.
      b. Interlayer Type: Clear Ionoplast (SentryGlas)
      c. Interlayer Thickness: 0.180 inch.
   6. Safety glazing required.

B. IGU2: Low-E-Coated, Translucent Insulating Laminated Glass
   1. Overall Unit Thickness: 1-1/2 inch.
   2. Outdoor Lite: Clear, fully-tempered glass.
      a. Minimum Thickness of Outdoor Lite: 6 mm.
      b. Surface #2: Low-e coating.
   3. Interspace Content: Argon.
   4. Thermal Spacer: 1/2 inch.
   5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
      a. Minimum Thickness of Each Glass Ply: 6 mm.
      b. Interlayer Type: Translucent Ionoplast.
         1) Basis of Design: SentryGlasTranslucent White (TW)
      c. Interlayer Thickness: 0.180 inch.
   6. Safety glazing required.

END OF SECTION

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior partitions.
   2. Suspension systems for interior ceilings and soffits.
   3. Grid suspension systems for gypsum board ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts, limitations and type of fasteners.

1.3 INFORMATIONAL SUBMITTALS

A. Installer Qualifications.

B. Product Certificates: For each type of code-compliance certification for studs and tracks.

C. Manufacturer's height limiting tables indicating products provided based on:
   1. Composite framing.
   2. Non-composite fully braced: Gypsum board on both sides of stud stop maximum 12 inches below top track.
   3. Non-composite fully braced: Bracing spacing above gypsum board on both sides of stud is less than Lu.
   4. Non-composite: Bracing spaced at 48 inches on center with gypsum board on one side.

D. Studs and runners: Provide documentation that framing member's certification is according to:
   1. SFIA's Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members based on checking mechanical properties, coatings, dimensions and labeling per:
      a. IBC 2015: AISI S220 and ASTM C645, Section 10 Screw Penetration test for studs and tracks, all other comply with AISI S220.
      b. IBC 2018: AISI S220.
      c. IBC 2021: AISI S220.
   2. SSMA's Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members based on checking mechanical properties, coatings, dimensions and labeling per:
      a. IBC 2015: AISI S220 and ASTM C645, Section 10.
      b. IBC 2018: AISI S220.
      c. IBC 2021: AISI S220.
   3. CSSA's Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members based on checking mechanical properties, coatings, dimensions and labeling per:
      a. IBC 2015: AISI S220 and ASTM C645, Section 10.
      b. IBC 2018: AISI S220.
      c. IBC 2021: AISI S220.

E. Evaluation Reports: For firestop tracks, submit evaluation reports certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria for inspection agencies, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Installer qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience

B. Single-Source Responsibility for Steel Framing: Obtain steel framing members from a single manufacturer, unless otherwise noted.
   1. Furnish framing materials in accordance with SSMA – Product Technical Information

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association.
   1. CSSA: Certified Steel Stud Association.
   2. Steel Framing Industry Association.
   3. SSMA: Steel Stud Manufacturer’s Association.

D. Perform work in accordance with ASTM C754.

E. Provide anti-corrosive coating that comply with SCAQMD Rule 1113, Architectural Coatings, amended June 3, 2011.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cemco Steel Framing and Metal Lath
   2. ClarkDietrich (Basis of Design)
   3. The Steel Network, Inc

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
   1. Dynamic Head-of-Wall Assemblies (HW-D): Vertical deflection assemblies provided in fire-resistance-rated assemblies as indicated, labeled and listed by UL, Warnock Hersey or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

1. Horizontal Deflection where tile is installed: L/360, with a minimum load of lbf/sq.ft.

D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

E. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

F. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of ½ inch

2.3 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.
1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated.
2. Provide G60 hot-dip galvanized coating where framing members are in direct contact with masonry or concrete surfaces.
3. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
   a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
   b. Do not exceed the VOC content limit established in SCAQMD Rule 1113, Architectural Coatings, amended February 6, 2016.
      1) Max VOC Content: 100 g/L

B. Studs and Track: AISI S220.
1. Product: ClarkDietrich; ProSTUD Drywall Framing System with Smart Edge technology or comparable product.
2. Thickness: 30 mil (20-gauge Drywall), minimum thickness, 0.0296 inches, design thickness 0.0312-inch, minimum yield, 33 ksi Depth: As indicated on Drawings.
   a. At walls with ceramic tile provide: 33 mil (20 gauge Structural), minimum thickness 0.0329 inches, design thickness 0.0346-inch minimum yield, 33 ksi.
3. Depth: As indicated on Drawings
4. Track: 1-1/4 inch in metal matching thickness of stud.

C. Slip-Type Head Joints: where indicated, provide the following:

D. Deflection Tracks/Clips: AISI S220. Width of clip to match depth of stud. Clip shall be manufactured from steel conforming to ASTM A653A, Grade 50, Class 1, 50 KSI minimum yield strength, 65 KSI minimum tensile strength, G-60 hot-dipped galvanized coating. Clips shall be designed for positive attachment to structure and stud web using step bushing to provide frictionless vertical movement. Provide clips with attached bushing and screws. At sloping beams and roof deck, bend horizontal leg as required so that vertical leg remains plumb. Use only deflection connection products that comply with ICC Acceptance Criteria AC261 such as Report No. ESR-1903 (or equivalent). Site fabricated clips are not permitted.
1. Basis of Design: Subject to compliance with requirements, provide VertiClip SLD angle or VertiTrack VTD, as manufactured by The Steel Network
   a. ClarkDietrich; MaxTrak Slotted Deflection Track
   b. MBA Building Supplies; FlatSteel Deflection Track
2. Thickness: 33 mils
3. Depth: 1-1/2 inches by 3 inches slotted leg
4. Material Specifications: ASTM A1003/A1003M Structural Grade 33 Type H, (ST33H): 33ksi minimum yield strength, 50ksi minimum tensile strength, 33 mil minimum thickness (20-

gauge, 0.0329-inch Min. Thickness, 0.0346-inch design thickness,) with ASTM C955 CP60 coating

5. At fire rated partitions provide a top runner that allows the partition head to expand and contract with movement of the structure while maintaining continuity of the fire-resistance-rated assembly indicated, in thickness not less than indicated for studs and in a width to accommodate depth of the studs. Comply with UL 2079. Refer to Section 07 84 00 Firestopping for approved fire stop materials.

E. Deflection Channel: At Head of Wall details UL HW-D-0529 and HW-D-0530 for installation at Pre-Engineered Metal Buildings, provide minimum 16 gage steel U-shaped deflection channels with 5-inch flanges

F. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
   a. Fire Trak Corp; Fire Trak System w/ Fire Trak PosiKlip
   b. ClarkDietrich; BlazeFrame

G. Flat Steel Plate: Steel sheet complying with ASTM A653 or ASTM A568 with minimum base steel thickness as follows:

1. Thickness: 54 mils, (16 gauge) minimum thickness 0.0538 inches, 33 ksi steel.
2. Width: 6 inches, unless noted otherwise.
3. Length: 10 feet.

H. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As Indicated on Drawings
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

I. Steel Rigid Furring Channels: AISI S220, hat shaped, depth and minimum base thickness of base (uncoated) metal as follows:

1. Product: ClarkDietrich; Furring Channel or comparable product.
2. Thickness: 30 mils, (20 gauge) minimum thickness 0.0296 inches, unless otherwise noted on Drawings.
3. Depth: 7/8 inch or 1 1/2 inches, unless otherwise indicated

J. Steel Z-Furring: ASTM C645, depth and minimum base thickness of base (uncoated) metal as follows:

1. Thickness: 30 mils, (20 gauge) minimum thickness 0.0296 inches, unless otherwise noted on Drawings.
2. Depth: Match thickness of board insulation

K. Clip Angles: 30 mils, (20 gauge) minimum thickness 0.0296 inches, 33 ksi steel. Size as shown on Drawings.

L. Radiused track: Galvanized track G60 coating in accordance with ASTM A653, 30 mil, minimum thickness 0.0296 inches, 2 ½, 3 5/8 inch and 6 inches Flex-C Trac with galvanized sliding steel strap as manufactured by Flex-Ability Concepts or 360TRAK manufactured by ClarkDietrich.

2.4 SUSPENSION SYSTEMS

A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123

B. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

C. Hanger Attachments to Concrete:
   1. Powder-Actuated Anchors: Federal Specification FF-P-395b. Manufactured from AISI 1062 or 1065 steel, austempered to a minimum core hardness of 50 to 54 HRC and zinc plated in accordance with ASTM B 633. Provide fasteners listed or approved by one or more of the following and of type, diameter and length as required by structural design calculations:
      a. Underwriters Laboratory.
      b. Factory Mutual.
      c. International Code Council (ICC).

D. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

E. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch base-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
   2. Steel Studs and Tracks: AISI S220.
      a. Minimum Base-Steel Thickness: 0.0269 inch.
      b. Depth: 1-5/8 inches.
   3. Hat-Shaped, Rigid Furring Channels: AISI S220, 7/8 inch deep.
      a. Product: ClarkDietrich; Hat-Shaped, Rigid Furring Channels or comparable product.
      b. Minimum Base-Steel Thickness: 0.0296 inch.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
      a. USG Drywall Suspension System, Heavy-Duty
         1) Main Tee: DGLW-26
         2) Cross Tee: DGLW424 w/ DGLW224
         3) Molding: DGWM-24
         4) DGSC-180 Splice Clip
      b. Armstrong Drywall Grid System, Heavy-Duty
      c. Rockfon Chicago Metallic Drywall Grid

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Provide screw type and size as required by structural design calculations for the specific condition and thickness of materials being joined.
      a. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
   2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
   3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board, including the following types:
      a. Paper-Faced Gypsum Board, Type X
      b. Glass Mat, Water-Resistant Mold-Resistant Interior Wall Panel
      c. Paper-Faced Gypsum Board Moisture and Mold Resistant
   2. Tile backing panels.
   3. Trim accessories.
   4. Partition Gap Closure Assembly.
   5. Sound-attenuation Blankets

1.2 RELATED WORK

A. Section 07 84 00 "Firestopping Systems" for UL listed joint firestopping systems for head of wall at rated gypsum board partitions.

B. Section 09 30 00 "Tiling" for products required to be installed with tile backer board product as part of Warrantied installation.

C. Section 09 91 23 "Interior Painting" for finish system intended to be installed on exposed tile backing panel at shower ceilings.

D. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Gypsum board, Type X.
   2. Glass Mat, Water-Resistant Mold-Resistant Interior Wall Panel.
   3. Paper-Faced Gypsum Board, Moisture and Mold Resistant.
   4. Submit tile backing panels and joint treatment materials concurrently with submittals required in Section 09 30 00 "Tiling."
   5. Interior trim.
   6. Joint treatment materials.
   7. Sound-attenuation blankets.

1.4 INFORMATIONAL SUBMITTALS

A. UL Listings and fire rating for each assembly submitted.

B. Provide Acoustic Performance of each assembly.

1.5 QUALITY ASSURANCE

A. Steel shaft wall studs shall be approved for use with the gypsum panel products listed in this section.

B. Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

C. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
   1. Fire-Resistance Ratings: As indicated in UL “Fire Resistance Directory” or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

D. Fire-Test Response Characteristics: At fire-resistance-rated gypsum board assemblies, provide assemblies that comply with the following requirements:
   1. Dynamic Head-of-Wall Assemblies (HW-D): Vertical deflection assemblies provided in fire-resistance-rated assemblies as indicated, labeled and listed by UL, Warnock Hersey or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Provide products by one of the manufacturers listed below, in accordance with UL Design Number U465 for one-hour fire-rated wall assemblies, UL Design Number U411 for two-hour fire-rated wall assemblies and non-rated assemblies unless otherwise noted

2.3 INTERIOR GYPSUM BOARD

A. Paper Faced Gypsum Wall Board: Fire-resistive Type X: ASTM C1396/C1396M.

1. Basis of Design: Subject to compliance with requirements, provide one of the following:
   a. American Gypsum Company, LLC: FIREBLOC Type X.
   b. Georgia-Pacific Gypsum, LLC: ToughRock Fireguard X.
   c. National Gypsum Co.: Gold Bond Fire-Shield Gypsum Board.
   d. United States Gypsum Co.: Sheetrock Brand Firecode X Panels.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Glass Mat, Water-Resistant Mold-Resistant Interior Wall Panel: Coated inorganic glass mat-faced, water-resistant, treated core gypsum wall board.
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. Georgia-Pacific Gypsum, LLC: DensArmor Plus Fireguard Interior Panel
      b. National Gypsum Company: Gold Bond Brand eXP Fire- Shield Interior Extreme Gypsum Panel
      c. USG: Sheetrock Brand Glass-Mat Interior Panels Mold Tough Firecode X
   2. Core: 5/8 inch, Type X.
   3. Long Edges: Tapered.
   4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
   5. Use mold and moisture resistant joint treatment with this board
   6. See Alternate Waterguard ½ inch.

C. Moisture and Mold Resistant Paper Faced Gypsum Wall Board: Fire-resistive Type X, ASTM C1396 and as follows:
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum Company, LLC: M-Bloc 5/8 inch Type X with mold and moisture resistance.
      b. National Gypsum Co.: Gold Bond XP Fire-Shield gypsum board.
      c. United States Gypsum Co.: Sheetrock Brand Mold Tough panels, Firecode X.
   2. Core: 5/8 inch, Type X.
   3. Long Edges: Tapered.
   4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
   5. Use mold and moisture resistant joint treatment with this board

2.4 TILE BACKING PANELS

A. Water-resistant treated core with glass mat moisture-protectant coating and glass mats, both sides. The face is surfaced with heat-cured copolymer water-resistant coating.
   1. Basis of Design: Subject to compliance with requirements, provide one of the following:
      a. Georgia Pacific Gypsum, LLC; DensShield Fireguard Tile Backer
      b. National Gypsum Co.; Gold Bond Brand eXP Fire-shield Tile Backer
      c. USG; Durock Brand Glass-Mat Tile Backer Board, Type X
      d. CertainTeed; SAINT-GOBAIN; Diamondback; GlasRoc Tile Backer
   2. Core: 5/8 inch, Type X.
   3. Moisture-resistant treated core with moisture and mold-resistant treated paper facings on front, back and long edges.
      a. Board shall achieve a score of 10 per ASTM D3273.
   4. Locations:
      a. Walls scheduled to receive tile.
      b. Ceilings in showers.
   5. Use mold and moisture resistant joint treatments with this board. Where tile is installed use mortar used to set tile to treat fasteners and panel joints

2.5 TRIM ACCESSORIES

A. Provide the following as alternate pricing to 3-inch glass-mat faced base of wall strip:

1. Product: Waterguard ½ inch high profile. Specifications | WaterGuard USA (waterguard-usa.com)
   a. At non-rated walls: Provide ½" tall extruded PVC GDW moisture guard: installed continuously at floor level of all GDW throughout building.
   b. 1-hour rated walls: Provide 1/2" tall extruded PVC GDW moisture guard installed continuously at floor level of all 1-Hour Fire Rated walls.
   c. 2-hour fire rated walls: Provide 1/2" tall extruded PVC GDW moisture guard: installed continuously at floor level of each layer of GDW on all 2-Hour Fire Rated walls and once the wall assembly is constructed, place a bead of caulk (latex, acrylic, silicone, polymer, or similar materials-not necessarily listed "fire caulk") at floor level against the outer most layer of moisture guard.

B. Standard Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.
      a. At tile backer board installed in areas scheduled to be tiled, imbed glass fiber tape in mortar used to install tile

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
      a. Basis of Design: USG Sheetrock Brand Tuff-Hide primer surfacer

D. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

E. Joint Compound for Head of Wall Exposed and Concealed Joints
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions

of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
a. Hilti CP 572 Smoke and Acoustic Spray
1) VOC content: 91 g/L. Meet maximum VOC content: 250 g/L.
2) Install at head of wall conditions with Hilti CP 767 Speed Strips, CP 777 Speed Plugs and OwensCorning Thermafiber SAFB

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Basis of Design: Subject to compliance with requirements, provide
a. CertaPro AcoustaTherm Batts, Certainteed Corporation.
b. Unfaced formaldehyde-free batt insulation, Johns Manville
c. EcoBatt with ECOSE Technology thermal/acoustical insulation, Knauf Insulation
d. EcoTouch Pink Fiberglass Insulation, Owens Corning
2. Flame spread/Smoke developed: 25/450
3. Installed Thickness:
a. 3 1/2 inches at 3 5/8 inch metal studs.
b. 6 inches at 6 inch metal studs

D. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

E. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form and install control and expansion joints at locations indicated on Drawings, and as follows with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
   1. Ceilings: Install joints in ceilings exceeding 900 square feet in area. The distance between ceiling control joints shall not exceed 30 feet in either direction. Install control joints where ceiling framing or furring changes direction.
   2. Partitions, walls and wall furring: Install joints in partitions, walls and wall furring with runs exceeding 30 feet. Distance between control joints shall not exceed 30 feet, and control joints shall be installed where an expansion joint occurs in the base exterior wall.
   3. At all door frames, provide control joints at each corner of the door frame and extend joints from top of frame up to bottom of structural deck. At all door frames located in interior partitions, locate control joints on both sides of partitions. At door frames on exterior walls provide control joints on interior side.
      a. Where temporary framed entrances are installed in gypsum board wall assemblies during construction, comply with the above requirement for placement of control joints.
   4. At all window frames, provide control joints at each corner, starting at the floor line and extending up to the structure. At all window frames located in interior partitions, locate control joints on both sides of partitions and extend up to bottom of structure/deck. At window frames on exterior walls provide control joints on interior side.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. At non-rated, non-load-bearing partitions that extend to the underside of the floor/roof deck, isolate perimeter of the gypsum board partitions at structural abutments and floor/roof deck, as detailed. Provide 1/2 inch wide spaces at these locations. Seal joints between items covered with cementitious fireproofing, abutting structural surfaces, floor/roof deck etc. with acoustical sealant, unless otherwise noted.

H. At fire-rated non-load-bearing partitions, terminate the gypsum panels 1/2 inch below the bottom/sides/top of the cementitious fireproofing on beams, joist, floor/roof deck where fireproofing is installed and 1/2 inch below the bottom/sides/top of beams, joists, floor/roof deck where fireproofing is not installed. Refer to UL head wall assemblies HW-D-0042 and HW-D-0049 for steel decks and HW-D-0083 for concrete decks in the UL Fire Resistance Directory

I. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

J. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

K. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both

faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

L. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Glass Mat, Water-Resistant Mold-Resistant Interior Wall Panel: Installed as 3-inch wall base strip, typical all gypsum board walls
   2. Paper-Faced, Type X: Vertical wall surfaces above 3-inch base strip, and ceiling surfaces unless otherwise indicated.
   3. Paper-Faced, Mold-Resistant Type X: Vertical wall surfaces above 3-inch base strip, and ceilings in Toilet Rooms, Mechanical Rooms, Non-tile wet locations.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Install tile backer board panels around the perimeter of all tub/shower walls, janitor closets, ceilings of showers and all areas scheduled to be tiled. Install with coated surface away from studs. Locate edge joints parallel to and on framing. Stagger intermediate end joints of adjacent lengths. Secure boards to studs with Type S-12 bugle head, self-tapping, rust resistant, fine thread minimum 1 5/8-inch screws at 6 inches o.c or type of fastener recommended by board manufacturer. At light gauge framing provide Type S, bugle self-tapping rust-resistant 1 1/4 inch screws at 6 inches o.c.or type of fastener recommended by board manufacturer. Butt ends and edges. Install with 1/4-inch open space where panels abut other construction or penetrations. Seal ends, cut edges and penetrations of each piece with water-resistant adhesive or where recommended by board manufacturer with water-resistant joint compound. Panels shall be installed horizontally
   1. Where ceilings are installed, extend tile backer board to ceiling leaving a 1/8-inch gap at corner.
   2. Where ceilings are not installed, extend tile backer board up to the underside of the floor/roof deck.
   3. Wet non-tile areas (ceilings of showers).

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. Bullnose Bead: Use where indicated.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated.
   5. U-Bead: Use where indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
   1. Level 1: For ceiling plenum areas and concealed areas unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies
   2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
      a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
   3. Level 5: For walls exposed to view where epoxy, gloss and semi-gloss paints are applied to gypsum board surfaces, and where required by wall covering manufacturer's specified in Section 09 72 00 "Wall Coverings."
      a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.7 PARTITION IDENTIFICATION

A. Rated Partitions: Identify fire rated partitions above ceiling finish to indicate extent of fire rated partitions. Where multiple rated spaces intersect larger space or corridor, identify with vertical line above ceiling to mark location of rated assembly beyond.

B. For Healthcare: Identify rated partitions and smoke stop partitions required to have protected openings with permanent signs or stencils above ceilings and in concealed spaces.
   1. Partitions to be identified:
      a. Rated corridor partitions.
      b. Smoke stops partitions.
      c. Horizontal exit partitions.
      d. Exit enclosures.
      e. Fire rated walls with protected openings.

C. Stencil with minimum 3-inch-high red lettering with minimum 3/8-inch stroke “FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS” every 20’-0”.

D. Identification to be done in a manner acceptable to the authority having jurisdiction.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 30 00 - TILING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Porcelain floor tile (CT-21).
      a. Large Format.
   2. Wall tile (CT-3, CT-9, CT-10).
      a. Tile Wall Base (CTB-3, CTB-9, CTB-10)
   3. Threshold (TS-3).
   4. Waterproofing membranes.
   5. Setting Materials.
   6. Grout Materials (G-9, G-11).
   7. Metal Transition Strips.
   8. Joint Sealant.

1.2 RELATED WORK

A. Section 09 29 00 "Gypsum Board" for tile backer board product installed as part of a Warrantied tile installation.

B. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.4 Tiling and Appendix and 9.12 Base and Threshold February 2024.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
   2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
   3. Installer employs only Ceramic Tile Education Foundation Certified Installers for Project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

A. System Warranty (Tile and Stone Installation Systems): Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period. Warranty includes floor prep, waterproofing membrane, setting materials, grout materials, and joint sealant.
   1. Warranty Period: 25 years from date of Product Purchase.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
   2. Obtain waterproof membrane from manufacturer of setting and grouting materials.
   3. Obtain joint sealant products form manufacturer of setting and grouting materials, or as recommended in writing by manufacturer for warrantied installation indicated.

2.2 PRODUCTS, GENERAL

A. Refer to “List of Finishes” as shown on the Drawings for each wall tile, floor tile and quarry tile product specified including manufacturer, composition, size, thickness and color.

B. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

C. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

A. Porcelain Floor Tile Type
   1. Basis of Design: Subject to compliance with requirements, provide product indicated on List of Finishes.
   2. Certification: Tile certified by the Porcelain Tile Certification Agency.
   3. Face Size: As indicated on List of Finishes.
   4. Thickness: As indicated on List of Finishes.
   5. Face: Plain with square or cushion edges.
   6. Dynamic Coefficient of Friction: Not less than 0.42.
   7. Tile Color: As indicated on List of Finishes.
   8. Grout Color (G-9, G-11): As indicated on List of Finishes.
   9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

B. Wall Tile Type
   1. Basis of Design: Subject to compliance with requirements, provide product indicated on List of Finishes.
   2. Module Size:As indicated on List of Finishes.
   3. Face Size Variation: Rectified.
   4. Thickness:As indicated on List of Finishes.
   5. Face: Plain with modified square edges or cushion edges.
   6. Tile Color and Pattern: As indicated on List of Finishes.
   7. Grout Color (G-9, G-11): As indicated on List of Finishes.

8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. Base: Coved Tile Base with surface bullnose top edge, face size indicated on List of Finishes.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
    1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Solid-Surface Thresholds: Homogeneous-filled plastic resin complying with ISFA-02-01.
    1. Description:
        a. Thickness: As indicated on Drawings
        b. Type: Standard type unless Special Purpose type is indicated.
        c. Colors and Patterns: As indicated on List of Finishes.

2.5 WATERPROOF MEMBRANES

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid Applied Waterproofing/Crack Isolation Membrane (Non-Shower Wet Areas): Manufacturer’s standard factory-prepackaged, job-mixed, proprietary self-curing fluid and reinforcing fabric which meets ANSI A118.10 and is IAPMO listed for use as a waterproofing shower pan liner.
    1. Basis of Design
        a. Laticrete Hydroban waterproof membrane; Laticrete International, Inc.
            1) VOC content: 2.39 g/L.

2.6 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
    1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
    2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
    3. Latex Additive: Manufacturer's standard acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
    4. Portland Cement: ASTM C150, Type 1, Grey.
    5. Aggregate: Sand in accordance with ASTM C144 for mortar and grout. Fine sand shall be clean, graded and shall pass a 16-mesh screen.
    6. Hydrated Lime: ASTM C206, Type S or ASTM C207, Type S.
    7. Water: Clean and Potable.
    8. In lieu of providing site-mixed mortars, the following factory pre-blended mortar mix may be used for the applications specified:
        a. Laticrete; 3701 Fortified Mortar Bed.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4, ANSI A118.11. Note: The use of organic adhesives complying with ANSI A136.1 will not be allowed.

1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
    a. Laticrete International Inc; 254 Platinum.

C. Latex-Portland Cement Mortar (Large Format Tile): ANSI A118.4HT, ANSI A118.11, ANSI A118.15. Provide products from the following manufacturers and complying with the ANSI and ISO 13007 standards indicated. Note: The use of organic adhesives complying with ANSI A136.1 will not be allowed.
    1. Product/Manufacturer:
        a. 4-XLT/Laticrete International, Inc.
            1) Standards: ANSI A118.4, A118.15 and ISO 13007 C2TES2
            2) VOC content: 2.56 g/L.

2.7 GROUT MATERIALS

A. Commercial grade water-cleanable epoxy grout: ANSI A118.3 and ISO 13007 Classification R2/RG, R2: Reaction Resin Adhesive, improved, RG: Reaction Resin Grout; color(s) as selected from manufacturer's standard colors.
    1. Use: All locations floors and walls unless noted otherwise, for grout joints 1/16 inch to 3/8 inch
    2. Product/Manufacturer:
        a. SpectraLOCK Pro Premium/Laticrete International, Inc.
            1) Standards: ANSI A118.3 and ISO 13007 Classification RG and EN.
            2) VOC content: 0.031 g/L.
            3) Colors: As indicated on List of Finishes
    3. Locations: Typical floor and wall tile grout.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.
    1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
        a. Schluter Systems; Profiles indicated on Drawings.
            1) Floor Edge Protection (Transitions)
            2) Wall Edge Protection: Outside Corners, Transition in wall finish.
            3) Cove Shaped Profile: Wall to Floor Transition.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Release Agent: Recommended by manufacturer of grout for use during construction to prevent grout staining of installed tile.

E. Sealant for Floor Tile: 100% Silicone sealant with integral color shall comply with ASTM C920, Single, Multi-Component or Pourable, Use T, Uses M and G as recommended by tile manufacturer for sealing joints in floor tile. Color of sealant to match grout color.
   1. Product/Manufacturer:
      a. Laticrete; Latasil.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108

series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors consisting of tiles 8 by 8 inches or larger.
   c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Pressed Floor Tile: 1/4 inch.
2. Glazed Wall Tile: 1/8 inch.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Comply with TCNA EJ171 "Movement Joint Guidelines for Ceramic, Glass, and Stone Tile."

H. Thresholds: Install solid surface thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set or improved modified dry-set mortar (thinset).
2. Do not extend waterproof membrane under thresholds. Fill joints between such thresholds and adjoining tile set on waterproof membrane with elastomeric sealant.

I. Metal Edge Strips: Install at locations indicated.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

B. Comply with Section 09 29 00 “Gypsum Board” and manufacturer's instructions to meet Warranty requirements.

3.5 INSTALLATION OF WATERPROOFING SYSTEMS

A. Install waterproofing membrane in compliance with waterproofing manufacturer's instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate. Install all required flashings at corners and wall to floor edges.

B. Where waterproofing are intended to be installed full coverage, tying in to floor drain assemblies with integral flanges or adapter kits for a seamless transition.

C. Extend waterproofing membrane up walls a minimum of 3 inches, under wall base. Overlap with waterproofing installed as part of wall tile assemblies, where wall tile is indicated.

D. Waterproofing system manufacturer to be present during installation.

E. Do not install mortar bed and or tile over waterproofing until waterproofing has been tested in accordance with ASTM D5957 to determine that it is watertight.

3.6 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete slabs-on-grade and suspended slabs.
   1. TCNA F121 and ANSI A108.1B: Concrete subfloor, unbonded cured Portland cement mortar bed (thickset) with waterproofing membrane.
      a. Cleavage Membrane.
      b. Mortar Bed, Reinforced.
      c. Waterproof Membrane: ANSI A108.13.
      d. Bond Coat: Latex-Portland Cement Mortar, ANSI A108.5.
      e. Grout: Epoxy Grout, ANSI A108.6.
      f. Location: Shower, kitchen, wet floors sloped to drain.
   2. TCNA F111 and ANSI A108.1A (thickset large format tile - new slab recess, no slope to drain):
      a. Mortar Bed, Reinforcing and Cleavage Membrane, ANSI A108.1A

b. Bond Coat: Portland cement paste on a mortar bed that is still workable.
c. Grout: Epoxy Grout, ANSI A108.6
d. Locations: Large Format Floor Tile (one edge greater than 15 inches)

3. TCNA F122 and ANSI A108.13: Interior bonded waterproofing membrane over concrete slab (thinset with waterproofing membrane)
   a. Waterproof Membrane: ANSI A108.13.
   b. Bond Coat: Latex-Portland Cement Mortar, ANSI A108.5.
   c. Grout: Epoxy Grout, ANSI A108.6.
   d. Location: Wet areas, standard tile size, slope to drain integral to structure.
   e. Alternate Locations: Interior renovation work without existing slab recess to accommodate added thickness of setting materials for large format tile, and where large format tile scheduled to be installed does not exceed 12 x 24 inches.

B. Interior Wall Installations, Metal Studs or Furring:
   1. TCNA W245: Thinset mortar on glass-mat, water-resistant gypsum tile backer board.
      a. Waterproof membrane: ANSI A108.13. Coat all vertical surfaces scheduled to receive tiles. (At wet areas only)
      b. Bond Coat: Latex-Portland Cement Mortar, ANSI A108.5.
      c. Grout: Epoxy Grout, ANSI A108.6.
      d. Location: Wall Tile Installation.

3.9 MOVEMENT JOINTS

A. Perimeter Joint
   1. TCNA EJ171G at thin-set installations.
   2. TCNA EJ171I at mortar bed installations.
   3. Provide sealant, matching color of grout and bond breaker tape, around the perimeter of the tile floor.

B. Contraction and Construction Joint
   1. TCNA EJ171A at mortar bed installation.
   2. TCNA EJ171B at thin-set installation.
   3. Provide sealant, matching color of grout and backer rod or bond breaker tape.

C. Expansion Joints:
   1. TCNA EJ171 at building expansion joints.
   2. TCNA EJ171C at mortar bed with cleavage membrane.
   3. TCNA EJ171E at mortar bed bonded over an existing expansion joint.
   4. TCNA EJ171H at mortar bed with cleavage membrane over an existing expansion joint.

D. Vertical movement joint in tile and backer board and wall framing.
   1. TCNA EJ171K

END OF SECTION

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

B. Acoustical panels (ACT1, ACT2).

C. Exposed suspension systems for interior ceilings.

D. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.5 Ceiling September 2021.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For tiles and grids with colored finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
   1. Acoustical Panels: Set of 6-inch-square with two finished edges for each panel type

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension-system members.
   2. Structural members to which suspension systems will be attached.
   3. Method of attaching hangers to building structure.
   4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
   5. Size and location of initial access modules for acoustical panels.
   6. Items penetrating finished ceiling and ceiling-mounted items including the following:
      a. Lighting fixtures.
      b. Diffusers.
      c. Grilles.
      d. Speakers.
      e. Sprinklers.
      f. Access panels.
      g. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this section with minimum five years of documented experience.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of ceiling area to reflect tile patterns 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.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E1264.

2. Smoke-Developed Index: 450 or less.

2.3 ACOUSTICAL PANELS (ACT1)

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
   1. Basis of Design: Subject to compliance with requirements, provide Cortega 770, as manufactured by Armstrong World Industries.
   2. ASTM E1264 Classification:
      a. Type: A
      b. Form: A1.2
      c. Pattern: E
      d. Fire Class: A
   3. Texture: Medium
   4. Color: White.
   5. Light Reflectance (LR): Not less than 0.80.
   6. Noise Reduction Coefficient (NRC): Not less than 0.55.
   7. CAC: 33.
   8. Edge/Joint Detail: Square.
   9. Thickness: 5/8 inch.
   10. Modular Size: 24 by 24 inches.

B. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 ACOUSTICAL PANELS (ACT2)

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
   1. Basis of Design: Subject to compliance with requirements, provide Clean Room VL 868 Unperforated, as manufactured by Armstrong World Industries.

B. Classification: Provide panels as follows:
   1. Type: A
   2. Form: A2.2
   3. Pattern: G
   4. Fire Class: A

C. Texture: Smooth

D. Color: White.

E. Light Reflectance (LR): Not less than 0.85.

F. Noise Reduction Coefficient (NRC): Not less than 0.75.

G. CAC: 35

H. Edge/Joint Detail: Square.

I. Thickness: 3/4 inch.

J. Modular Size: 24 by 24 inches

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.5 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
   1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
      a. Armstrong World Industries; Prelude XL.
   2. Structural Classification: Heavy-duty system.
   3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   4. Face Design: Flat, flush.
   5. Cap Material: Cold-rolled steel.
   6. Cap Finish: Prefinished white.

2.6 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.8 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
a. As indicated on reflected ceiling plans.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoplastic-rubber base (B-4).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.12 Base and Threshold March 2025 Update.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For adhesive, indicate VOC content.

B. Shop Drawings: Submit shop drawings each type of flooring and base concurrently.
   1. Include base layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Include flooring transitions.

C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

D. Product Schedule: For resilient base and accessory products.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet Insert dimension for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.8 WARRANTY

A. Flooring products shall be warranted within the specified term and conditions after the date of substantial completion:
   1. Warranty Period commencing on the Date of Substantial Completion:
      a. Rubber Base: 1-year manufacturing and workmanship warranty.

PART 2 PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

A. Basis of Design: Subject to compliance with requirements, provide product indicated on List of Finishes.

B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
   1. Group: I (solid, homogeneous).
   2. Style and Location:
      a. Style B, Cove: Provide in areas with resilient floor coverings.

C. Thickness: 0.125 inch.

D. Height: 4 inch.

E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Field Formed.

G. Inside Corners: Field Formed.

H. Colors: As indicated on List of Finishes.

2.2 RUBBER MOLDING ACCESSORY

A. Basis of Design: Subject to compliance with requirements, provide rubber molding accessories as manufactured by Johnsonite Tarkett, or comparable products by one of the following:
   1. Roppe Corporation, USA

B. Description: Rubber transition strips, nosing for carpet, nosing for resilient floor covering, reducer string for resilient floor covering.

C. Profile and Dimensions: As indicated on Drawings.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As selected by Architect from manufacturer’s full range.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
   1. Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
      a. Maximum VOC Content for Cove Base adhesives: 50 g/L.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch resilient base during installation.

E. Coordinate installation materials for wall base with manufacturer of wall coverings that extend underneath wall base to ensure compatibility between adhesive and substrate.

F. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration or whitening at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Unbacked Vinyl Sheet Flooring (VSF-6)
   2. Unbacked Rubber Sheet Flooring (RSF-1, RSF-2, RSF-3).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.6 Resilient Flooring February 2024 Update.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For adhesive, indicate VOC content.

B. Shop Drawings: For each type of resilient sheet flooring.
   1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples: For each exposed product and for each color, texture, and pattern specified, in manufacturer's standard size, but not less than 6-by-9-inch sections.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

1.10 WARRANTY

A. Flooring products shall be warranted within the specified term and conditions after the date of substantial completion:
   1. Warranty Period commencing on the Date of Substantial Completion:
      a. Vinyl Sheet: 5-year warranty.
      b. Rubber Sheet: 5-year warranty.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Static Coefficient of Friction ASTM D2047: Greater than or equal to 0.50 SCOF

2.2 UNBACKED VINYL SHEET FLOORING

A. Phthalate-Free, Homogeneous Sheet ASTM F1913:
   1. Basis of Design: See List of Finishes.

B. Thickness: 0.080 inch.

C. Wearing Surface: Smooth.

D. Sheet Width: As standard with manufacturer.

E. Seamless-Installation Method: Heat welded.

F. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 UNBACKED RUBBER SHEET FLOORING

A. Basis of Design: Provide product indicated on List of Finishes.

B. Product Standard: ASTM F1859.
   1. Type: Type I, homogeneous rubber sheet floor covering.
   2. Thickness: As standard with manufacturer.
   3. Hardness: Not less than required by ASTM F1859.

C. Wearing Surface: Smooth.

D. Sheet Width: As standard with manufacturer.

E. Seamless-Installation Method: Heat welded.

F. Colors and Patterns: As indicated on List of Finishes.

2.4 INSTALLATION MATERIALS

A. Prefabricated Flash Cove Base:
   1. Fabricated from same material and dye lots as resilient sheet flooring, in maximum practical lengths, with 1-1/2" x 1-1/2" formed aluminum reinforcing bonded to back of base material. Acceptable Product: "FlashCove Prefabricated Bases" by FlashCove Prefabricated Bases Inc.
      a. Height: As indicated on Drawings.
   2. Metal Base Cap: For adhesive installation; stainless steel cap; "chiklet" by FlashCove Prefabricated Bases Inc.
   3. Provide integral cove base where indicated on Drawings.

B. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

C. Metal Transition Strips: Angle or L-shaped, height to match tile and setting-bed thickness, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.
   1. Basis of Design: Schluter Systems; Vinpro-U

D. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
   1. Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
      a. Maximum VOC Content for Vinyl adhesives: 50 g/L.
      b. Maximum VOC Content for Rubber Floor adhesives: 60 g/L.

E. Seamless-Installation Accessories:
   1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
      a. Colors: See List of Finishes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity Testing: Perform pH testing according to ASTM F710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.
1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:
1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring

installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:
   1. Remove adhesive and other blemishes from surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION

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SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Modular carpet tile (CPT-7).
   2. Modular carpet tile for entrance systems (WM-1).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.8 Carpet December 2021 Update.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

B. Comply with SCAQMD Rule 1168– Adhesive and Sealant Applications, current version.
   1. Maximum VOC Content: 50 g/L.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, the following:
      a. More than 10 percent edge raveling, snags, and runs.
      b. Dimensional instability.
      c. Excess static discharge.
      d. Loss of tuft-bind strength.
      e. Loss of face fiber.
      f. Delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

1.12 REFERENCE STANDARDS

A. CRI 104 - Standard for Installation of Commercial Carpet; 2018.

PART 2 PRODUCTS

2.1 CARPET TILE

A. Basis of Design: Subject to compliance with requirements, provide products indicated on List of Finishes.

B. Color/Pattern: As indicated on List of Finishes.

C. Fiber Content: 100 percent nylon 6, 6.

D. Primary Backing/Backcoating: Manufacturer's standard composite materials.

E. Secondary Backing: Manufacturer's standard material.

F. Size: As indicated List of Finishes.

G. Applied Treatments:
   1. Soil-Resistance Treatment: Manufacturer's standard treatment.
   2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
      a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

2.2 MODULAR CARPET TILE FOR ENTRANCE SYSTEMS

A. Basis of Design: Subject to compliance with requirements, provide products indicated on List of Finishes.

B. Size: As indicated on List of Finishes.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
   1. Maximum VOC content: 50 g/L.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
   1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
      c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Adhere fully as recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

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SECTION 09 72 00 - WALL COVERINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom Vinyl Wall Covering (WC-1).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement seams and termination points.

C. Samples for Initial Selection: For each type of wall covering.

D. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.
   1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied.
      a. Show complete pattern repeat.
      b. Mark top and face of fabric.

E. Product Schedule: For wall coverings.[Use same designations indicated on Drawings.]

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.

1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F1141 for appearance shading characteristics.
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.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Fire-Growth Contribution: No flashover and heat and smoke release when tested in accordance with NFPA 286.

2.2 CUSTOM VINYL WALL COVERING

A. Basis of Design: Subject to compliance with requirements, provide custom printed vinyl wall covering as manufactured by one of the following:
   1. Len-Tex Clean Vinyl Technology; by MDC Interior Solutions.
   2. Level Digital Wallcoverings, Phthalate free.

B. Description: Provide vinyl products in rolls from same production run and complying with the following:
   1. Wallcovering Association's W-101 for Type II, Medium Duty.
   2. ASTM F793/F793M for strippable wall coverings.
      a. Category: V, Type II, Commercial Serviceability (Vinyl Coated).

C. Total Weight: 20 oz/lineal yard, excluding coatings.

D. Width: 54 inches.

E. Backing: Nonwoven fabric.

F. Mildew Resistance: Rating of zero or 1 when tested in accordance with ASTM G21.

G. Features:
   1. Stain-Resistant Coating
   2. Antimicrobial.

3. Water-based inks.
4. Phthalate free.
5. Heavy-metals free.
6. Halogenated-fire-retardant free.

H. Colors, Textures, and Patterns: Custom Graphic. Artwork is the responsibility of the fabricator to generate as required to print on Wall. Architect will provide inspiration image.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer’s written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
1. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
2. Painted Surfaces:
   a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
   b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.
1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Primers.
   2. Finish coatings.
   3. Floor sealers and paints.

B. Surface preparation, priming and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.

1.2 RELATED WORK

A. Section 09 91 23 "Interior Painting"

B. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.10 Painting and Coating June 2022 Update.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include preparation requirements and application instructions.
   2. Indicate VOC content.
   3. Include MPI# on product data sheet.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

E. Product Schedule: Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Qualifications.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
   1. Sherwin-Williams (BOD)
   2. Pittsburgh Paints, formerly PPG Industries.
   3. Benjamin Moore
   4. Behr Paint Company; Behr Process Corporation

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its “MPI Approved Products List”

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

C. Colors: As indicated on Finish Schedule.

D. VOC Limits, Exterior: All paints, primers and coatings used on the exterior of the building (defined as everything outside and inclusive of the primary and secondary weatherproofing system) shall comply with the following criteria:
   1. California Air Resource Board (CARB) 2007 Suggested Control Measure for Architectural Coatings February 1, 2008:
      a. VOC limits shown are grams of VOC per Liter of coating, less water and less exempt compounds.
         1) Flat Coatings: 50 g/L
         2) Nonflat Coatings: 100 g/L
         3) Nonflat-High Gloss Coatings: 150 g/L
         4) Concrete Curing Compounds: 350 g/L
         5) Concrete/Masonry Sealers:100 g/L
         6) Dry Fog Coatings: 150 g/L
         7) Primers, Sealers and Undercoaters: 100 g/L
         8) Rust Preventative Coatings: 250 g/L
         9) Stains: 250 g/L
         10) Waterproofing membranes: 250 g/L
         11) Wood coatings: 275 g/L
         12) Zinc-Rich Primers: 340 g/L

E. South Coast Air Quality Management District (SCAQMD) Rule 1113 Volatile Organic Compound (VOC) Limits as of February 5, 2016. Rule 1113 Table of Standards (aqmd.gov)

F. Chemical Component Restrictions: The manufacturer shall demonstrate that the following chemical compounds are not used as ingredients in the manufacture of the product:
   1. Halomethanes:
      a. Methylene chloride
   2. Chlorinated ethanes:
      a. 1,1,1-trichloroethane
   3. Aromatic solvents:
      a. Benzene
      b. Toluene (methylbenzene)
      c. Ethylbenzene
   4. Chlorinated ethylenes:
      a. Vinyl chloride
   5. Polynuclear aromatics:
      a. Naphthalene
   6. Chlorobenzenes:
      a. 1,2-dichlorobenzene
   7. Phthalate esters:
      a. Di (2-ehtylhexyl) phthalate
      b. Butyl benzyl phthalate
      c. Di-n-butyl phthalate
      d. Di-n-octyl phthalate
      e. Diethyl phthalate
      f. Dimethyl phthalate
   8. Miscellaneous semi-volatile organics:
      a. Isophorone
   9. Metals and their compounds:
      a. Antimony
      b. Cadmium
      c. Hexavalent chromium

d. Lead
e. Mercury

10. Preservatives (anti-fouling agents)
    a. Formaldehyde
11. Ketones:
    a. Methyl ethyl ketone
    b. Methyl isobutyl ketone
12. Miscellaneous volatile organics:
    a. Acrolein
    b. Acrylonitrile

G. Packaging Requirements:
1. Toxics in packaging:
    a. The manufacturer shall demonstrate that paint cans and their components are not fabricated with lead.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 INSTALLATION

A. 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 pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

B. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels

C. Apply paints in accordance with manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
   3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

E. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed to view:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Metal conduit.
      e. Plastic conduit.
   2. 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.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
   1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
   2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
   3. Allow empty paint cans to dry before disposal.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates: Galvanized steel doors and frames.
   1. Water-Based, Light Industrial Coating System MPI EXT 5.3J:
      a. Prime Coat: Water-based, galvanized-metal primer MPI#134.
         1) Basis of Design: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Exterior, water-based, light industrial coating, semi-gloss (MPI Gloss Level 5) MPI #163
         1) Basis of Design: Sherwin-Williams Pro Industrial DTM Acrylic Semi-Gloss.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Primers.
   2. Water-based finish coatings.

1.2 RELATED WORK

A. Section 09 91 13 "Exterior Painting"

B. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.10 Painting and Coating June 2022 Update.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include preparation requirements and application instructions.
   2. Indicate VOC content.
   3. Include MPI# on product data sheet.

B. Samples: For each type of topcoat product.

C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect
   1. Sherwin-Williams (BOD)

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its “MPI Approved Products List”

B. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated on Finish Schedule.

D. VOC Limits, Interior Coatings: All paints, primers and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied onsite) shall comply with the following criteria:
   1. Architectural paints, coatings and primers applied to interior walls, floors and ceilings: Do not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, current version.
   2. VOC limits shown are grams of VOC per Liter of coating, less water and less exempt compounds.
      a. Clear wood finish: 275 g/L
      b. Concrete curing compounds: 100 g/L
      c. Dry-Fog Coatings: 50 g/L
      d. Flats: 50 g/L

e. Floor coatings: 50 g/L
f. Nonflat Coatings: 50 g/L
g. Primers, Sealers and Undercoaters: 100 g/L
h. Rust Preventative Coatings: 100 g/L
i. Shellac, clear: 730 g/L
j. Shellac, pigmented: 550 g/L
k. Specialty Primers: 100 g/L
l. Stains, Interior: 250 g/L
m. Waterproofing Concrete/Masonry Sealers: 100 g/L

E. General Emissions, Interior Coatings: All paints, primers and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied onsite) shall comply with the following criteria:
1. Architectural paints, coatings and primers applied to interior walls, floors and ceilings: Shall be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1-2010.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      h. Mechanical Diffusers hosted in accent walls and ceilings finishes (color extends beyond prefinish color chart published by diffuser and grille manufacturer) to be factory primed for field painting to match adjacent surface finish color.
      i. Other items as directed by Architect.
   2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates: Door Frames.
   1. Institutional Low-odor over water-based rust-inhibitive primer: MPI INT 5.1S
      a. Prime Coat: Primer, rust-inhibitive, water based. MPI #107
         1) Basis of Design: Sherwin-Williams Pro Industrial Pro-Cryl Universal.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Interior, latex, institutional low-odor, semi-gloss (MPI Gloss Level 5), MPI #147.
         1) Basis of Design: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss.

B. Gypsum Board Substrates: Ceilings and Soffits.
   1. Institutional Low-odor over water-based primer: MPI INT 9.2M.
      a. Prime Coat: Interior primer sealer institutional low odor MPI #149.
         1) Basis of Design: Sherwin-Williams ProMar 200 Zero VOC Interior Latex.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Interior, latex, institutional low odor, flat, MPI Gloss Level 1, MPI #143.
         1) Basis of Design: Sherwin-Williams ProMar 200 HP Zero VOC Interior Eg-Shel.

C. Gypsum Board Substrates: Walls.
   1. Institutional Low-odor over water-based primer: MPI INT 9.2M
      a. Prime Coat: Interior primer sealer institutional low odor MPI #149
         1) Basis of Design: Sherwin-Williams ProMar 200 Zero Interior Latex.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Interior, latex, institutional low odor, MPI Gloss Level 3, MPI #145.
         1) Basis of Design: Sherwin-Williams ProMar 200 HP Zero VOC Interior Eg-Shel.

D. Gypsum Board Substrate: Wall and Ceilings in wet areas.
   1. Epoxy-Modified Latex, Interior. MPI INT 9.2F
      a. Prime Coat: Water-based latex primer sealer MPI #50
         1) Basis of Design: Sherwin-Williams ProMar 200 Zero Interior Latex Primer.
      b. Intermediate Coat: Match topcoat.
      c. Topcoat: Water-based epoxy-modified latex, Gloss Level 5, MPI #215
         1) Basis of Design: Sherwin-Williams Pro Industrial Water-based Catalyzed Epoxy Gloss.

END OF SECTION

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SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Frameless. Magnetic Glass Markerboards (GB-01, GB-02).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.
   1. Include plans, elevations, sections, details, and attachment to other work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each visual display unit, for tests performed by a qualified testing agency.

C. Manufacturers shall certify in writing that the porcelain enameling shall be performed in accordance with the current edition of the PEI Manual and Performance Specifications for Porcelain Enameled Writing Surfaces (PEI-1002) issued by the Porcelain Enamel Institute

D. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings 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.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

2.2 FRAMELESS RESINOUS MARKERBOARD

A. Tempered Safety Glass Markerboards: magnetic, non-staining, glass panel, frameless with polished and beveled edges, optically clear for a permanent installation.
   1. Basis of Design: Subject to compliance with requirement, provide Premium Glass Boards by Fulbright Glass Boards.

B. Color: As ini

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless steel dimensional characters for concealed post mounting at exterior locations.
   2. Weathered steel plate dimensional characters for site-supported signage "HEAL"
      a. Cast acrylic dimensional characters with integral color to match Paint selection indicated on List of Finishes, for concealed post mounting at interior locations.

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 10.8 Signage and Wayfinding Master Plan October 2019.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
   4. Electrical power wiring diagrams.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Dimensional Characters: Full-size Sample of dimensional character.
   2. Exposed Accessories: Full-size Sample of each accessory type.
   3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

E. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

F. Delegated Design Submittal: For signs indicated in "Performance Requirements" Article.
   1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Fabricator.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design sign structure and anchorage of dimensional character sign type(s) according to structural performance requirements.

B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
   1. Uniform Wind Load: As indicated on Drawings.
   2. Concentrated Horizontal Load: As indicated on Drawings.
   3. Other Design Load: As indicated on Drawings
   4. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 DIMENSIONAL CHARACTERS

A. Fabricated Channel Characters: Metal face and side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
   1. Illuminated Characters: Backlighted character construction with LED lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
      a. Power: 120 V, 60 Hz, 1 phase, 15 A.
      b. Weeps: Provide weep holes to drain water at lowest part of exterior characters. Equip weeps with permanent baffles to block light leakage without inhibiting drainage.
   2. Character Material: Sheet or plate stainless steel.
   3. Material Thickness: Manufacturer's standard for size and design of character.
   4. Character Height: As indicated on Drawings.
   5. Character Depth: As indicated on Drawings.

6. Finishes:
7. Integral Stainless Steel Finish: As selected by Architect from full range of industry finishes.
8. Mounting: Concealed, stainless steel back bar or bracket assembly.
9. Hold characters at manufacturer's recommended distance from wall surface.

B. Weathered steel plate dimensional letters, "HEAL" - welded to steel base plate anchored into foundation on site. Final design and artwork delegated to fabricator approved by Owner.
   1. Basis of Design: Zahner, Solanum Steel.
   2. Depth: 6 inches.
   3. Approximate height: 3'-6"
   4. Mounting: Letters welded to base plate of matching material or finish, plate anchored into concrete foundation.

C. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
   1. Character Material: Stainless steel for exterior locations, and Cast Acrylic with integral color
   2. Character Height: As indicated on Drawings.
   3. Thickness: 1/2-inch minimum depth for letters up to 6 inches, and 1-inch minimum for letters 6 inches to 24 inches, 2 inches minimum for letters 24 inches and taller.
   4. Finishes:
      a. Stainless steel: Satin No. 4
   5. Typeface: As selected from signage fabricators full range of typefaces.

D. Molded-Plastic Characters: Injection molded characters having uniform faces and profiles, with polished edges, and as follows:
   1. Character Height: As indicated on Drawings.
   2. Thickness: 1/2-inch minimum depth for letters up to 6 inches, and 1-inch minimum for letters 6 inches to 24 inches, 2 inches minimum for letters 24 inches and taller.
   3. Finishes:
      a. Acrylic: Integral color
   4. Color: Manufacturer's standard process, in color matching Architect's sample.
   5. Typeface: As selected from signage fabricators full range of typefaces.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

B. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
   3. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
   6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
   7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
   1. Aluminum Brackets (Interior Only): Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color color unless otherwise indicated.
   2. Stainless Steel Brackets: Factory finish brackets with No. 4 finish unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

2.7 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   2. Directional Satin Finish: No. 4.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

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SECTION 10 14 23 - PANEL SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes the following Panel Signage:
   1. Interior Room Identification Signage
   2. Exterior Room Identification Signage, including:
      a. Exterior Entrance Identification signs
   3. Interior Egress Signage, including:
      a. Means of Egress Signage
         1) Exit Discharge
         2) Exit Passageways
   4. Wall mounted tent signage for cabinets storing emergency supplies.

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 10.8 Signage and Wayfinding Master Plan October 2019.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Panel Signs: Full-size Sample.
   2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
   3. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Variable Component Materials: 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in TDLR “2012 Texas Accessibility Standards” (TAS)

2.2 PANEL SIGN MATERIAL - INTERIOR

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
   1. Solid-Sheet Sign: Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
      a. Thickness: 0.125 inch (3.18 mm).
      b. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
      c. Corner Style: Square

2.3 PANEL SIGN MATERIAL - EXTERIOR

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
   1. Solid-Sheet Sign: Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
      a. Thickness: 0.125 inch (3.18 mm).
      b. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
      c. Corner Style: Square

2.4 PANEL SIGNAGE CONTENT

A. Panel Size: Provide size of sign as required to fit designated room names, room numbers, pictograms, International Symbol of Accessibility, and/or Braille.

B. All panel signs shall have the following characteristics:
   1. Characters and symbols: Raised 1/32 inch minimum above the sign background.
   2. Character style: Sans serif character.
      a. Acceptable fonts include:
         1) Helvetica.
         2) Arial.
         3) Comply with owner standard font.
   3. Character case: Uppercase.
   4. Character height: Character height measured vertically from the baseline of the character shall be 5/8 inch minimum and 2 inches maximum based on the height of the uppercase letter “I.”
   5. Character stroke thickness: Stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character.
   6. Character spacing: Character spacing shall be 1/8 inch minimum and maximum 4 times the raised character stroke width.
      a. Characters shall be separated from raised borders and decorative elements minimum 3/8 inch.
   7. Braille:
      a. Braille shall be Grade 2. Sign manufacturer shall
      b. Braille dots shall have a domed or rounded shape and shall comply with the Braille dimensions listed in the 2010 Standard.
         1) The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials and acronyms.
      c. Braille shall duplicate the raised characters and shall be positioned below the corresponding text.
         1) If text is multi-lined, Braille shall be placed below the entire text.
         2) Braille shall be separated 3/8 inch minimum from tactile characters and 3/8 inch minimum from raised borders and decorative elements.

C. Pictograms:
   1. Pictograms shall be provided on signs installed at the following spaces:
      a. Restrooms, toilet rooms.
   2. Pictograms shall have a field height of minimum 6 inches. Note: Pictogram characters and Braille shall not be located in the pictogram field.
   3. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.
      a. Pictograms and their field shall have a non-glare finish.
   4. Pictograms shall have text descriptions located directly below the pictogram. Text descriptors shall comply with Paragraph E of this article.
   5. Provide male pictograms at spaces used by men. Provide female pictograms at spaces used by women. At toilet rooms indicated to be used by both men and women, provide both male and female pictograms on the same sign.

D. International Symbol of Accessibility:
   1. The International Symbol of Accessibility shall be provided on signs installed at the following spaces:
      a. Restrooms, toilet rooms.
   2. The International Symbol shall comply with the figure shown in the 2010 Standards.

3. The International Symbol of Accessibility shall contrast with the background per Paragraph F, Subparagraph 3 of this Article, including non-glare finish.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
   1. Use concealed fasteners and anchors unless indicated to be exposed.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   4. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
   5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Color: As selected by Architect from Manufacturer’s Full Range

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Examine panel signs for misspelling and similar errors.

D. Reject panel signs with errors prior to installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard

C. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

D. Where signs are mounted to vision glass (sidelights, borrowed lights, etc.), provide a backing plate made of the same materials, size, thickness and background color as the sign. Mount backing plate on opposite side of glass using foam tape or adhesive. Backing plate shall be aligned with sign in order to hide the sign’s mounting.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 PANEL SIGNAGE SCHEDULE

A. Room Identification signs:
1. Provide one interior room panel sign for each interior door and each programmed space entry point.
2. Signs with Changeable Message Capability (where indicated): Fabricate signs to allow insertion of changeable messages as follows:
a. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.

B. Means of egress signs:
1. Provide tactile signs complying with TAS at the following locations:

a. Exit discharge.
b. Exit passageways

C. Exterior Entrance Identification signs:
1. Provide one interior and one exterior sign for each exterior entrance.
2. Exterior entrance identification numbering shall align with IFC requirements.
3. Exterior entrance identification signs shall comply with the following:
a. Minimum character height: 6 inches.
b. Panel size wide enough to accommodate up to two digits.
c. Characters shall contrast with background with either light characters on a dark background or dark characters on a light background.

D. Provide one wall mounted tent sign above each fire extinguisher cabinet, automated external defibrillator cabinet, and controlled substance cabinet location.

END OF SECTION

SECTION 10 21 23 - CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cubicle-curtain tracks and carriers.
   2. Cubicle curtains (CC-3).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this seciton are required to comply with Harris Health Design Standards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For each type of curtain fabric indicated, include durability, laundry temperature limits, fade resistance, applied curtain treatments, and fire-test-response characteristics.
   2. Track Systems: For each system include maximum weight of draperies.

B. Shop Drawings: For curtains and tracks.
   1. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
   2. Indicate reflected ceiling plan view of curtain track, hangers and suspension points, attachments details, and schedule of curtain sizes
   3. Include details of blocking for track support.

C. Samples for Initial Selection: For each type of curtain material indicated.

D. Samples for Verification: For each type of product required, prepared on Samples of size indicated below:
   1. Curtain Fabric: Not less than 10 inches square and showing complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
   2. Mesh Top: Not less than 10 inches square.
   3. Curtain Track: Not less than 10 inches long.
   4. Curtain Carrier: Full-size unit.

E. Product Schedule: For curtains and tracks. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtains, tracks, and hardware to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed for each size indicated, but no fewer than 10 units.
   2. Curtains: Full-size units equal to 10 percent of amount installed for each size indicated, but no fewer than two units.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical cubicle as shown on Drawings as part of a welding lab mockup.
   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.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Cubicle Curtains : Provide curtain fabrics with the following characteristics:
   1. Flame Resistance: Provide fabrics identical to those that have passed NFPA 701 when tested by a qualified testing agency acceptable to authorities having jurisdiction.
      a. Identify fabrics with appropriate markings of a qualified testing agency.

2.2 CUBICLE-CURTAIN SUPPORT SYSTEMS

A. Basis of Design: Subject to compliance with requirements, provide General Cubicle's #6062N, as manufactured by Construction Specialties, or comparable product by one of the following:
   1. Imperial Fastener Company; IFC-98
   2. Inpro Corporation; Clickeze Optitrac CE5000

B. Extruded-Aluminum 6063-T5 Curtain Track: Not less than 1-1/4 inches wide by 3/4 inch high.
   1. Track Minimum Wall Thickness: 0.060 inch.
   2. Curved Track: Factory-fabricated, 12-inch- radius bends.
   3. Finish: Clear anodized.

C. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

D. Curtain Roller Carriers: Two nylon rollers and nylon axle with nylon hook.

E. Breakaway Curtain Carriers: One-piece nylon breakaway curtain carriers designed to allow curtains to detach from tracks with a pulling force of no more than 5 lbf.

F. Exposed Fasteners: Stainless steel.

G. Concealed Fasteners: Stainless steel.

2.3 CURTAINS

A. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fabric: Curtain manufacturer's standard, 100 percent polyester; inherently and permanently flame resistant, stain resistant, and antimicrobial.
   1. Basis of Design: Standard Textile Blocks.
   2. Pattern/Style: As indicated on List of Finishes.

C. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

D. Mesh Top: Not less than 20-inch- high mesh top.
   1. Mesh: 100 percent nylon mesh
   2. Top Integral Header: 1-3/4 inches

E. Snap Attachments: Provide manufacturer's standard nickel-plated brass snap attachments for modular panels.

F. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

2.4 CURTAIN FABRICATION

A. Continuous Curtain Panels:
   1. Width: Equal to track length from which curtain is hung plus 10 percent of added fullness, but not less than 12 inches of added fullness.
   2. Length: Equal to floor-to-ceiling height, minus depth of track and carrier at top, and minus clearance above the finished floor of 12 inches.
   3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lockstitched.
   4. Mesh Top: Top hem of mesh not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lockstitched. Double lockstitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
   5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced, and double lockstitched.
   6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lockstitched.
   7. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install tracks level and plumb, according to manufacturer's written instructions.

B. For tracks of up to 20 feet in length, provide track fabricated from single, continuous length.
   1. Curtain-Track Mounting: Suspended, and surface as indicated.

C. Surface-Track Mounting: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
   1. Attach track to suspended ceiling grid with manufacturer's proprietary clip.

D. Suspended-Track Mounting: Install track with manufacturer's standard tubular aluminum suspended supports at intervals and with fasteners recommended by manufacturer. Fasten supports to structure. Provide supports at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.

E. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

F. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

G. Cubicle Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION

SECTION 10 26 00 - WALL PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Impact Resistant Handrails (HR-1).
   2. Corner Guards (CG-1, CG-2).
   3. End Wall Guards (EG-1).
   4. Abuse-Resistant Wall Coverings (WP-1, WP-2, WP-3).

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 10.4 Wall Protection February 2024 Update.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
   2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall protection showing locations and extent.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.
   1. Include Samples of accent strips and accessories to verify color selection.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
   1. Corner Guards: 12 inches long. Include example top caps.
   2. Field Wall Covering: 6 by 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of exposed plastic material.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall protection product to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials[, from the same product run,] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Handrail Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 96-inch long units.

2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to [2] percent of each type, color, and texture of cover installed, but no fewer than [two, 48-inch- (1200-mm-)] long units.
3. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic materials out of direct sunlight.
   3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
      a. Store corner-guard covers in a vertical position.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

B. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.

C. Structural Performance: Handrails, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
   2. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   3. Uniform and concentrated loads need not be assumed to act concurrently

D. Regulatory Requirements: Comply with applicable provisions in Texas Accessibility Standards (TAS).

2.2 IMPACT RESISTANT HANDRAIL

A. Surface-Mounted Handrail: Engineered PVC Free Impact-Resistant Handrails consisting of aluminum retainer with snap-on cover and integral shock absorbing cushion. Provide color matched end caps, mechanically fastened with concealed fasteners.
   1. Basis of Design: Acrovyn Handrails Model HRB-10CN, as manufactured by Construction Specialties.
   2. Face Size (Height): 5-1/2 inch
   3. Grip: 1-1/2 inch gripping diameter, extended 3 inches from the wall
   4. Accessories: Prefabricated, injection-molded or foam-molded end caps and inside and outside corners with concealed splices, cushions, and other accessories as required.
      a. End Caps and Inside/Outside Corner:
         1) Match plastic cover color
         2) Self-aligning connector plate.

2.3 CORNER GUARDS

A. Surface-Mounted, Resilient Plastic Corner Guards:
   1. Basis of Design: Subject to compliance with requirements provide Model SM-10N, as manufactured by Construction Specialties
   2. Cover: Rigid, impact-resistant plastic, minimum 0.078 inch (1.9mm) thick, in dimensions and profiles indicated.
   3. Retainer: Continuous, one-piece, extruded aluminum 6063-T6 alloy retainer, minimum 0.062 inch thick.
   4. Leg Size: 3 inch by 3 inch
   5. Height: As indicated on List of Finishes.
   6. Nose Radius: 1/4 inch.
   7. Accessories: Prefabricated aluminum retainer with concealed splices, mounting hardware and other accessories as required.
      a. End Caps:
         1) Match plastic cover color.
         2) Field adjustable for close alignment with snap-on plastic covers.
   8. Cover Color: As indicated on List of Finishes
   9. Screws: As recommended by the manufacturer

2.4 END WALL GUARDS

A. Surface-Mounted, Plastic-Cover, End-Wall Guard: Manufacturer's standard configuration including two corner guards complying with CG type, and one resilient filler panel complying with WP type. Includes mounting hardware and end caps.
   1. Basis of Design: Subject to compliance with requirements provide Model SM-10N as manufactured by Construction Specialties
   2. Height: As indicated on List of Finishes.

2.5 ABUSE-RESISTANT WALL COVERING

A. Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, plastic sheet wall-covering material.
   1. Basis of Design: Subject to compliance with requirements, provide Acrovyn Wall Covering, as manufactured by Construction Specialties, Inc, or comparable products by one of the following:
   2. Size: 48 by 120 inches for roll.
   3. Sheet Thickness: 0.040 inch.
   4. Color and Texture: As indicated on List of Finishes
   5. Height: As indicated on List of Finishes.
   6. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
      a. J-Molding
      b. Divider Bar
      c. Inside Corner
      d. Outside Corner
   7. Mounting: Adhesive.
   8. For panels sizes requiring vertical joint between panels, provide joint width required by manufacturer with Divider Bar Trim to match panel material.

2.6 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: As recommended by protection product manufacturer.

2.7 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.8 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.
   1. Complete finishing operations, including painting, before beginning installation of wall surface protection system materials.
   2. Wall surfaces to receive impact-resistant wallcovering materials shall be dry and free from dirt, grease, loose paint, and scale.

B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Install aluminum retainers, mounting brackets, and other accessories in strict accordance with the manufacturer's instructions.

C. Where splices occur in horizontal runs of over 20 feet (6 m), splice aluminum retainer and plastic cover at same locations along the run.

D. Installation of corner guards:
   1. Position surface-mounted corner guards above wall base.
   2. Adhere extruded corner guards to wall using primer and adhesive as recommended by manufacturer.

E. Installation of Impact Resistant Handrails:
   1. Position top of corridor handrail 36 inches (914.4 mm) from finished floor.
   2. Terminate rails 1 inch (25.4 mm) short of door openings, intersecting walls, corner guards and swing of corridor dual egress doors.
   3. Return rails to wall.
   4. Where handrail is used in conjunction with sheet goods terminate top of sheets at Center Line of handrail.

F. Installation of Abuse Resistant Wall Covering:
   1. Install semi-rigid vinyl wallcovering sheets with texture running in the same direction for uniform appearance.
   2. Provide continuous "J" -molding at all exposed ends of semi-rigid wall covering.
   3. Coordinate installation of vinyl fabric wall covering with corner guard frame and cover.
   4. Install top and edge moldings, corners, and divider bars as required for a complete installation.

G. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings.

H. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
   1. Provide anchoring devices and suitable locations to withstand imposed loads.
   2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Owner-Furnished, Contractor Installed Materials:
      a. Toilet Tissue Dispenser - OFCI
      b. Soap Dispenser - OFCI
      c. Paper Towel Dispenser - OFCI
      d. Toilet Seat Cover Dispenser - OFCI
   2. Contractor-Furnished, Contractor Installed Materials:
      a. Grab Bar - CFCI
      b. Feminine Napkin Disposal - CFCI
      c. Framed Mirrors - CFCI
      d. Robe Hook - CFCI
      e. Baby Changing Station - CFCI
      f. Specimen Pass-Through Cabinet - CFCI
   3. Underlavatory guards.

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 10.2 Toilet Accessories February 2022 Update.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.

B. Samples: For each exposed product and for each finish specified, full size.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify accessories using TA-# designations indicated on Drawings.

D. Delegated Design Submittal: For grab bars.
   1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Baby Changing Station: Manufacturer agrees to repair or replace baby changing stations that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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. Structural Performance: Design accessories and fasteners to comply with the following requirements:
   1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 WASHROOM ACCESSORIES

A. Source Limitations: Obtain washroom accessories from single source from single manufacturer.

B. Straight Grab Bar:
   1. Basis of Design: Bobrick B-6806
   2. Mounting: Flanges with concealed fasteners.
   3. Material: Stainless steel, 0.05 inch thick.
      a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
   4. Outside Diameter: 1-1/2 inches.
   5. Configuration: Horizontal
      a. Length (inches): 42 inches and 48 inches

C. Recessed Sanitary-Napkin Disposal Unit:
   1. Basis of Design: Bobrick B-35303 R
   2. Mounting: Recess-mounted.
   3. Door or Cover: Self-closing, disposal-opening cover.
   4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

D. Mirror Unit:
   1. Basis of Design: Bobrick B-290 Glass Mirror with Stainless Steel angle Frame
   2. Frame: Stainless steel channel.
      a. Corners: Heliarc welded, ground and polished smooth
   3. Size: 18 inches by 36 inches

4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

E. Robe Hook:
1. Basis of Design: Bobrick B-7671
2. Description: Single Robe Hook
3. Size: 2 inch x 2 inch
4. Material and Finish: Stainless steel, Satin Finish ASTM A666 and ASTM A653/A653M

2.3 HAND DRYERS

A. Source Limitations: Obtain hand dryers from single source from single manufacturer.

B. High-Efficiency, Non-heated Air, Electric Hand Dryer with HEPA Filtration System:
1. Basis of Design: Excel Dryer ThinAir Model TA-SB, or one of the following:
   a. World Dryer: VerdeDri
2. Description: High-speed, unheated-air hand dryer for rapid hand drying.
3. Mounting: Surface mounted.
   a. Protrusion Limit: Installed unit protrudes maximum 4 inches from wall surface.
4. Operation: Infrared-sensor activated with timed power cut-off switch.
   a. Average Dry Time: 12 seconds.
   b. Automatic Shut Off: At 35 seconds.
5. Cover Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
6. Electrical Requirements: 110V-120V

2.4 CHILDCARE ACCESSORIES

A. Source Limitations: Obtain each type of childcare accessory from single source from single manufacturer.

B. Baby-Changing Station: Surface-Mounted, Horizontal Folding
1. Basis of Design: Koala Care KB300 Horizontal, Surface-Mounted Changing Station
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support minimum of 250-lb (113-kg) static load when opened.
3. Mounting: Surface-mounted, with unit projecting not more than 4 inches inches from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Unibody steel chassis HDPE exterior with rounded plastic corners; HDPE interior in manufacturer's standard color.
6. Liner Dispenser: Integral dual liner cavity with internal spring tab, allowing for single liner dispensing.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard:
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.6 HEALTHCARE ACCESSORIES

A. Source Limitations: Obtain each type of healthcare accessory from single source from single manufacturer.

B. Specimen Pass-Through Cabinet : Recessed in wall of 3 inch to 5 inch depth.

1. Basis of Design: Bobrick B-505
2. Description: Two-sided type, with self-closing, interlocking doors on both sides, that prevent both from being open at same time, and removable stainless-steel tray.
3. Nominal Wall Opening: 11-1/2 by 10-7/8 inches, width by height.
4. Removable stainless steel tray.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.7 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

C. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.8 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
   1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire-protection cabinets for the following:
      a. Portable fire extinguisher.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.
   1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Basis of Design: Subject to compliance with requirements, provide Larsen’s Vertical Duo Clear Acrylic Door with Larsen-Loc in Stainless Steel No. 4 Finish, or comparable by one of the following:
      a. J.L. Industries
      b. Potter Roemer
      c. Walter Kidde, Division of Kidde, Inc

B. Size: Coordinate with fire extinguishers specified in Section 10 44 16 "Fire Extinguishers"

C. Cabinet Construction: Nonrated and One-hour fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: Stainless steel sheet.

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
   2. Rolled-Edge Trim: 2-1/2-inch backbend depth.

F. Cabinet Trim Material: Stainless steel sheet.

G. Door Material: Stainless steel sheet.

H. Door Style: Stainless steel sheet with vertical acrylic glazed window

I. Door Glazing: Acrylic sheet.
   1. Acrylic Sheet Color:
      a. Clear transparent acrylic sheet.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide manufacturer's standard.
   2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

K. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         2) Application Process: Pressure-sensitive vinyl letters.
         3) Lettering Color: White or red, to contrast cabinet.
         4) Orientation: Vertical.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.
   4. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Mount bottom of cabinet at 2’-0” above finished floor.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
   2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
   3. Install one fire-extinguisher cabinet in each science laboratory space.

C. Identification:
   1. Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Owner-Furnished Material: Hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amerex Corporation
   b. J.L. Industries
   c. Larsens Manufacturing Company
   d. Nystrom
   e. Potter Roemer
2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Dry Chemical Type, (DC10): UL-rated 60B:C, 10-lb nominal capacity, in enameled steel container.
   1. Install one wall-mounted fire extinguisher in the following spaces:
      a. Electrical Rooms.

C. Multipurpose Dry Chemical Type, 4A:60BC.
   1. Basis of Design: J.L Industries Academy Aluminum Model 1025 F12 with handle or approved alternate.
   2. Typical extinguisher required for each fire extinguisher cabinet location.

D. Ansul Clean Agent Fire Extinguisher, (FE36): UL rated 2-A:10-B:C, Model FE13 as distributed by Koetter Fire Protection.
   1. Install one wall-mounted fire extinguisher in the following spaces:
      a. IDF

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
   1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

C. Mount bracket at 36 inches above finished floor. Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION

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SECTION 10 45 00 - AUTOMATED EXTERNAL DEFIBRILLATOR CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Semi-Recessed Metal Cabinets with Alarmed Access for the following:
      a. Automatic External Automated external defibrillators (AEDs)

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For automated external defibrillator cabinets.
   1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For automated external defibrillator cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate sizes and locations of automated external defibrillator cabinets with wall depths.

1.6 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

PART 2 PRODUCTS

2.1 METAL AUTOMATED EXTERNAL DEFIBRILLATOR CABINET

A. Cabinet Type: Suitable for automatic external automated external defibrillator.
   1. Basis of Design: Subject to compliance with requirements, provide 1415F17SA LifeStart AED Cabinet, with Physio-Control LIFEPAK CR2, as manufactured by JL Industries.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semi-Recessed Cabinet:
   1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed panel with frame

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:
   1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
   3. Alarm: Manufacturer's standard cabinet-mounted alarm that actuates when automated external defibrillator cabinet door is opened and that is powered by batteries. Alarm is deactivated when cabinet is closed.
      a. Basis of Design: Commander standard audible alarm as manufactured by JL Industries.

K. Materials:
   1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
      a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
      b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      c. Color: As selected by Architect from manufacturer's full range.
   2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FABRICATION

A. Automated external defibrillator Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of automated external defibrillator cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish automated external defibrillator cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install automated external defibrillator cabinets in locations and at mounting heights indicated

B. Automated External Defibrillator Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed automated external defibrillator cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed automated external defibrillator cabinets.

C. Identification:
   1. Apply decals and vinyl lettering in manufacturer’s standard location on glazing panel.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as automated external defibrillator cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust automated external defibrillator cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of automated external defibrillator cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace automated external defibrillator cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by automated external defibrillator cabinet and mounting bracket manufacturers.

E. Replace automated external defibrillator cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 10 51 13 - METAL LOCKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal Wardrobe Lockers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: For metal lockers.
   1. Include plans, elevations, sections, and attachment details.
   2. Show locker trim and accessories.
   3. Include locker identification system and numbering sequence.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

D. Samples for Verification: For the following products, in manufacturer's standard size:
   1. Lockers and equipment.

E. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
      a. Locks.
      b. Blank identification plates.
      c. Hooks.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of latches and other door hardware.
   2. Damage from deliberate destruction and vandalism is excluded.
   3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.
   1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers and locker benches indicated to be accessible, comply with applicable provisions in Texas Accessibility Standards (TAS).

2.3 METAL LOCKERS

A. Lockers: Free-standing, metal, ventilated, quiet lockers with matching closed base.
   1. Basis of Design: Subject to compliance with requirements, provide Standard Lockers as manufactured by Republic Storage Systems Company, or one of the following:
      a. Tennsco Storage; Steel Lockers.

B. Locker Size: 12 inch width by 18 inch depth by 36 inch opening height

C. Frame Height: 72 inches.

D. Configuration: As indicated on Drawings.

E. Fittings: Hat shelf, coat rod, and three single-prong hooks.

F. Doors: One piece; fabricated from 16 gauge steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
   1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
   2. Door Style: Vented panel as follows:

a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier three louver openings at top and bottom for double-tier lockers.

G. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
2. Backs: 0.048-inch nominal thickness.
3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.

H. Frames: Channel formed; fabricated from 16 gauge steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

I. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Continuous Hinges: 16 gauge continuous piano hinges.

J. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic latching and pre-locking.
a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a pre-locking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

K. Door Handle and Latch for Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

L. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

M. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

N. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.
1. Closed Front and End Bases: Fabricated from 0.036-inch nominal-thickness steel sheet.

O. Continuous Zee Base (where concrete curb mounting base is not provided): Fabricated from, manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
1. Height: 4 inches.

P. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
1. Closures: Vertical-end type.

Q. Materials:
1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

R. Finish: Baked enamel or powder coat.
   1. Color: Manufacturer's Color Sand or Champagne/Putty, as approved by Architect.

2.4 LOCKS

A. Digital Door Lock: Battery-powered electronic alphanumeric keypad interface and key slot to operate locks with an ADA compliant user key.
   1. Basis of Design: Digilock Curve
   2. Style: Vertical body style with pull handle
   3. Deadlatch or Deadlock.
   4. Finish: Manufacturer's standard.

2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
   1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
   2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:
   1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
   2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

E. Accessible Lockers (at least 5%):
   1. Fabricate as follows:
      a. Locate bottom shelf no lower than 15 inches above the floor.
      b. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
   1. Sloping-top corner fillers, mitered.

H. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of non-recessed metal lockers; finished to match lockers.

2.6 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and at concrete or masonry substrates, for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.
1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Equipment:
1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
   a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
1. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
2. Attach sloping-top units to metal lockers, with closures at exposed ends.
3. Attach boxed end panels using concealed fasteners to conceal exposed ends of non-recessed metal lockers.
4. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of non-recessed metal lockers.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 10 73 43 - MANUFACTURED ALUMINUM CANOPIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Design, fabrication and installation of welded extruded aluminum canopies and walkway covers, supported and drained as follows:
   1. Post Supported Walkway Covers, drained internally to downspouts integral to vertical post supports
   2. Cantilevered Entry Canopy: supported by building structure, drained at the perimeter fascia drain

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for canopies.

B. Shop Drawings: For canopies.
   1. Include plans, elevations, sections, and attachment details.
      a. Anchor-Bolt Plans: Submit anchor-bolt plans and templates. Include location, diameter, and projection of anchor bolts required to attach canopies to concrete bases. Indicate post reactions at each location.
   2. Design calculations bearing the seal of a Registered Professional Engineer, licensed in the State of Texas. Design calculations shall state that the walkway cover system, entry canopy, trellis design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish.
   1. Size: Manufacturers' standard size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualifications: Manufacturer

B. Evaluation Reports:
   1. Research Reports: For anchors, from ICC-ES.

C. Sample warranties.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years of experience in the design, fabrication and erection of extruded aluminum walkway cover systems entry canopy systems trellis canopies.
   1. Installer is the canopy manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For canopies.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair finish or replace canopies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Canopies to withstand the following loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7:
   1. Design Loads: Refer to Structural Drawings for:
      a. Wind Speed
      b. Exposure
      c. Importance Factor

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Design Walkways in accordance with The Aluminum Design Manual 2010

2.2 MANUFACTURED ALUMINUM CANOPIES

A. Provide an all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable

B. Fabricate canopies as an integrated set of modular components ready for assembly on Project site.
   1. Basis of Design: Subject to compliance with requirements, provide Manufactured Aluminum Canopies and Walkway Covers by AVAdek, or comparable products by one of the following manufacturers:
      a. Canopy Solutions
      b. Dittmer Architectural Aluminum
      c. Peachtree Protective Covers, Inc.

C. Structural Framework: Fabricated from the following size (inches) extruded aluminum tubing, channel, angle, or tee extrusions.
   1. Walkway U-Bent Canopy
      a. Columns: 4x4
      b. Beams: 4x6
      c. Deck: 2-3/4 inch
      d. Trim: 6 inch facia
      e. Soffit Panels.
      f. Accessories: Rain Cap at each deck transition
      g. Drainage: Water shall drain from covered surfaces into intermediate trough and be directed to downspouts integral to posts
   2. Entry Canopies
      a. Beams, Deck
      b. Trim: 6 inch fascia

c. Drainage: Water shall drain from covered surfaces into intermediate trough and be directed to Fascia Drain.

D. Provide expansion joints with no metal to metal contact.

E. Post Bases: Externally adjustable, flanged, aluminum sleeves; minimum 3-inch vertical adjustment. Include shims for leveling.

F. Anchorage: Cast-in-place anchor bolts, fabricated from stainless steel, with allowable load or strength design capacities calculated to be greater than or equal to the design load.

G. Materials:
1. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   a. Sheet: ASTM B209.
   b. Extruded aluminum, ASTM B221, 6063 alloy, T6 temper.
   c. Aluminum Flashing: ASTM B209, Type 3003 H14, 0.040-inch, minimum
2. Gaskets: Dry seal santoprene pressure type
3. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic
4. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel
5. Grout:
   a. Portland Cement: ASTM C150, Type I.
   b. Sand: ASTM C404.
   c. Water: Potable
   d. Compressive Strength: 2,000 psi, minimum
6. Grout Mixes: 1 part Portland cement to 3 parts sand; add water to produce a pouring consistency

H. High performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent Hylar polyvinylidene fluoride resin by weight; complying with AAMA 2604

2.3 FABRICATION

A. General:
1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
2. Welding: In accordance with ANSI/AWS D1.2.
3. Bent Construction: Factory weld beams to columns with neatly mitered corners to form one-piece rigid bents. Make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints may be used only if fully welded bents cannot be shipped on local, state, or federal highways without a special permit from the department of transportation.
4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints at 8 inches on center creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Assemble deck with sufficient camber to offset dead load deflection.

B. Columns: Provide radius-cornered tubular extrusions with cutout and internal diverter for drainage where indicated. Circular downspout opening in column not acceptable.

C. Beams: Provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner. Provide structural ties in tops of all beams.

D. Deck: Extruded self-flashing sections interlocking into a composite unit. Provide welded plate closures at deck ends.

E. Fascia: Manufacturer’s standard shape. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non vertical surfaces.

F. Flashing: Flashing shall be minimum 0.040 aluminum.

G. Where noted on drawings provide downspouts at entry canopies. Size based on rain fall intensity

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including concrete bases; accurate placement, pattern, and orientation of anchor bolts; and critical dimensions; and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Erect protective cover true to line, level and plumb. Protect aluminum columns embedded in concrete with clear acrylic. Fill downspout columns with grout to the discharge level to prevent standing water. Install weep holes at top of concrete in non-draining columns to remove condensation.

B. Provide hairline miters and fitted joints.

C. Install canopies in accordance with manufacturer's written instructions.

D. Set canopies plumb and aligned with full bearing on concrete bases.

E. Fasten canopies securely to concrete base with anchorage indicated.

F. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 10 90 00 - HIGH SECURITY ENTRY SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hinged door key box.

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:
      a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Department Registration Forms: Provide local fire department copies of registration forms for each of the products listed.

1.4 QUALITY ASSURANCE

A. Products in this section must be UL listed.

1.5 PROJECT CONDITIONS

A. Coordinate High Security Entry System installation with locations noted on Drawings.

B. Coordinate with local fire departments to get exact locations and key requirements

PART 2 PRODUCTS

2.1 HIGH SECURITY ENTRY SYSTEM

A. Manufacturer: Provide products by Knox Company.
   1. Products:
      a. Entry Box Type 1: Surface or recessed mounted, hinged-door, high capacity volume for keys, access cards, entry credentials and plans.
         1) Basis of Design: KnoxVault 4400.
         2) Color: As selected by Architect from manufacturer's standard colors.
      b. Entry Box Type 2: Surface or recessed mounted, hinged-door, for maximum ten (10) keys.
         1) Basis of Design: Knoxbox Model 3200.
         2) Color: As selected by Architect from manufacturer's standard colors.

B. Fire Department Connection (FDC) Plug: 3043, 2 1/2 inch male plug, all stainless steel.

C. Remote electrical power shutdown station: 4534 recess mount. Coordinate installation with electrical drawings.

D. Padlocks for vehicle and pedestrian gates: Model 3772 shrouded exterior padlock, with fire department label.

E. For each entry system provide the fire department with appropriate keys and keywrenches.

F. Provide signage for remote FDC complying with Section 10 14 23 "Panel Signage."

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install high security entry system products in compliance with manufacturer’s recommendations.

END OF SECTION

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manually-operated, single roller, 5% light-filtering (W-T1)
   2. Motor-operated, single roller, 5% light-filtering (W-T2)

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
   1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Product Schedule: For roller shades.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Certificates: For each type of shadeband material.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years of experience in manufacturing products comparable to those specified in this section.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY-OPERATED SHADES WITH SINGLE ROLLERS

A. Basis of Design: Subject to compliance with requirements, provide one of the following products:
   1. MechoShade Systems, Inc.; Mecho 5 System.
   2. Draper FlexShade NEXD.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Nickel-plated metal or Stainless steel.
      a. Loop Length: Full length of roller shade.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Chain tensioner, jamb mounted.
   2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
      a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
   2. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:
   1. Shadeband Material:
      a. Light-filtering fabric, 5%
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.

b. Color and Finish: As selected by Architect from manufacturer's full range.

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Basis of Design: Subject to compliance with requirements, provide ElectroShade with WhisperShade IQ2 EDU, and ThermoVeil shadeband fabric, as manufactured by MechoShade Systems, Inc., or comparable products by one of the following:
   1. Draper Inc.; Flexshade MO

B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
   1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Motor Characteristics: Quiet motor type that operates at 30 percent less motor noise than standard tubular motors.
      a. Single phase, 110 V, 60 Hz.
         1) Low voltage motors are not acceptable.
      b. Quiet Standard Motor: Motor operates at 44 Db measured 3 feet from the motor. Makes no audible clicks when motor stops or starts.
      c. Motor shall include integrated remote queryable motor control, which delivers automatic alignment with a +/- 2mm accuracy, programmable configuration via PC. Systems using a “run time function” for positioning are not acceptable.
      d. Upper and lower limits are adjustable on site via hand-held device, no need to access the roller assembly. No external, mechanical limit wheels or buttons are involved.
      e. Pre-set stopping points are electronically precision set and locked into a power – failure memory.
      f. Each unit shall come equipped with 6 ft. power cord and optional disconnect plug.
      g. Each unit shall come equipped with 6 ft. of RJ9 control cable to connect to the digital control network.
      h. Each drive unit complies with UL325 tip to tip, CSA and cUL standards.
      i. Each units electrical components are tested to withstand a 15 Kvolt electrostatic discharge without damage or loss of memory.
   3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
      a. Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
      b. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
   4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
   5. Operating Features:
      a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
      b. Capable of interface with audiovisual control (Crestron) system.
      c. Capable of accepting input from building automation control system.
      d. Override switch.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands

indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As indicated on Drawings.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

F. Shadebands:
1. Shadeband Material:
   a. Light-filtering fabric, 5%
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   a. Type: Enclosed in sealed pocket of shadeband material.
   b. Color and Finish: As selected by Architect from manufacturer's full range.

2.4 INSTALLATION ACCESSORIES

A. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
1. Shape: L-shaped.
2. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.

B. Endcap Covers: To cover exposed endcaps.

C. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
1. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.
2. Provide pocket with lip at lower edge to support acoustical ceiling panel.

D. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

E. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.5 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
1. Source: E Screen with Koolback as manufactured by Mermet
2. Weave: Basketweave.
3. Thickness: 0.036 inches
4. Weight: 20 oz./sq.yd.
5. Orientation on Shadeband: Up the bolt.
6. Openness Factor: 5%.
7. Color: As selected by Architect from manufacturer's full range.

C. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   1. Type: Enclosed in sealed pocket of shadeband material.
   2. Color and Finish: As selected by Architect from manufacturer's full range.

2.6 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
   1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances,and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Roller Shade Locations: Where indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

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SECTION 12 36 23.13 - PLASTIC-LAMINATE-FACED COUNTERTOPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced countertops and backsplash (PL-4).

1.2 RELATED WORK

A. Section 06 41 16 "Plastic-Laminate-Faced Architectural Cabinets" for countertop support brackets and for requirements of aprons at restroom cabinetry.

B. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.11 Plastic-Laminate and Solid Surface February 2024.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For plastic-laminate-faced countertops.
   1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
   2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-faced countertops.
   3. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For the following:
   1. Composite wood products.
   2. High-pressure decorative laminate.
   3. Adhesives.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program.

1.5 QUALITY ASSURANCE

A. Fabricator’s Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Fabricator’s Certification: Licensed participant in AWI's Quality Certification Program.
   2. Alternate: Woodworking Institute’s (WI) Certified Compliance Program Licensee with experience fabricating work complying with the Certified Compliance Program meeting requirements of the North American Architectural Woodwork Standards (NAAWS).

B. Installer Qualifications: AWI's Quality Certification Program accredited participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.7 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.1 COUNTERTOPS, GENERAL

A. Laminate Material Quality Standard: Comply with NEMA LD 3 "High-Pressure Decorative Laminates" and laminate material manufacturer's written instructions.

B. Countertop Quality Standard: Comply with ANSI 1236-2022 "Architectural Woodwork Institute - Countertops."
   1. Aesthetic: Custom Grade

C. The Contract Documents may contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.2 FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
   1. Buda Woodworks, LLC
   2. Dovetail Custom Woodworks
   3. K&J Woodworks
   4. Millennia Cabinetry Inc
   5. Trautschold Millwork, Ltd
   6. https://awiqcp.org/woodworkers/find-a-qcp-firm/

B. Single Source: Provide Plastic-Laminate-Faced Countertops by same fabricator as Plastic-Laminate-Faced Architectural Cabinetry as specified in Division 06

2.3 PLASTIC-LAMINATE-FACED COUNTERTOPS

A. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
   1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions

of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
a. Wilsonart – As Scheduled

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Match Architect's sample.

C. Edge Treatment: Same as laminate facing on horizontal surfaces.

D. Core Material: MDF or Exterior-grade plywood.

E. Core Material at Sinks: MDF made with exterior glue or exterior-grade plywood.

F. Core Thickness: ¾ inch.
1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

G. Backsplashes: 1/2-inch- thick material with edge sealer at wet spaces.

H. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
1. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.
2. Softwood Plywood: DOC PS 1.

2.5 ACCESSORIES

A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Basis of Design: Contract Documents are based on manufacturer and products named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be submitted as a substitution in accordance with Conditions of the Contract and appropriate Division 01 Sections provided deviations are minor and does not change the concept as expressed in the Contract Documents as judged by Architect.
a. Hafele; 631.26.301
2. Outside Diameter: 2-3/8 inches.
3. Color: Black

2.6 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.

B. Seal all exposed edges of MDF and plywood with the following:
1. Waterproof Edge Sealer: The West System; Two-part epoxy system.
a. Part A, West System 105 Epoxy Resin.
b. Part B, West System 206 Slow Hardener.
c. VOC Content: The combined VOC content is 9.59 g/L. for waterproofing sealers.
1) Complies with: SCAQMD Rule 1113, Architectural Coatings. Max VOC Content for waterproofing sealers: 100 g/L.

2.7 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
   1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of cutouts by saturating with varnish.

PART 3 EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
   1. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
   1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
   2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
   3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semi-exposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

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SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid surface material countertops (SS-5, SS-21).
   2. Solid surface material backsplashes.
   3. Solid surface material thresholds.

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this section are required to comply with Harris Health's Design Standards. See Appendix 9.11 Plastic Laminate and Solid Surface February 2024

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops and window sills. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:
   1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 PRODUCTS

2.1 COUNTERTOPS, GENERAL

A. Quality Standard: Solid Surfacing Material: comply with ISFA 2-01 "International Surface Fabricators Association - Classification and Standards for Solid Surfacing Material."

B. Fabricate countertops according to solid surface material manufacturer's written instructions and in accordance with ANSI 1236-2022 "Architectural Woodwork Institute - Countertops."
   1. Aesthetic: Custom Grade

2.2 SOLID SURFACE MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
   1. Basis of Design: Subject to compliance with requirements, provide product and manufacturer indicated on List of Finishes.
   2. Type: Provide Standard type unless Special Purpose type is indicated.
   3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
   4. Colors and Patterns: As indicated on List of Finishes.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

C. Seal all exposed edges of plywood with the following:
   1. Waterproof Edge Sealer: The West System; Two-part epoxy system.
      a. Part A, West System 105 Epoxy Resin.
      b. Part B, West System 206 Slow Hardener.
      c. VOC Content: The combined VOC content is 9.59 g/L. for waterproofing sealers.
         1) Complies with: SCAQMD Rule 1113, Architectural Coatings. Max VOC Content for waterproofing sealers: 100 g/L.

2.3 FABRICATION

A. Configuration:
   1. Front: Straight, slightly eased at top.
   2. Backsplash: Straight, slightly eased at corner.
   3. End Splash: Matching backsplash.

B. Countertops:
   1. 1/2-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Fabricate with loose backsplashes for field assembly.
   2. Install integral sink bowls in countertops in the shop.

E. Joints:
   1. Fabricate countertops without joints where possible.
   2. Fabricate countertops in sections for joining in field where required due to size limitations.

F. Joint Locations: Not within 18 inches of openings or perimeter and not where a countertop section less than 36 inches long would result, unless unavoidable.

G. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

H. Cutouts for sinks furnished by others shall be smooth and uniform without saw marks. The top and bottom of sink openings shall be finished smooth. Corners of sink cutouts must be a minimum of 1/4-inch radius.

I. Full underlayment: At wall hung counters, base cabinets with or without sinks provide the following core material for solid surface counters:
   1. ¾ inch exterior grade veneer core plywood with waterproof adhesive, minimum 5 ply, fir or poplar.
   2. Provide full underlayment only at locations where cooking does not take place.

J. Spacer support frames: At countertops supported by base cabinets where cooking takes place, provide the following core material for solid surface counters:
   1. ¾ inch exterior grade veneer core plywood with waterproof adhesive, minimum 5 ply, fir or poplar constructed ladder system as follows:
   2. All solid sheeting constructed ladder system:

K. Rip plywood into 4-inch-wide strips.

L. Front to back 4-inch-wide strips (ladder strips) shall align with all cutouts and cabinet supports in a ladder structure.

M. Notch front and back 4-inch-wide rails to accept front to back (ladder strips) supports.

N. Join stiles using screwed or glued wooden biscuit seams, serrated dowels or rabbeted seams.

O. Cutouts and Holes:
   1. Undercounter Plumbing Fixtures: Make cutouts for fixtures[in shop] using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

P. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
   1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
   2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.4 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
   1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION

SECTION 21 00 01 - BASIC FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Basic Fire Protection Requirements specifically applicable to Division 21 sections, in addition to Division 1 - General Requirements.

1.2 REFERENCES

A. All references in Division 21 to codes, standards or other publications shall be the latest edition / version, unless noted otherwise.

B. International Fire Code

C. NFPA 13 – Standard for the Installation of Sprinkler Systems.

D. NFPA 14 – Standard for the Installation of Standpipe and Hose Systems.

E. NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection.

F. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

G. NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

H. NFPA 70 – National Electrical Code.

I. NFPA 72 – Fire Alarm and Signaling Code.

J. NFPA 101 – Life Safety Code

K. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.

L. UL – Fire Equipment Directory.

M. UL 199 – Automatic Sprinklers.

1.3 PLANS

A. These specifications are accompanied by plans indicating typical layouts, pipe and equipment location, etc. The plans and these specifications are complimentary each to the other and what is called for by one shall be as binding as if called for by both. Should there be a conflict between Drawings and specifications regarding a material shown of work described or detailed then the material of work having the greater value shall be provided.

B. The plans as prepared are in general diagrammatic. The Contractor shall carefully lay out his work at the site to conform to the architectural, mechanical, electrical and structural conditions to provide grading of piping, to avoid all obstructions and to conform to details of installation as shown on the plans and supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated satisfactorily operating installation. The General Contractor must coordinate the work of all trades. All necessary offsets in piping, fittings, ductwork, etc. required

to avoid interferences between piping, equipment, structural and architectural work are not shown but shall be furnished and installed by the contractor without additional expense to the Owner.

C. This project contains several different type of ceiling finishes, ceiling heights, elevation changes, high volumes, etc. The contractor shall coordinate all pipe routing to keep piping concealed above ceilings wherever possible. Where fire protection piping will be exposed in spaces with no ceilings, the piping shall be routed as high and close to structure as possible. The exact routing and location of exposed piping shall be reviewed by and acceptable to the Architect and Engineer. Exposed elevation change is not acceptable and shall be subject to removal, at the contractor's expense, unless coordinated with the A/E. The contractor shall carefully coordinate pipe routing and sprinkler head locations with all trades.

D. These specifications and plans accompanying same are intended to cover systems which will not interfere with the design of the building, which will fit into the available spaces, and which will insure complete and satisfactory systems. Each contractor shall, therefore, carefully examine the plans and the building and shall be responsible for the proper fitting of his material and apparatus into the building.

E. Contractor's attention is directed that all equipment he proposes to furnish shall fit into the spaces allocated for same on the plans. It shall be the Contractor's responsibility to furnish data to evidence that sufficient space can be provided for the installation of proposed equipment and that adequate access will exist for servicing and maintenance of equipment. Should changes become necessary during construction, the contractor shall make such necessary changes at his (the Contractor's) own expense.

F. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention no later than five (5) days prior to the bid date. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus or equipment.

1.4 CHANGES

A. Any changes from the plans necessary to make this work conform to the building as it is constructed, to make this work fit the work of other trades or to make this work conform to the rules of city and municipal bodies having jurisdiction shall be made by this contractor at no additional cost to the Owner. However, no changes shall be made from the work described on the plans and these specifications except on written order from the Architect.

B. If any changes are required other than those mentioned above and the changes involve extra work on the part of the contractor, no charges for this extra work shall be allowed unless authorized in advance of the work by a written order from the Owner and/or Architect stating the charges to be made for the work.

C. Proposed use of item or equipment other than that specified or indicated may require redesign of structure, partitions, foundations, piping, wiring, or other parts of mechanical, electrical, or architectural layout. Redesign, new drawings, and detailing required shall be prepared and submitted to Architect/Engineer for approval.

D. Where approved deviation requires different quantity, size and arrangement of wiring, conduit, equipment, etc. from that specified or indicated, provide such items and all other additional equipment required by system at not additional cost to the Owner.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection:

1. 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.
2. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
3. Damaged equipment or material shall be replaced with new as determined and directed by the Architect or Engineer. In particular, piping insulation which becomes saturated will be rejected and must be removed from the job site. Such repair or replacement shall be at no additional cost to the Owner.
4. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
5. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Owner.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 SUBSTITUTIONS

A. The materials, products and equipment described and specified establish a standard of quality, function, dimension and appearance to be met by any proposed substitutions.

B. Reference Division 01 – Product Requirements.

1.7 SUBMITTALS

A. Submit under provisions of Division 01.

B. The Contractor shall furnish copies of the manufacturer's literature and Drawings describing all proposed equipment and materials indicated in the specifications. The proposed use of the exact equipment and materials specified shall not change this requirement of including literature describing the proposed equipment. Manufactured items proposed for use, whether specified or proposed for substitution, shall be the current, catalogued product of the manufacturer, and replacement parts shall be available.

C. Manufacturer's regular catalog sheets will not be acceptable under this requirement unless they indicate completely all of the specification requirements and submittal page labeling criteria stated above. Where drawings cover several sizes or types of construction, they shall clearly indicate the size or type of construction to be used on the project. In cases where several sizes of the same type of equipment are required to be furnished, the submittal shall include a schedule identifying each piece of equipment, complete with all capacity information needed to compare every submitted item with its respective specified item.

D. Brochures shall contain a certification that the equipment or materials are suitable for conditions shown and specified; that the equipment or materials are believed to be in conformity with the plans and specifications, except as may be specifically described and that approval is

recommended. The certification shall be signed by the Contractor. Brochures received not in conformity with these requirements will be returned for required actions. Any deviation from the requirements of the specifications shall be clearly noted and marked for the Engineer's consideration.

E. Approval of the brochures, or any part of the contents therein, shall not eliminate responsibility for compliance with the plans and specifications, unless specific attention has been called in writing to proposed deviations at the time of transmittal of the brochures and such deviations have been approved, nor shall it eliminate the requirements or the responsibilities, if there are errors of any sort in the data submitted.

F. Detailed coordination drawings showing proposed fire protection piping layout as well as HVAC ducts and diffusers, HVAC piping, plumbing piping, electrical conduit, light fixtures and other ceiling elements must be submitted for approval prior to proceeding with any installation.

G. Contractor shall submit a copy of all permits and all inspection results from local authorities as well as result dates and notes from all test performed on the fire protection systems.

1.8 INTERFERENCES AND COOPERATION

A. The plans are generally diagrammatic and the Contractor shall coordinate the work of the different trades so that interferences between piping, equipment, structural and architectural work will be avoided. Not all offsets in piping, ductwork, etc., are shown. The Contractor shall cooperate with the General Contractor and all other contractors to coordinate their work to avoid interferences and delays and arrange all parts of the work to harmonize in service and appearance with all other parts.

B. The General Contractor shall coordinate the work of all trades. The various systems to be installed shall follow the normal, common sense priority of systems installation with the highest system to lowest system installation as follows:

1. HVAC ductwork shall be installed up and against building (floor/roof) structural members.
2. Sanitary waste and storm drainage piping system shall begin horizontal routing as high as possible between structural members.
3. Electrical conduit shall be installed up, and against building structure, running parallel with HVAC ductwork and offsetting up into structural bay (void) or below HVAC ductwork to obtain a change in direction or branch take-off.
4. HVAC heating and chilled water supply and return piping, domestic hot and cold water supply and hot water circulating return piping, and medical gas piping shall be installed beside and below the HVAC ductwork and electrical conduit.
5. Fire sprinkler piping system shall be installed below all other systems and components. The fire sprinkler piping shall not conflict with the installation or removal of ceiling system components or tile. The fire sprinkler system piping layout and installation shall be coordinated by the fire sprinkler contractor and the General Contractor with all other trades performing work in the affected area, to avoid conflict with the installation or removal of any other systems components, or to prevent ready access to valves, equipment of the other trades. Do not install sprinkler piping until ductwork mains are in place.

C. Provide an overhead coordination submittal per Division 01. The submittal shall include all structural, plumbing, mechanical, electrical, and fire protection components.

1.9 MATERIALS AND WORKMANSHIP

A. All materials shall be new, of the quality specified and free of any defects. Manufacturer's names are listed to establish a standard of quality and construction.

B. The Contractor will be responsible for transportation of his materials to the job and for their storage and protection until the final acceptance of the job.

C. Contractor shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds and all labor required for the safe and expeditious execution of his contract.

1.10 PERMITS AND INSPECTIONS

A. The Contractor will be responsible for all permits and inspections required by law for the completion of his work. Cost of all permits and inspections shall be paid for by the Contractor. The Contractor shall obtain and pay for all certificates of approval which must be delivered to the Architect before final acceptance of the job. All materials and labor furnished by the Contractor shall be in strict accordance with the rules and requirements of the National Board of Fire Underwriters, state and municipal regulations and other authorities who may have lawful jurisdiction over the work being done. One (1) copy of all permits obtained under this contract and all inspections performed and/or certificates of acceptances, approval or beneficial occupancy received for this work, shall be forwarded to the Engineer.

B. Each contractor shall be responsible for coordinating their work with the General Contractor and scheduling progress inspections through the General Contractor to allow for the following inspections to be performed without impeding the progress of construction. Generally, the Contractor shall plan for inspections to occur two (2) weeks prior to the scheduled concealment of work in the area of inspection.

1.11 EXAMINATION OF SITE

A. All Contractors submitting proposals for this work shall first examine the site and all conditions thereon and therein. All proposals shall take into consideration conditions as may affect the work under this contract. They shall satisfy themselves as to existing grades and the actual formation, and soil conditions.

B. Contractors shall verify all service locations, depths, sizes, etc. No information given on the plans shall relieve the Contractor of this responsibility.

C. Before starting work, the Contractor shall verify all associated existing systems, pipe sizes, locations, and dimensions so that the new systems can be properly connected as indicated on the documents.

1.12 QUALITY ASSURANCE

A. Perform Work in accordance with the codes listed on the drawings, the local authority having jurisdiction, the Owner’s Insurance carrier and the Architect/Engineer. As the minimum standard for the level of quality, in all cases the greater quantity or better quality shall be the first consideration for the basis of an acceptable product or process. The local authority having jurisdiction, the Architect and the Engineer shall have the final authority on the approval and/or use of any product or process specified or submitted for substitution. The greater quality and/or value specified herein for the system(s) and various components and installation procedures shall take precedence over the minimum requirements of the herein before mentioned codes or that of NFPA 13, NFPA 14 or NFPA 24 in all instances.

B. Equipment and Components: Bear UL label or marking.

C. Welding Materials and Procedures: Perform to ASME Code.

D. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Piping: All piping installed on this project shall bear the complete ASTM and Manufacturer's marking. Labeling and identification requirements as required by ASTM. All installed piping 3'-0" or greater in length shall be readily identifiable per ASTM labeling criteria. Piping not bearing this identification upon installation shall be removed and replaced by the correctly labeled piping. Piping shall not be re-stenciled after it is installed, to meet this requirement.

F. All materials shall be new, undamaged, and free of rust. Protect installed piping, valves and associated materials during progression of the construction period to avoid clogging with dirt, and debris and to prevent damage, rust, etc.

1. Rusted fittings and/or pipe are not allowed and will be required to be removed at the contractor's cost.

1.13 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 5-year manufacturer warranty for Heat tracing cable and controls.

C. Provide any exceptions with explanation for review.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 ESCUTCHEONS AND PLATES

A. Solid plates, 316 Stainless Steel with set screws shall be used where the sectional plates will not stay in place or are not available in the required size, or where other individual specification section(s) require one piece or greater quality escutcheons or plates.

2.4 INSULATION

A. All insulation materials used inside the building on this project, including finishes and adhesives on the exterior surfaces of ducts, pipes and equipment shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less as determined by an independent testing laboratory in accordance with NFPA 255 as required by NFPA 90A, unless noted otherwise acceptable.

2.5 ASBESTOS

A. Materials containing asbestos are not permitted.

B. If any asbestos-containing material is discovered or suspected, the contractor shall immediately cease any and all work in that area. Cover the exposed material in plastic containment without disturbing the exposed material and notify the Architect and the Owner's representative.

C. Certify in writing that neither the Contractor nor any of Contractor's subcontractors or suppliers will supply any materials that contain any asbestos in any form for this Project.

PART 3 - EXECUTION

3.1 EXISTING FACILITIES

A. All piping, valves, fittings, switches, starters, conduit boxes and/or any other items of mechanical or electrical equipment which are not in service at the completion of this contract shall be removed.

B. Where an existing service to existing building requires disconnection to facilitate installation of this work, this Contractor shall include in his bid the cost of such disconnecting, re-routing and re-connecting. Where any existing facilities which are to remain occupied are affected by disconnection, re-routing or re-connection, then such disconnecting, re-connecting and re-routing shall be done in such a manner so as not to interrupt any service to the building, including but not limited to, sanitary sewer, domestic water, fire protection, alarm, communications, natural gas, refrigerant piping and electrical power. Satisfactory arrangements shall be made with local authorities and/or the various utility companies involved.

1. Impairment tags shall be posted on all system control valves, each fire department connection and other locations required by the AHJ, indicating which systems, or part thereof, has been removed from service.
2. The method of disconnecting, re-routing and re-connecting shall be as shown on the submitted shop Drawings, or if not shown on the submitted shop Drawings, subject to the approval of the Architect and Owner.

C. Unless noted otherwise, all equipment and material indicated or specified to be removed shall become the property of the Owner and shall be removed from the site at the discretion of the Owner.

D. This Contractor shall carefully coordinate work in and around existing services and equipment and adjoining rooms to remodel areas. Coordinate shutdown, removal, capping and turn-on of existing services with the facilities' engineering department and General Contractor to provide continuous (uninterrupted) service throughout the construction period. This Contractor shall refer

to the architectural plans and specifications and thoroughly familiarize himself with the construction phasing in remodel areas before beginning work.

E. Protection during construction: Where existing ceilings are removed during demolition and construction period, the sprinkler head layout shall be modified and heads changed to upright type to provide full fire sprinkler coverage and protection for the entire space and above duct work, lights, etc. that have been left exposed.

F. Demolition and replacement of existing ceilings, Walls, Partitions and/or floors; that are not identified on the architectural drawing but is required for the removal and/or installation or modification of the fire protection system, this work shall be part of DIV 21 contract. This shall include the removal of the above-mentioned structure and finishes and the Replacement of the above mentioned structure to match existing finishes and/or to accept new finishes as the project dictates.

3.2 ACCESS PANELS

A. All valves, drains, gauges, etc., must be accessible. The Contractor shall, wherever required to service his installation, coordinate size and location of access panels with General Contractor. Refer to Division 08 – Access Doors and Frames.

3.3 FIRESTOPPING

A. Firestopping: Unused slots, sleeves and other penetrations in floors, walls or other general construction shall be closed and sealed with an approved firestopping material.

1. Reference Division 07 – Firestopping for appropriate firestopping material required for each wall rating and penetration size and type.
2. Floor slots and openings shall be closed with 16-gauge galvanized steel sheet supported on 1-inch by 1-inch by 1/8-inch structural angle drilled or supported with powder-driven studs into the building structure. Firestop with a layer of silicone elastomer not less than 1-inch thick which completely fills the opening. The top surface of the silicone elastomer shall be approximately 1 inch below the finished floor slab.
3. Openings in walls shall be closed with 16-gauge galvanized steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of the steel sheet with not less than 1/8-inch thick layer of non-sagging silicone elastomer to fully cover the opening.
4. Single or multiple pipes passing through walls and floors shall have the annular space between pipes or between pipes and structure filled with silicone elastomer to provide a 3-hour rated firestop for floors and walls.

B. The annulus between exposed pipe and walls or floors, in finished spaces shall be refilled, sealed and painted to match adjacent surfaces.

3.4 CUTTING AND PATCHING

A. All cutting and patching of floors, walls and ceilings for installation of work covered in these sections will be done by the General Contractor.

B. Where it becomes necessary to drill into or cut through any existing or completed floors, walls or ceilings to permit the installation of any work under this contract or to repair any defects that may appear up to the expiration of the guarantee, such cutting and patching shall be done by the General Contractor under the supervision of the Architect.

C. No joists, beams, girders or columns shall be cut without first obtaining written permission from the Architect or Structural Engineer.

D. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations approved by the Architect/Engineer. Impact type equipment shall not be used except where specifically approved by the Architect/Engineer. Openings in precast concrete slabs for pipes, etc., shall be core drilled to exact size.

E. Where core drilling or saw cutting of concrete floor or wall penetrations is required, work shall be performed in accordance with Division 03 Specifications. Where applicable Division 03 Specifications are not included in the Project, core drilling shall be in accordance with generally accepted standards and be performed by licensed personnel where applicable.

F. Contractor shall use ground penetrating radar (GPR) to scan areas of concrete prior to core drilling or saw cutting for embedments. Contractor shall clearly mark locations of embedments for review by Structural Engineer or owner’s construction representative before core drilling or saw cutting.

G. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner approved by the Architect/Engineer.

H. Plaster: All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

I. All drilling for expansion bolts, hangers and other supports shall be done subject to be approval of the Architect or Structural Engineer. Labor and materials required to replace or rebuild parts or injured portions shall be furnished at the Contractor's expense, subject to the satisfaction of the Architect.

J. Restoration: All openings shall be restored to "as new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

K. The annulus between exposed pipe and walls or floors, in finished spaces shall be refilled, sealed and painted to match adjacent surfaces.

L. Opening and Closing Pavement and/or Concrete Flatwork: Cut and patch existing pavement, concrete flatwork, etc. as required to perform work in the contract, satisfactory to the Architect/Engineer. Existing construction shall be machine-cut on straight lines. Unless otherwise described in "Excavating and Backfill", sub-base, base course and paving materials shall be equal to existing materials as required by other Divisions of these specifications or as required to match existing conditions. Materials shall be thoroughly compacted to required (or adjacent) densities and thicknesses and shall be finished level with adjacent surfaces.

3.5 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers and equipment. Locate piping, sleeves, inserts, hangers and equipment clear of windows, doors, openings, light outlets, ductwork and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items and valves. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Minor Piping: Generally, small diameter pipe runs from drips and drains and other services are not shown but must be provided.

F. Install gages, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

G. Work in Existing Building: Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to Cutting and Patching article in Part 3 of this section.

3.6 UNIONS

A. No unions are to be placed in any pipe in a location which will be concealed or inaccessible after completion of the building unless furnished with an access panel either as shown on the Drawings or as specified herein. Unions must be installed on each side of all pieces of equipment such as heating units, pumps, etc., so that such equipment may be readily disconnected.

3.7 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities, when required by the phasing or called for specifically on the plans.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.

C. When construction is complete, temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs in potable water systems will not be allowed. Provide necessary blind flanges and caps to seal open piping remaining in service.

D. Provide temporary fire protection during the construction phase of Project. Inform and obtain approval from the Owner and General Contractor for any interruptions of existing fire protection, domestic water or fire alarm systems.

3.8 DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor. Such access shall be provided without additional cost or time to the Owner. Where work is in an operating facility, provide approved protection from dust and debris at all times for the safety of personnel and maintenance of building operation and environment of the facility.

B. In an operating facility, maintain the operation, cleanliness and safety. The Owner's personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and facility operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of facility operation. Perform all flame cutting to maintain the fire safety integrity of this facility. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards.

C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from the property expeditiously and shall not be allowed to accumulate.

E. At any time work is occurring when the building is occupied, avoid using tools that create excessive noise that might disrupt the building operations (e.g. concrete breaking equipment, excavating equipment, hammer drills, screw guns, etc.). Use other types of tools or schedule work to occur outside of normally occupied hours. Carefully plan water control for all coring and sawing operations to prevent damage and disruption of occupants.

3.9 FIRE ALARM INTERFACE

A. Ensure that all required fire protection system alarm devices are installed and connected as required to the fire alarm system; including but not limited to: flow switches, tamper switches and alarm notifications.

3.10 UTILITIES

A. The Contractor shall arrange and pay for any necessary revisions to existing utility services, including meter deposits and connection fees to all serving utility companies and shall install utilities, where applicable.

3.11 INDOOR AIR QUALITY CONTROL:

A. All Adhesives, sealants, paints, coatings applied within the weatherproofed interior of the building shall comply with applicable VOC thresholds of SCAQMD 1113 and 1168.

3.12 PAINTING

A. Paint all exposed fire sprinkler pipe. Paint color shall be submitted and acceptable to the Architect and Engineer. Where the color is other than Red; then the pipe shall also be labeled.

B. Surfaces to be painted and types of paint shall be as specified in the Architectural specifications. Refer to Division 09.

C. All surfaces to be painted shall be thoroughly cleaned, all rust scraped off and all oil and grease removed before any paint is applied.

D. Under no conditions shall paint be applied to sprinkler heads, escutcheons, or covers. If paint is so applied, replacement of the affected parts shall be required.

E. Finishing paint coats shall not be applied until all the plastering or other structural building work is completed. Cloths shall be spread where necessary to prevent drops of paint, oil, etc. from defacing walls, floors, etc., and the Contractor shall be held responsible for all damage by neglect of such precautions. The finished conditions of the painting shall be subject to the approval of the Architect, who may require retouching or repainting of surfaces not properly finished.

3.13 EXCAVATING AND BACKFILLING

A. The Contractor shall do all excavating and backfilling necessary for the installation of the work, including shoring, bailing and pumping to maintain his trenches and keep them in dry condition until the work in question has been tested and approved.

B. Care shall be taken that piping is properly and uniformly graded and that trench beds are well rammed and that ground under pipelines is firm and secure before piping is laid. All trenches must be backfilled with clean sand, four inches under pipe, rammed down, soaked with water and made solid. All surplus material shall be removed and carted away.

C. The Contractors will be responsible for resurfacing all areas after trenches have been backfilled.

D. The Contractor is directed to comply with all OSHA Requirements and State Requirements regarding trench safety.

E. Perform all work with the highest regard to safety and in accordance with U.S. 29 CFR 1926 “Safety and Health Regulations for Construction”. Special attention shall be directed to Subpart P – Excavations. Refer also to 230010.1.12 – Safety.

1. Safety Precautions and Programs

    a. In excavations that are four (4) feet or more in depth, means of egress shall be provided by stairway, ladder, ramp or other safe means so as to require no more than twenty-five (25) feet of lateral travel for employees.
    b. In addition, on projects in which trench excavation will have a depth of five feet or more, the Contractor, and all of their subcontractors, shall comply with all requirements of 29 CFR 1926 Subpart P 652 “Safety and Health Regulations for Construction – Excavations” and all Appendices related thereto.
    c. Before commencing any trench excavation that will be five (5) feet deep or deeper, provide Owner, through A/E, with detailed plans and specifications regarding the safety systems to be utilized. Said plans and specifications shall include a certification from a registered professional engineer indicating full compliance with the 29 CFR 1926 Subpart P -- Excavations.
    d. Contractor shall ascertain, prior to proposal, whether or not such conditions prevail and services are needed, and shall include cost of same in proposal.

2. All shoring and bracing shall be designed so that it is effective to the bottom of the excavation. Sheeting, sheet piling, bracing, shoring, trench boxes, and other methods of protection, including sloping, shall be based upon the condition and nature of the materials

to be retained, and by loads (including surcharge) imparted to the sides of excavation by equipment and stored materials.

3. Store excavated or other materials a minimum of two feet (2') from the edge of any excavation. Retain such materials to prevent their falling or sliding into the excavation, and to prevent excessive pressure on the sides of the excavation.
4. Maintain sides and slopes of excavations in a safe condition by scaling, benching or barricading.
5. Take other precautions via shoring and bracing to prevent slides or cave-ins. Take special precautions when trenches are located adjacent to backfilled excavations, or subjected to vibrations from railroads, highway traffic, operation of machines, etc.

F. Verify locations of all existing utilities in the area prior to start of excavation (gas, electrical, water, sanitary, storm, telephone, cable TV, optical cable, etc.). Coordinate with utility companies as required.

1. Excavation within four feet (4') of existing utilities shall be done by hand digging only.

G. Where conditions require concrete or other materials to be placed against undisturbed earth surfaces, any loosened or disturbed materials shall be removed from such surfaces.

H. Trenching

1. Trenches shall be large enough to permit handling of pipe and accessories and making connections. Trench bottom width shall exceed coupling diameters by at least twelve inches (12").
2. Trenches in rock, soil containing rocks larger than two (2) inches in any dimension, and other non-uniform materials, shall be four (4) inches minimum and twelve inches (12") maximum below the bottom of the pipe to provide for a bedding course.

I. Preparation of Trench Bottom

1. If the excavation is carried below the finished flow line grade of the pipe in order to remove unsuitable material or for any other reason, the trench shall be course bedded to within six inches (6") of the finished flow line grade of the pipe bottom with compacted load-bearing backfill. A bedding course as specified below shall then be placed over the load-bearing backfill.
2. Trenches shall be dry when the trench bottom is prepared. A continuous trough with compacted bedding course shall be prepared to receive the bottom quadrant of the pipe barrel. Remove loose or disturbed material and bring the trench bottom up to grade with bedding material as follows:

    a. For active soils where metallic piping is used, washed pea gravel with material no larger than 1/2 inch in largest dimension shall be utilized. Provide a Bentonite plug in the trench at the building perimeter where site drainage or other conditions could permit water intrusion into the trench under the building. Bentonite plug to extend 2 ft. on either side of the perimeter grade beam. (Sand bedding material may be substituted beyond ten (10) feet from building line only.)
    b. NOTE: Confirm soil conditions prior to trenching. In general, soils with a plasticity index (PI) over 10 at depths to be encountered are considered active. Refer to Geotechnical Report included in project Specifications for PI value and additional information.

3. In addition, for bell joint pipe, excavation for the bell or coupling shall be so that the pipe will bear on the trench bottom along the entire length of the barrel.

4. Prepare the trench bottom carefully so that when placed in its final position, the pipe will be true to line and grade and uniformly supported.

J. Laying Pipe

1. All pipe shall be clean at the time it is placed in the line. Open ends of pipe sections already in place shall be tightly plugged to prevent the entrance of trench water, mud, dirt, etc.
2. Keep trench bottom free of frost, frozen earth or standing water at the time of pipe laying and jointing.

K. Compaction

1. Where compaction is indicated by specifications, accomplish same with vibratory or rammer type compactor, minimum of two full width passes.
2. Compaction below slabs, roads, flatwork, or other construction elements shall be performed to the requirements of compaction for those elements. Coordinate with general construction trades and other Division's specifications.

L. Backfilling

1. Clean trenches and backfill material of any organic material, roots, trash, lumber, other debris and frozen material prior to backfilling. Backfill material shall contain no organic material, roots, trash, lumber, other debris or frozen material. Backfill material under slabs inside building shall match adjacent materials and be of density acceptable to the A/E.
2. Backfilling by means of sluicing or flooding with water is not permitted. Backfill shall not be placed on frozen ground.
3. Partially backfill immediately after the pipe is laid (unless other methods for anchoring pipe are provided). Leave joints exposed for hydrostatic testing. Water shall not be permitted to rise in unbackfilled trenches after pipe has been placed.
4. Whenever timber or other sheeting is driven to a depth below the elevation of the top of the pipe, that portion of the sheeting below a point four feet above the elevation of the top of the pipe shall not be disturbed or removed.
5. Pipe layer backfill (bedding material under the bottom quadrant of the pipe, around sides, and up to a point one foot above the top of the pipe) shall be: sand or select material containing rocks no larger than 1/2 inch in greatest dimension (sand only shall be used with all plastic piping systems or plastic jacketed piping systems); except that pipe layer backfill below slabs in active soils shall be washed pea gravel of 1/2 inch minus dimensions. Backfill below slabs may utilize flowable fill.
6. Backfill material shall be placed and compacted in six inch (6") layers. Backfill shall be brought up evenly on both sides of the pipe simultaneously to avoid damage or displacement from unbalanced loading.
7. Joints shall not be covered with backfill until pressure and leak testing is completed.
8. Backfill to grade (above pipe layer).

    a. Active Soils: Where active soils are encountered backfill to grade within ten (10) feet of building line shall be uncompacted washed pea gravel to match the pipe layer backfill specified above.

M. The Contractor shall also comply with requirements set forth in Division 31 Specifications.

3.14 ESCUTCHEONS AND PLATES

A. Where pipes pass through ceilings or walls in finished spaces, install sectional plates or escutcheons to cover the annular opening between pipe and sleeve..

B. The annulus between pipe and walls or floors, shall be filled with Sonolastic NP unless fire wall or barrier then the approved UL listed fire assembly shall be used.

C. Inside diameter of escutcheons shall fit around insulation and around pipe when not insulated; outside diameter shall cover sleeve. Secure escutcheons or plates to pipe or sleeve but not to insulation. All escutcheons shall be triple nickel-chromium plated brass, or Type 316L stainless steel.

3.15 CLOSE OUT DOCUMENTATION AND TESTING REPORTS

A. Contractor shall provide Project Record Documents, Operation and Maintenance data and all product warranty data as specified in Division 01.

B. Contractor shall provide copies of all fire protection system tests and certification reports for inclusion in project close out documents. Reports shall include, but shall not be limited to, the following:

1. Acceptance testing for various fire protection systems, as required by appropriate NFPA standard.
2. Contractor’s Material and Test Certificates.
3. Final approval documentation from local Fire Department.
4. Backflow prevention assembly certifications.

C. Contractor shall provide As-Built Fire Protection Drawings, as hard copies and/or electronic format as required by Owner.

END OF SECTION

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, fittings and valves for fire suppression systems.
2. Fire department connections.
3. Piping specialties for fire suppression systems

B. Related Sections:

1. Division 09 – Painting: Preparation and painting of fire protection piping systems.
2. Section 21 00 01 - Basic Fire protection Requirements
3. Section 21 05 53 – Fire Protection Identification.
4. Section 21 12 00 – Fire Suppression Standpipe Systems
5. Section 21 13 13 – Wet Pipe Sprinkler Systems.
6. Section 21 13 16 – Dry Pipe Sprinkler Systems.
7. Section 22 06 29 – Hanger and Supports for Plumbing Piping and Equipment
8. Section 26 05 03 – Equipment Wiring Systems.
9. Section 28 31 00 – Fire Detection and Alarm.

1.2 REFERENCES

A. ASME Boiler and Pressure Vessel Code Section IX – Welding and Brazing Qualifications.

B. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

C. ASME B16.3 – Malleable Iron Threaded Fittings, Class 150 and 300.

D. ASME B16.4 – Cast Iron Threaded Fittings, Class 125 and 250.

E. ASME B16.5 – Pipe Flanges and Flanged Fittings.

F. ASME B16.9 – Factory-made Wrought Steel Buttwelding Fittings.

G. ASME B16.11 – Forged Steel Fittings, Socket-welding and Threaded.

H. ASME B16.15 – Cast Bronze Threaded Fittings

I. ASME B16.25 – Buttwelding Ends.

J. ASME B36.10 – Welded and Seamless Wrought Steel Pipe.

K. ASTM A135 – Electric-Resistance-Welded Steel Pipe.

L. ASTM A47 – Malleable Iron Castings.

M. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

N. ASTM A234 – Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

O. ASTM A395 – Standard Specification for Ferritic Ductile Iron Pressure-Rated Castings.

P. ASTM A795 – Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

Q. ASTM D2000 – Standard Classification System for Rubber Products.

R. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.

S. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

T. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast.

U. AWWA C550 – Protective Interior coatings for Valves and Hydrants.

V. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings.

W. ASTM B88 – Standard Specification for Seamless Copper Water Tube.

X. AWS A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

Y. AWS D10.9 – Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

Z. NFPA 13 – Standard for the Installation of Sprinkler Systems.

AA. NFPA 13R – Standard for the Installation of Sprinkler Systems In Low-Rise Residential Occupancies

BB. NFPA 14 – Standard for the Installation of Standpipe and Hose Systems.

CC. NFPA 20 – Standard for the Installation of Fire Pumps.

DD. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

EE. NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

FF. NFPA 70 – National Electric Code

GG. NFPA 72 – Fire Alarm and Signaling Code.

HH. NFPA 101 – Life Safety Code.

II. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.

JJ. NFPA 2001 – Clean Agent Fire Extinguishing System

KK. UL – Fire Equipment Directory.

LL. UL 262 – Gate Valves for Fire-Protection Service.

MM. UL 312 – Check Valves for Fire-Protection Service.

NN. UL 405 – Fire Department Connections.

1.3 SUBMITTALS FOR REVIEW

A. Submit under provisions of Division 01 and Section 21 00 01.

B. General: All new applications, all rework applications and all modifications to existing systems shall be submitted for approval as described herein.

C. At start of project, perform current fire flow tests or secure current water pressure/flow capacity data from water utility. Do not rely on previous data or reports unless such were prepared with the site/city utilities being unchanged from current conditions and unless data was obtained within 6 months prior to system design.

D. Product Data: Provide data on sprinkler heads, piping materials, joining methods, supports, valves, flow switches, tamper switches and all other components and accessories intended to be installed. Include manufacturers' catalog information, Code and Standards compliance, performance ratings, rough-in details, weights, finishes, support and connection requirements.

E. Coordination Drawings: Submit piping and sprinkler head Layout Drawings that have been fully coordinated with other disciplines to avoid space conflicts. Prepare these Coordination Drawings prior to submittal of fire suppression Drawings for Fire Department approval.

F. Shop Drawings:

1. Submit detailed and accurate Shop Drawings electronically of entire systems prior to fabrication. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate system controls, hydraulic reference points, detailed pipe layout, valves, hangers and supports, components and accessories.
2. Hydraulic calculations: Submit flow test results and comprehensive hydraulic data sheets complying with NFPA 13.
3. Where expanding existing systems, the submitted design drawings shall show a sufficient amount of the existing system as required, the minimum shall show back to cross main or feed main to clearly identifying how the new work connects to the existing system.

G. Design Data: Submit Shop Drawings and design calculations signed and sealed by professional engineer, licensed by the State of Texas or a Responsible Managing Employee (RME), as defined in the Texas Insurance Code, Article 5.43-3§1C10, licensed by the State of Texas Fire Marshal Office for the fire protection system installed.

H. Design (e.g. hydraulic calculations) shall include a minimum "safety factor" of 10% of the hydrant flow test static pressure or 10 psig (whichever is greater) to account for future variations in water supply pressure, deterioration of piping system and future renovations to system. Hydraulic calculations shall show inclusion of this "safety factor."

I. Fire Suppression Submittals:

1. Submit Drawings for approval by local Fire Department and Owner's insurance carrier after acceptance of Coordination Drawings by Owner and Engineer.
2. Submit Drawings and calculations approved by local Fire Department for final approval by Owner and Engineer.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

A. Submit under provisions of Division 01 – Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of sprinklers and all deviations of piping from approved shop drawings. Indicate sizes and types of sprinkler heads, all valve, drain and test locations and all system equipment or other components. Provide electronic copies of all system record documents and final hydraulic calculations.

C. System Acceptance Forms: Provide appropriate Contractor's Material and Test Certificate(s), completed and signed, as required by Chapter 25 of NFPA 13.

D. Provide certification of compliance from local authority having jurisdiction indicating approval of system acceptance test(s).

E. System Certification: For any project subject to the Hospital Licensing Rules of the Texas State Department of Health Services, the Contractor shall provide a copy of a letter or certification from a professional engineer (P.E.) licensed in the State of Texas and experienced in fire sprinkler system installations, indicating that the fire sprinkler working plans, hydraulic calculations, system testing and field inspection of the new or modified sprinkler system is in compliance with the requirements of NFPA 13, Standard for the Installation of Sprinkler Systems.

F. Provide test certifications form any Backflow Prevention Assemblies.

G. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot. Provide a preventative maintenance schedule for all applicable equipment and systems. Also include a copy of NFPA 25 for the Owner's reference.

1. This Project and the fulfillment of the Contractor's responsibilities will not be considered for "Substantial Completion" until the Owner's Operation and Maintenance Manuals (and, if required, the corrected copies) have been submitted to and approved by the Engineer; and, in turn submitted to the Owner; and, the Owner's facilities personnel have received the required instructional period on the operation and maintenance of the installed systems and equipment.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

I. Provide a final acceptance letter from the Owner's insurance provider.

1.5 QUALITY ASSURANCE

A. Sprinkler and Standpipe Systems: Perform work to the International Building Code, NFPA 13 and 14 as modified herein, the local authority having jurisdiction, and the Architect/Engineer, and the requirements of the owner's insurance carrier. The greater quality and/or value specified herein for the system(s) and various components and installation procedures shall take precedence over the minimum requirements of NFPA, in all instances.

B. Sprinkler Shop Drawings and hydraulic calculations are to be sealed by a Professional Engineer, knowledgeable in fire protection engineering or a Responsible Managing Employee (RME) licensed by the State of Texas Fire Marshal Office, before submitting for review.

C. Welding Materials and Procedures: Perform to ASME Code.

D. Valves: Bear UL/FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Piping: All piping installed on this project shall bear the complete ASTM and manufacturer marking, labeling and identification requirements as required by ASTM. All installed piping 3'-0" or greater in length shall be readily identifiable per ASTM labeling criteria. Piping not bearing this identification upon installation shall be removed and replaced by the correctly labeled piping. Piping shall not be re-stenciled after it is installed to meet these criteria. Maintain one copy of each document on site.

F. Coordinate with the general contractor and MRI shielding supplier for fire sprinkler penetrations through the MRI shield. MRI Shield suppler to provide penetrations for sprinkler through the shield.

G. The system shall conform to applicable requirements of the Texas Administrative Code Title 28, Chapter 34.

1.6 REGULATORY REQUIREMENTS

A. Sprinkler Systems: Conform work to NFPA 13.

B. Standpipe and Hose Systems: Conform to NFPA 14.

C. Service Mains: Conform to NFPA 24.

D. Fire Pumps: Conform to NFPA 20.

E. Installation, identification and Testing: Conform to NFPA 25.

F. FM Global standards and guidelines.

G. Welding Materials and Procedures: Conform to ASME Code AWS D10.9.

H. Valves: Bear UL FM label or marking. Provide manufacturer's name and pressure rating marked on valve body. UL or FM approved for fire protection service.

I. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

J. Texas Administrative Code, Title 28, Chapter 34.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01.

B. Deliver and store valves in shipping containers, with labeling in place. Provide temporary protective coating on cast iron and steel valves. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Piping and piping systems shall not be allowed to be exposed to exterior weather or elements. Piping, fittings and valves stored outside shall be covered at all times and shall be stored on pallets or rack systems, above ground. Piping, fittings and valves stored inside shall be stored on pallets or racks and shall not be allowed to be strewn around the construction area. Cleanliness of the work area and safety of the construction personnel shall be the first consideration.

1.8 EXTRA MATERIALS

A. Division 01 – Contract Closeout.

B. Provide one valve stem packing for each size and type of valve installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. All piping, materials and equipment used in the installation of sprinkler and standpipe systems shall be new and listed as approved by the Underwriters' Laboratories, Inc., List of Inspected Fire Protection Equipment and Materials and the Factory Mutual Testing Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard and shall be the latest design of the manufacturer.

C. Pressure ratings of pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the designed system pressures in which they are installed.

D. The installing Contractor shall identify piping, fire department connections, valves and hydraulic design information in accordance with applicable NFPA Standards.

2.2 BELOW GRADE PIPING

A. General: All materials shall comply with applicable NFPA, ASTM, AWWA, UL and FM standards. All valves shall be UL listed and FM approved for the fire protection service.

B. Below-grade piping shall be one of the following:

1. AWWA C151 cement mortar lined ductile iron water pipe with restrained push-on joints. All iron pipe, fittings and accessories shall be wrapped with standard 8 mil (minimum) low density polyethylene film or 4-mil (minimum) cross laminated high-density polyethylene conforming to AWWA C-105.

    a. Push-on joints shall be in accordance with ANSI/ AWWA C111/A21.11 "Rubber-Gasket Joints for Ductile-Iron Pipe and Fittings." Restrained joint fittings and the restraining components shall be ductile iron in accordance with applicable requirements of ANSI/AWWA C110/A21.10 and/or C153/A21.53 with the exception of the manufacturer's proprietary design dimensions. Push-on joints for such fittings shall be in accordance with ANSI/AWWA C111/A21.11. Restrained joint pipe and fittings shall be U.S. Pipe's TR FLEX Pipe and Fittings or approved equal. Restraint of field cut pipe shall be provided with U.S. Pipe's TR FLEX GRIPPER Ring, TR FLEX Pipe field weldments or approved equal.
    b. Restrained push-on joints for pipe and fittings shall be designed for a water working pressure of 350 psi for sizes 4 inches through 24 inches. For fire protection service, 4-inch through 12-inch pipe and fittings are listed by Underwriters Laboratories for 350 psi and are approved by Factory Mutual for 250 psi.
    c. Cement mortar lining and seal coating for pipe and fittings, where applicable, shall be in accordance with ANSI/AWWA C104/A21.4.
    d. Asphaltic outside coating shall be in accordance with ANSI/AWWA C151/A21.51 for pipe and ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/ A21.53 for fittings.

2. ANSI/AWWA C900-07, FM 1612 DR 18 PVC with bell and spigot type joints with elastomeric gaskets and metallic restraining casings and rings, 235 PSI pressure class. J.M. Eagle "Eagle Loc 900" or approved equal.

C. Provide approved transition couplings/fittings as required from one piping material to another.

D. Building service riser: Riser shall be composed of a single extended 90-degree fitting of fabricated 304 stainless steel tubing, maximum working pressure 200 psi. The fitting shall have a flanged connection on the inlet (building) side and a CIPS coupler on the inlet (underground) side. Riser shall be equivalent to Ames Fire & Waterworks Series IBR In-Building Riser.

2.3 ABOVE-GROUND PIPING

A. Steel Pipe for Wet-Pipe Systems: Schedule 40 black steel pipe meeting ASTM A53 (Grade B, Type S or E); ASTM A135; or ASTM A795. All pipe shall be either seamless or electric resistance welded – furnace welded pipe will not be allowed. Piping 6” and larger to be ASTM A53 Type s (seamless). All pipe shall be UL listed or FM approved for fire protection service and the interior surface shall be coated to reduce microbiologically influenced corrosion (MIC). At contractor’s option, piping larger than 2 inches may be Schedule 10 black steel pipe, meeting all of the above requirements.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded; ASME B16.25, buttweld ends; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings ASTM A47.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, “C” shaped elastomeric sealing gasket, steel bolts, nuts, and washers. Provide Rigid couplings on Risers and mains; Provide Flex couplings on loop and branch piping. Couplings shall have two (2) bolts. One Bolt rigid couplings or similar style are prohibited.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.
6. Flange Fittings; ASTM B16.5, Class 150

    a. Gasket material – AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
    b. Bolts – ASME B18.2.1, carbon steel unless otherwise indicated.

B. Steel Pipe for Dry-Pipe Systems shall meet all requirements of paragraph A, except that all pipe and fittings shall be hot dipped zinc coated (galvanized).

C. Sprinkler piping in areas subject to magnetic fields (i.e. MRI Rooms)

1. Copper Tube; Seamless, drawn; Type “K”, ASTM B88,
2. Fittings: ASTM B16.15: Wrought Copper; brazed joints
3. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting temperature range 1190 to 1480 degrees F.

2.4 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13 and NFPA 14.

B. Fire protection piping shall be substantially supported from the building structure as required by NFPA 13.

C. Fire protection piping shall be supported independently of all other systems.

D. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.

E. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

G. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

H. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

I. Vertical Support: Steel riser clamp or Angle ring.

J. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

K. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

L. Wire or perforated strap iron will not be acceptable as hanger material.

2.5 VALVES

A. Similar types of valves shall be the product of one manufacturer; i.e., all butterfly valves shall be of the same manufacturer, all ball valves shall be of the same manufacturer, etc.

B. All valves used to control the flow of water to and within standpipe and sprinkler systems shall be listed indicating type complete with electric supervisory switches. Coordinate wiring with the electrical Contractor.

2.6 GATE VALVES

A. Up to and Including 2 Inches: UL listed, FM approved, complying with AWWA C550 and NSF 61 approved, bronze body, bronze trim, rising stem, handwheel, inside screw, double wedge or disc, threaded ends.

B. Over 2 Inches: UL listed, FM approved, complying with AWWA C550 and NSF 61 approved, iron body, bronze trim, non-rising stem, handwheel, double wedge, flanged, grooved or mechanical joint ends.

C. Underground application: UL listed, FM approved, 250 PSI WWP flanged iron body non-rising stem gate valve with square operating nut. bolted bonnet and resilient wedge. The body and bonnet shall be coated with fusion bonded epoxy both interior and exterior, complying with AWWA C550 and be NSF 61 approved.

1. Provide solid bar, carbon steel, valve stem extension. Provide ductile iron bonnet box and cover; bonnet box extension and 316 S.S. centering ring

2.7 GLOBE OR ANGLE VALVES

A. Up to 2 Inches: UL listed and FM approved Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, screwed ends, with back seating capacity repackable under pressure.

B. Over 2 Inches: UL listed, FM approved Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.8 BALL VALVES

A. Up to and Including 2 Inches: UL listed, FM approved Iron Bronze three-piece body, stainless steel ball, Teflon seats and stuffing box ring, with integral, factory-mounted tamper switch, threaded ends with union.

B. Over 2 Inches: UL listed, FM approved cast iron or ductile iron body, stainless steel ball, Teflon seat and stuffing box seals, with integral factory-mounted tamper switch, and threaded or grooved ends.

2.9 BUTTERFLY VALVES

A. Over 2 Inches: Ductile iron body conforming to ASTM A395 with polyamide coating, ductile iron disc, UL listed, FM approved with EPDM encapsulated rubber seal conforming to ASTM D2000, Type 416 stainless steel stem and gear operator with handwheel and indicator flag. Valves shall be furnished with integral supervisory switch rated for 1/2 amp at 120-volt DC and 5 amps at 120-volt AC.

2.10 CHECK VALVES

A. Manufacturers: UL listed, FM approved.

B. Up to and Including 2 Inches: Bronze swing disc, screwed ends.

C. Over 2 Inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

2.11 DRAIN VALVES

A. Manufacturers: UL listed, FM approved.

B. Bronze compression stop with hose thread nipple and cap.

C. Brass ball valve with cap and chain, 3/4-inch hose thread.

2.12 POST INDICATOR AND VALVE

A. Valve shall be UL listed, FM approved, 250 PSI WWP flanged iron body non-rising stem gate valve with indicator post pattern, bolted bonnet and resilient wedge. The body and bonnet shall be coated with fusion bonded epoxy both interior and exterior, complying with AWWA C550 and be NSF 61 approved.

B. Post Indicator: UL listed, FM approved, vertical type, cast iron body with operating wrench, extension rod, view windows (for “OPEN” and “SHUT” signage), and adjustable cast iron barrel of length required for depth of burial of valve.

C. Wall Post Indicator: UL listed, FM approved, horizontal type, cast iron body with hand wheel, view windows (for “OPEN” and “SHUT” signage) and 12” wide wall flange.

2.13 BACKFLOW PREVENTERS

A. Provide one of the following double check valve backflow prevention assemblies on the fire water service entry, unless local municipality requires a reduced pressure type backflow preventer. Double check valve assembly shall be UL listed, FM approved and ASSE 1015 listed.

B. Where installed inside building, backflow prevention assembly shall be equal to Watts Series 757 or 757N with two independent check modules within a single type 304 schedule 40 stainless steel housing with four test cocks and grooved butterfly shutoff valves with integral tamper switches. Assembly shall be available for either horizontal or vertical installation.

C. Where installed outside building or where required by AHJ to monitor unauthorized use of water, provide double check detector assembly equal to Watts Series 757DCDA or 757NDCDA with two independent check modules within a single type 304 schedule 40 stainless steel housing with four test cocks and grooved butterfly shutoff valves with integral tamper switches. The assembly shall also include a bypass line with meter, double check backflow assembly and required test cocks. The overall assembly shall be available for either horizontal or vertical installation.

2.14 FIRE DEPARTMENT CONNECTIONS

A. Provide a fire department connection as required by NFPA and the local Fire Department, at the location indicated on the Drawings.

B. Each fire department connection shall consist of 2-1/2–inch inlets with clappers compatible with equipment utilized by the local Fire Department and equipped with UL listed Knox caps with swivel guards (Knox model 3041 or approved equal, keyed for the local Fire Department). Provide adequate number of inlets to meet sprinkler and/or standpipe system design flow, based on a maximum of 250 GPM per inlet connection.

C. Wall-mounted Fire Department Connections shall be flush mounted type with ductile iron body and polished brass plate and snoots with pin lug hose thread inlets, equal to Potter-Roemer 5100-5400 Series.

D. A single 5-inch straight Storz connection with 30-degree downward Storz elbow adapter. The Storz adapter shall have a hard anodized aluminum metal face or Nitrol lip gasket type seal and hard anodized aluminum Storz ramps and lugs. The adapter shall be made of forged or extruded 6061-T6 aluminum secured to the pipe by 5/16” stainless steel set. Provide with Knox locking capes- The Knox Storz Lock made of anodized aluminum – 5-inch; aluminum construction Lock: Locks with a proprietary Knox Keywrench: Dark, hard anodized aluminum finish. Provide escutcheon signage.

E. Free standing Fire Department Connections shall have either a cast brass or red polyester coated ductile iron body, with 18” long polished brass cover sleeve and cast brass identification base plate, equal to Potter-Roemer 5761-5792 Series.

F. Each fire department connection shall be labeled as required by the local Fire Department with raised letters reading "AUTOMATIC SPRINKLER" or "STANDPIPE".

G. Each fire department connection shall be mounted not be less than 2 feet and not more than 3 feet 6 inches in elevation, measured from the ground level to the centerline of the inlets.

H. Provide signage as required by NFPA 13 and NFPA 14, and any additional signage specifically required by the local fire department.

2.15 OUTSIDE ALARM BELL

A. UL listed and FM approved vibrating type electric bell for fire signaling to receive signal from Fire Alarm System with 120-volt single phase power requirement, 10” size, for outdoor use, red powder coating with weatherproof back box, 94 dB at 10 feet.

2.16 WATER FLOW ALARM SWITCH

A. Provide, where indicated on the drawings and where required by NFPA 13., Provide field adjustable vane type waterflow switch UL listed and FM approved, Flow switch shall be provided with delay, adjustable up to 90 seconds. See Division 28 for electrical signal connection by others to these flow switches.

2.17 SPRINKLER SYSTEM INSPECTOR'S Test Assembly

A. NFPA 13 compliant UL Listed and FM approved sprinkler system inspector's test assembly, consisting of sight glass, tamper resistant test orifice, test and drain ball valve, rated for 300 psi.

2.18 SUPERVISORY SWITCHES

A. UL Listed and FM approved unit for monitoring the open position of fire protection valves, red in color, tamper proof cover, two double throw double pole micro-switches, NEMA 3R enclosure, Coordinate with Division 28 for power requirements.

B. UL Listed and FM approved supervisory actuated low/high pressure switch for low differential dry and preaction valves, designed to detect an increase and/or decrease from normal system pressure in automatic fire sprinkler systems. Unit shall consist of two factory set switches. The low switch is set to activate at approximately 10 psi on a decrease in pressure, and the high switch is set to activate at approximately 20 psi on an increase in pressure. Unit shall have a die-cast cover with textured red powder coat finish, NEMA 4X enclosure, SPDT switch contacts. Coordinate with Division 28 for power requirements.

2.19 PRESSURE SWITCHES

A. UL Listed and FM approved for use on fire protection systems, pressure type flow switch, activated by any flow of water equal to or in excess of the discharge of one sprinkler head, bellows activated, maximum service pressure rating of 300 psi, adjustable range of 4-20 psi, (2) SPDT contacts, 24 VDC power requirement, ½" male NPT, NEMA 4 rating,

2.20 PRESSURE GAUGES

A. UL Listed and FM approved for use on fire protection systems, 0-300 psi pressure range, phosphor bronze bourdon tube, polycarbonate one-piece ring and crystal, 3-1/2" dial, ¼" brass connection.

2.21 HEAT TRACING OF PIPING EXPOSED TO FREEZING CONDITIONS OR OUTSIDE OF THE HEATED AREAS

A. Furnish and install a complete UL listed system of heaters, components and controls to prevent freezing of domestic water piping exposed to freezing conditions. The heat trace system utilized on the fire protection water line shall be listed specifically for use on fire suppression piping.

B. Heat trace system shall be equivalent to Raychem "XL-Trace," utilizing a self-regulating cable with an output 5 watts/foot with 277 VAC supply voltage (Raychem 5XL2-CR).

C. Power connection, end seal, splice and tee kit components shall be applied in the field.

D. The heat trace system shall be controlled by a heat-tracing power distribution panel complete with main circuit breaker, door disconnect switch, alarm relay and alarm horn ground-fault and monitoring for group control of multiple circuits. Panel shall be equivalent to Raychem Model HTPG.

E. The system shall be controlled thru an ambient temperature sensor, Raychem model RTD-200 or equal, set to energize heat trace below 40 degrees F.

F. Heater shall be installed linearly on the pipe after piping has been successfully pressure tested. Heater shall be secured to pipe with cable ties or type PF-1 polyester tape as specified by the manufacturer.

G. System shall be tested in accordance with manufacturer's recommendations prior to the application of the thermal insulation as specified in Section 22 07 00.

2.22 RF SHIELD PIPE PENETRATION

A. At MRI Rooms, provide RF shield pipe penetrations with dielectric unions; ETC Lindgren wave guide feed-through or equal. Coordinate type and length of pipe penetration with MRI; EF shield supplier.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Systems shall be flushed until the system is clean of any foreign matter.

3.2 INSTALLATION

A. Install piping in accordance with NFPA 13 for sprinkler systems; NFPA 14 for standpipe and hose systems; and NFPA 24 for service mains.

B. Route piping in orderly manner, plumb and parallel to building structure and concealed above ceilings where possible. Locate concealed valves, switches and alarm connections in accessible location, and coordinate size and location of access panels/doors with General Contractor.

C. Install piping to conserve building space, to not interfere with use of space and other work. Coordinate location of sprinkler piping with access requirements of above ceiling equipment (i.e. mechanical VAV boxes, fan coils, etc.).

D. Group piping whenever practical at common elevations.

E. Sleeve pipes passing through partitions, walls and floors.

F. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

G. Pipe Hangers and Supports:

1. Install in accordance with NFPA 13 and NFPA 14.
2. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.

4. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper-plated hangers and supports for copper piping, sheet lead packing between hanger or support and piping.
8. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts and suspended ceiling spaces are not considered exposed.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Division 09.

J. Do not penetrate building structural members unless indicated unless indicated otherwise on Contract Drawings.

K. Provide steel sleeves when penetrating footings, floors and walls.

L. Penetrations through fire rated walls, floors and partitions shall be sealed to provide a U.L. rating equal to or greater than the wall, floor or partition

M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union and couplings for servicing are consistently provided.

N. Die-cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

O. Provide gate or ball valves for shut-off or isolating service.

P. Provide UL listed caps for concealed sprinkler heads to match architectural and interior ceiling finishes.

Q. Provide drain valves at main shut-off valves, low points of piping and apparatus. Extend drain to floor sink/floor drain.

R. Install valves with stems upright, not inverted. All valves shall be located such that the removal of their bonnets is possible. Valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. Valves shall be installed as nearly as possible to the locations indicated in the Construction Drawings. Any change in valve location must be so indicated on the Record Drawings. Remove protective coatings after installation.

S. Heat generated by welding or soldering procedures shall not be transmitted to valves, groove couplings, or any other components installed within the piping system that may be damaged due to high temperatures. Contractor shall take all precautions necessary and allow heated piping to cool to ambient temperature before attachment.

T. All screw joints shall be made with taper threads properly cut. Joints shall be made tight with Teflon tape or non-toxic joint compound applied to the pipe threads only and not to fittings. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Before installing pipe that has been cut and threaded, the lengths of pipe shall be upended and hammered to remove all shavings and foreign material.

U. Inspector's test valves shall be installed for each sprinkler control valve assembly.

V. Do not route piping in the following rooms. Sprinkler coverage shall be provided with side wall heads. Areas where this is not practical shall be brought to the attention of the engineer.

1. Elevator equipment room
2. IT Computer rooms (i.e. IDF, MDF, Data Rooms)

a. Sprinkler heads or pipes shall not be located over equipment spaces. Sprinklers heads shall be protected by wire cages to minimize the potential of accidental discharge due to impact damage.
b. Sprinkler pipes shall not pass-through communications or vendor closet. Sprinkler requirements for these areas will spur off a main that is located outside the closet.
c. The exception of a & b above is when a pre-action system is installed for these areas. Refer to plans.

3. Electrical Rooms.

W. Do not route sprinkler piping directly over Electrical equipment (i.e. electrical panels, Substations, switchboards, motor control centers, emergency generators, bus duct, transformer).

X. Paint all exposed sprinkler piping as specified in Section 21 05 00.

Y. Provide sidewall sprinkler heads in elevator pits no more than 24" above finished floor.

Z. Provide upright sprinkler heads in all shell spaces.

3.3 INSTALLATION OF FIRE DEPARTMENT CONNECTIONS

A. Installation of Fire Department Connections shall all requirements of NFPA and of the local Fire Department.

B. Fire department connections shall be located not less than 18 inches nor more than 48 inches above the level of adjoining ground sidewalk or grade surface.

C. Fire department connections shall be located within 100 feet of the nearest fire hydrant unless otherwise approved by the local fire department.

D. Each fire department connection shall be designated by a sign reading "STANDPIPE" or "AUTOSPKR" or both depending on system served. For manual standpipe systems, signage shall also indicate the pressure required to deliver system demand and whether the standpipe is wet or dry. Sign shall also indicated the building served.

1. Where the fire department connection does not serve the entire building, a sign shall be provided indicating the portions of the building served.

E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent fire department connectors to allow full swing of fire department wrench handle and so that hose lines can be attached to inlets without interference from nearby objects.

3.4 INSTALLATION OF BACKFLOW PREVENTION DEVICES

A. Backflow prevention devices and assemblies shall be installed in compliance with American Water Works Association Manual M-14 “Backflow Prevention,” and the following:

1. Devices and assemblies shall be located as shown on plans.
2. The highest part of any device or assembly shall not be installed over 5 feet above the finish floor. There shall be a minimum of 12 inches clearance above the device/assembly.
3. The lowest part of any backflow preventer assembly shall be installed a minimum of 12 inches above finish floor.
4. The service side of any device/assembly shall have a minimum clearance of 24 inches from the outermost dimension.
5. The non-service side of a backflow assembly shall have a minimum clearance of 4 inches from the outermost dimension.
6. All backflow and/or backsiphonage assemblies/devices shall be tested in accordance with the rules and regulations of Texas Commission on Environmental Quality and the utility supplying the domestic water before substantial completion inspection is requested.
7. Final reports shall be submitted to local code/inspection authorities and to A/E and utility prior to scheduling Substantial Completion reviews by the A/E.
8. Persons performing the test on backflow prevention assemblies/devices shall meet the following requirements:

    a. Licensed by the Texas Commission on Environmental Quality as a Backflow Prevention Assembly Technician, and
    b. If required by the utility supplying the water, registered with the utility for testing backflow preventer assemblies.
    c. Testing of backflow preventer assemblies serving fire protection systems shall be performed by a person or organization with a current certificate of registration from the State Fire Marshal as an independent fire protection sprinkler contractor (Registered Firm) under the direct supervision of a licensed Responsible Managing Employee (RME) as defined by Texas Insurance Code (TIC), Chapter 6003 (formerly Article 5.43-3), Fire Protection Sprinkler System Service and Installation and the Texas Administrative Code Title 28, Chapter 34, Subchapter G – Fire Sprinkler Rules.

3.5 ELEVATOR SPRINKLER PROTECTION

A. Elevator fire protection shall comply with NFPA 13, NFPA 70, NFPA 72, and ANSI/ASME A17.1 or A17.3 as applicable.

B. When sprinklers are installed in elevator equipment rooms, the electrical power to the elevator controller must shut down prior to sprinkler activation. A heat detector shall activate an independently controlled shunt trip circuit breaker when the temperature in the machine room exceeds the setting of the heat detector. The detector shall have both a lower temperature rating and a higher sensitivity (lower Response Time Index) as compared to the sprinkler. Sprinkler heads shall be rated at 212°F and heat detectors shall be rated at 135°F. Heat detectors used to shut down elevator power prior to sprinkler operation shall be placed within two feet of each sprinkler head and connected to the fire alarm control panel.

C. Smoke detectors shall be provided to initiate phase one elevator recall, sending cars to the appropriate level prior to electrical power shut-down.

D. No sprinkler risers shall be permitted inside any hoist way. Sprinkler branch lines shall enter hoist ways only where a sprinkler is required.

3.6 HEAT TRACE INSTALLATION

A. All materials and products shall be installed in accordance with manufacturer's published recommendations. Use tools manufactured for the installation of the specific material or product.

B. Secure the heater cable to piping with in accordance with manufacturer's recommendations.

C. Do not install heat maintenance cable until piping has been tested and approved.

D. Heat generated by soldering or welding procedures shall not be transmitted to cable, splices, tees, end terminations or any other components installed within the system that may be damaged due to high temperatures. Contractor shall take all precautions necessary and allow heated piping to cool to ambient temperature before attachment.

E. All connection kits except for the power connection shall be installed under the piping thermal insulation.

F. Cable system components shall not interfere with operation of or access to valves, air vents, drains, unions, etc.

G. Apply a permanent "Electric Heat Tracing-Caution" label every 10 to 15 feet to indicate the presence of electrically traced piping after the insulation and moisture barrier have been applied.

3.7 TESTING

A. Each system installed under this contract shall be cleaned and tested to appropriate NFPA Standards for each particular application.

B. Refer to appropriate sprinkler system and/or standpipe system specification section for additional system acceptance and testing requirements.

C. Testing shall also include any additional requirements from the authority having jurisdiction and the Owner's insurance underwriter.

D. Test heat maintenance cable systems after the pipe insulation has been installed and prior to the installation of wall or ceiling panels.
   1. Heat trace Tests shall be performed in accordance with manufacturer's published recommendations

E. Coordinate system testing with Fire alarm contractor and general contractor.

END OF SECTION

SECTION 21 05 53 - IDENTIFICATION FOR FIRE PROTECTION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment markers.
2. Valve tags.
3. Valve schedules.
4. Pipe markers.
5. Ceiling tacks.
6. Signs.
7. Detectable Underground Warning Tape.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 – Scheme for the Identification of Piping Systems.

B. American National Standards Institute:

1. ANSI Z535.1 – Safety Color Standard.
2. ANSI Z535.2 – Environmental and Facility Safety Signs.

C. National Fire Protection Association:

1. NFPA 13.
2. NFPA 14.
3. NFPA 20

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer’s catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification. Submit a valve chart and schedule, including valve tag number, location, function and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 and ANSI Z535.1 for color scheme for identification of piping systems and accessories.

B. Conform to ASME A13.1 for length of field and letter height for pipe markers.

C. Conform to ANSI Z535.1 and ANSI Z535.2 for emergency operating information and warning signs.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing Work of this section with minimum three years of experience.

PART 2 - PRODUCTS

2.1 PIPE MARKERS

A. General: Conform to ASME A13.1 for background and letter colors, length of color field and letter height.

B. Self-Adhesive Pipe Markers: Flexible, indoor/outdoor grade vinyl with factory-applied pressure-sensitive adhesive. Provide with minimum 1-1/2 inch wide banding tape.

C. Mechanically Applied Pipe Markers:

1. For pipes with an overall diameter up to 6 inches, including insulation, provide semi-rigid plastic wrap around pipe marker that extends 360 degrees around the pipe at each marker location. The semi-rigid marker should include the legend and a directional flow arrow. The marker shall be supplied as a pre-tensioned device and be equipped with a 1/2 inch strip of adhesive on the inside to further secure the marker in a permanent position on vertical locations.
2. For pipes with an overall diameter greater than 6 inches, including insulation, provide a semi-rigid plastic strap-on pipe marker with a height no less than 3 times the letter height. The marker shall include a legend and a directional flow arrow. Markers to be installed indoors shall be supplied with no less than two nylon straps to secure the marker in place. Markers to be installed outdoors shall be supplied with stainless steel or aluminum strapping.

2.2 DIRECTIONAL ARROWS

A. Flow Direction: Provide flow directional arrows either as part of pipe markers, banding tape or separately, attached to pipes.

1. Conform to requirements for markers.
2. Size to conform to ANSI A13.1 (1 inch wide minimum).

2.3 DETECTABLE UNDERGROUND WARNING TAPE

A. Description: Polyethylene tape resistant to acids, alkalis and other destructive soil components with metallic core for detection and location of piping with metal detector. Tape shall be a minimum of 6 inches wide with a minimum thickness of 5 mils. Utilize manufacturer's standard legends to identify water lines, pipe lines, gas lines, fuel lines, steam lines and sewer lines. Provide a continuous printed message with bold black lettering similar to "Caution Buried Water Line Below". Tape color and lettering shall be unaffected by moisture and other substances contained in the backfill material. The tape color shall conform to the American Public Works Association Uniform Color Code.

2.4 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. Red: Fire protection valves or equipment.

2.5 PLASTIC EQUIPMENT MARKERS

A. General: Provide laminated plastic equipment markers for all scheduled items of fire protection equipment installed indoors.

B. Size: Size laminated plastic markers not less than one inch in height and three inches in length with engraved lettering white on black not less than 1/4 inch in height. For larger pieces of equipment, size markers 1-1/2 inch in height by 4-1/2 inches long, of 3/32 inch laminated plastic melamine with white on black lettering engraved not less than 1/16 inch deep and 1/2 inch high.

C. Attachment: Attach nameplates with rivets, stainless steel screws or bolts. On equipment such as tanks and pumps which cannot be drilled or pierced, attach nameplates with brass chains and "S" hooks.

D. For fire protection equipment installed above ceiling, provide 3/4 inch by 2-1/2 inches laminate tags attached with rivets to the ceiling grid below.

2.6 ALUMINUM EQUIPMENT MARKERS

A. General: Provide engraved anodized aluminum equipment markers for all scheduled items of plumbing equipment installed outdoors.

B. Size: Size engraved aluminum markers not less than 1 inch in height and 3 inches in length with engraved lettering white on black background not less than 5/8 inch in height. For larger pieces of equipment, size markers 3 inches in height by 6 inches long, with lettering not less than 1 inch in height.

C. Attachment: Attach nameplates with rivets, stainless steel screws or bolts. On equipment such as tanks and pumps which cannot be drilled or pierced, attach nameplates with stainless steel chains and "S" hooks.

2.7 VALVE TAGS

A. Materials: Provide indoor valve tags of solid brass with stamped or engraved lettering or numbers. Provide outdoor valve tags of aluminum with stamped or engraved lettering or numbers.

1. Fill lettering and numbers with black paint.
2. Lettering shall be not less than 1/4 inch in height.

3. Numbers shall be not less than 1/2 inch in height.

B. Attachment: For valve tags in mechanical rooms, provide with brass jack chain and “S” hook attachment. For all other indoor valve tags, provide with brass beaded chain attachment. For all outdoor valve tags, provide with stainless steel jack chain and “S” hook attachment.

2.8 ENGRAVED PLASTIC LAMINATE SIGNS

A. General: Where indicated in other sections of the specifications, provide engraved instruction signs, warning signs, operational instructions or other signs designated.

B. Emergency Operating Signs: For emergency operating instructions, provide engraved, laminate, melamine plastic, white on red, not less than 1/8 inch thick.

1. Provide concise written instructions on the emergency operation of the device.
2. Letters shall be not less than 5/16 inch in height, engraved 1/16 inch deep in block capital letters.

C. Information and Warning Signs: Provide general information and warning signs of laminated, melamine plastic, not less than 1/8 inch thick, with white engraved lettering on black, with letters not less than 1/4 inch in height, block capitals.

D. Attachment: Attach signs directly to the equipment with rivets, bolts or screws, if possible. Otherwise, attach signs with angle brackets, U-bolts, or metal plates held in place to piping with stainless steel draw-bands.

1. Attachment with adhesives will not be permitted.
2. Locate signs not less than 4 feet nor more than 6 feet above the operating floor, directly visible from an operating aisle.
3. Locate signs to preclude damage during maintenance and repair or by operating traffic.

2.9 VALVE SCHEDULES AND FRAMES

A. General: Provide valve schedules for all valves provided by Division 2.

B. Schedules: Provide typed or machine printed schedules, one item per line, double spaced.

1. Printing shall be black on 8-1/2-inch by 11-inch white paper. Paper shall be waterproof or laminated after printing.
2. For each valve, list the valve number, location, size and use or operating function.
3. Support schedules in full extruded aluminum frames with removable, non-yellowing, clear plastic faces.
4. Screw or bolt schedules to equipment room walls where directed.
5. Coordinate valve numbers with valve tags so that no two valves or scheduled devices have the same number.

PART 3 - EXECUTION

3.1 GENERAL

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Install identifying devices after completion of coverings and painting.

C. Install labels with sufficient adhesive for permanent adhesion. For unfinished canvas covering, apply paint primer before applying labels.

3.2 CONCEALED VALVES AND EQUIPMENT

A. Equipment Above Ceilings: Provide valve tagging and identification to equipment located above ceilings, such as valves and other items before the ceilings are installed.

B. Finished Surfaces: Where identification is to be provided on surfaces which require insulation, painting and finishing, install identification after covering and painting is complete.

C. Provide ceiling tacks to locate valves or equipment above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 PIPING SYSTEM IDENTIFICATION

A. Install pipe markers on all piping systems and include arrows to show the normal direction of flow. Where flow can be in both directions, arrows in both directions shall be displayed.

B. Identify piping exposed to view and concealed by accessible ceilings, including hard ceilings provided with access panels. Identify piping outdoors, in crawlspaces, on roof, above grade and within parking structures. Only piping located within walls or inaccessible areas need not be identified.

C. Locate pipe markers as follows:

1. Every 15 feet on straight runs.
2. At each valve and control device.
3. At each branch or take-off. Provide flow arrows on the branch pipe as well as on the main on both sides of the branch.
4. At any change in piping direction.
5. Above and below every floor or roof penetration.
6. On either side of every wall or partition. Ensure there is a minimum of one marker per pipe in every room.
7. On either side of large obstructions, ductwork or equipment that piping passes above.
8. At 5-foot intervals where piping is obscured by close proximity to walls or other pipes.
9. Provide only one label per unit drain connection for condensate drain piping on roof.

D. Install pipe markers so they are visible and legible from a normal standing position.

E. Secure each end of self-adhesive pipe markers with a full wrap of banding tape of the same background color. Banding tape shall overlap itself a minimum of 3 inches.

F. Provide mechanically applied pipe markers for all piping in mechanical rooms and outdoors.

G. Install detectable underground warning tape 12 inches below finished grade, directly above buried pipe. If piping is buried more than 36 inches below finished grade, then provide an additional continuous length of tape buried 12 inches above the piping.

3.4 VALVE IDENTIFICATION

A. General: Provide a valve tag on every valve, cock and control device in each piping system. Exclude check valves and valves within factory-fabricated equipment units. List each tagged valve in valve schedule for each piping system. In existing buildings, coordinate valve tags and schedules such that no valve numbers are duplicated.

1. Tagging Schedule: Comply with requirements of "Valve Tags" and "Valve Schedules and Frames" paragraph.

B. Install valve schedule frames and schedules in machine rooms where indicated or where directed.

C. Mark all sprinkler system valves in accordance with NFPA 13, and Division 21 Section “Wet Pipe Sprinkler Systems,” “Dry Pipe Sprinkler Systems,” or “Pre-Action Sprinkler Systems” or other as appropriate

D. Identify Sprinkler Riser trim in accordance with NFPA 13, and Division 21 Section “Wet Pipe Sprinkler Systems,” “Dry Pipe Sprinkler Systems,” or “Pre-Action Sprinkler Systems” or other as appropriate.

E. Fire Protection Valve and Trim Signage: Equipment identification signs used for indoor equipment shall be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.020 inch aluminum with red letters on a white background or white letters on red background. All text shall be a minimum 1” lettering.

F. Fire Alarm System and Device Components: Identify fire alarm equipment devices by means of 3/32 inch (3 mm) thick red laminated phenolic nameplate with white core. Engrave fire alarm panel identification using a minimum size of 1 inch (25 mm) character height, Helvetica style font. Fire Alarm device numbers shall be a minimum of 3/16 inch (5 mm) size and fire alarm zone numbers shall be 1/4 inch (7 mm) size. Attach nameplates with No. 4-36 RH nickel plated brass machine screws. Device numbers may be adhered with glue or equivalent.

3.5 FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. General: Install equipment markers and identification on or near each major item of fire protection equipment. Provide signs for the following general categories of equipment and operational devices:

1. Main alarm and operating valves.
2. Meters and gauges.
3. Pumps, air compressors and motor-driven units.
4. Tanks and pressure vessels.
5. Fire Department Connections
6. Standpipe valves and cabinets

B. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

3.6 COLOR AND IDENTIFICATION SCHEDULE

A. Provide all pipe labels and lettering of colors listed below:

FLUID SERVICE TYPE	PIPE MARKER LEGEND	PIPE MARKER BACKGROUND / LETTERING COLOR	VALVE TAG LETTERING
Fire Protection	FIRE PROTECTION WATER	Red/White	FP

END OF SECTION

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wet-pipe sprinkler system.
2. System design, installation, and certification.
3. Sprinkler heads.
4. Piping Specialties.
5. Fire department connections.

B. Refer also to Related Sections:

1. Section 21 00 01 – Basic Fire Protection Requirements
2. Section 21 05 00 – Common Work Results for Fire Suppression.
3. Section 21 05 53 – Identification for Fire Protection Piping.
4. Section 21 12 00 - Fire Suppression Standpipes.
5. Section 21 16 16 – Dry-Pipe Sprinkler Systems
6. Section 21 30 00 – Fire Pumps
7. Section 26 05 03 – Equipment Wiring Systems
8. Section 28 31 00 – Fire Detection and Alarm.

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 13 – Standard for the Installation of Sprinkler Systems.
2. NFPA 13R – Standard for the Installation of Sprinkler Systems In Low-Rise Residential Occupancies.
3. NFPA 14 – Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.
4. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
5. NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
6. NFPA 70 – National Electrical Code.
7. NFPA 72 - National Fire Alarm and Signaling Code

B. Underwriter’s Laboratories (UL):

1. UL – Fire Equipment Directory.
2. UL 199 – Automatic Sprinklers.

1.3 SYSTEM DESCRIPTION

A. The Sprinkler system shall provide coverage for building areas noted on Drawings. If the building is more than 52,000 square feet on any single floor, the system shall be divided into separate systems with multiple risers and alarm valves and shall be laid out accordingly.

B. Provide hydraulically designed system(s) to meet NFPA 13 requirements for each occupancy classification, as indicated on Drawings.

C. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data available prior to submittals.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections as indicated on Drawings.

1.4 SUBMITTALS FOR REVIEW

A. Submit under provisions of Division 01 and Section 21 00 01.

B. Submittals shall include all items listed in Section 21 05 00, including but not limited to: fire flow test data, product data, coordination drawings, shop drawings and local Fire Department approval.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Submit under provisions of Division 01 – Execution and Closeout Requirements.

B. Submittals shall include all items listed in Section 21 05 00, including but not limited to Project Record Documents, System Certification forms, Operation and Maintenance data and warranty forms.

1.6 QUALITY ASSURANCE

A. Perform work to the local adopted building and fire codes (as listed on sheet FP1.1), NFPA 13, 24 and 25 as modified herein, the local authority having jurisdiction, FM Global standards (where applicable) and the Architect/Engineer. The greater quality and/or value specified herein for the system(s) and various components and installation procedures shall take precedence over the minimum requirements of NFPA, in all instances.

B. All work shall be supervised by a minimum NICET II certified individual or higher as may be required by the local AHJ. Certification shall be for above grade fire suppression installation.

C. Sprinkler Shop Drawings and hydraulic calculations are to be sealed by a Professional Engineer, knowledgeable in fire protection engineering or a Responsible Managing Employee (RME) licensed by the State of Texas Fire Marshal Office, before submitting for review.

D. Welding Materials and Procedures: Perform to ASME Code.

E. Valves: Bear UL/FM label or marking. Provide manufacturer’s name and pressure rating marked on valve body.

F. Piping: All piping installed on this project shall bear the complete ASTM and manufacturer marking, labeling and identification requirements as required by ASTM. All installed piping 3’-0” or greater in length shall be readily identifiable per ASTM labeling criteria. Piping not bearing this identification upon installation shall be removed and replaced by the correctly labeled piping. Piping shall not be re-stenciled after it is installed to meet these criteria.

G. The system shall also conform to applicable requirements of the Texas Administrative Code Title 28, Chapter 34.

1.7 QUALIFICATIONS

A. The work shall be performed by a person or organization with a current certificate of registration from the State Fire Marshal as an independent fire protection sprinkler contractor (Registered Firm). This contractor shall be fully responsible for all design to meet project requirements, including items exceeding those specifically illustrated or mentioned in the contract documents.

B. The work shall be performed under the supervision of a licensed Responsible Managing Employee (RME) as defined by Texas Insurance Code (TIC), Chapter, Fire Protection Sprinkler System Service and Installation and the Texas Administrative Code Title 28, Chapter 34, Subchapter G – Fire Sprinkler Rules.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing Work specified in this section with minimum three years of documented experience.

E. Although Contractor is responsible for design of system; sizes, routing and equipment shown on drawings and specifications shall be considered as minimum requirements, even if they exceed NFPA, FM and AHJ requirements. Contractor is reminded that other sections of specifications also apply to this work (i.e., refer to “Related Sections” above) and contractor shall comply with these sections even if they exceed NFPA, FM, and AHJ requirements.

F. The system design and installation shall in all respects conform to the latest adopted editions of applicable NFPA, Building Code and Fire Code requirements, and any local modifications and/or amendments thereto. Where latest adopted editions vary between code authorities having jurisdiction (AHJ’s) over this project, system shall meet the most stringent requirements. These requirements include, but not necessarily be limited to:

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
3. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
4. NFPA 45 – Standard on Fire Protection for Laboratories Using Chemicals.
5. NFPA 72 – National Fire Alarm and Signaling Code

1.8 DELIVERY, STORAGE AND PROTECTION

A. Division 01 – Product Requirements: Transport, handle, store and protect products.

B. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

C. Utilize manufacturer supplied sprinkler caps, covers and bulb protectors. Remove all caps prior to placing system(s) in service.

1.9 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one-year manufacturer warranty for system components.

1.10 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements.

B. Furnish, equip and install spare sprinkler cabinet(s) in accordance with provisions of NFPA 13. Locate near main system riser assembly or as indicated on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Grinnell
2. Reliable Automatic Sprinkler Co.
3. Tyco Fire Products
4. Viking

B. Division 01 – Product Requirements: Product options and substitutions. Substitutions.

2.2 SPRINKLER HEADS

A. Unless otherwise specified or indicated on the drawings, sprinkler heads shall be regular automatic closed type spray heads with temperature ratings as required by National Fire Protection Association Standard No. 13.

1. Where feasible, all sprinkler heads shall be quick-response type.
2. The installing contractor is to verify the existing type of sprinkler head installed in area of renovation projects to ensure the response type is the same. Standard response and quick response heads are not to be mixed in a project.
3. Finished Ceilings: Provide concealed ceiling sprinklers with factory finished (no field painting) cover plate, color to match ceiling finish. (Exception: Provide chrome plated or alternate color cover plates where directed by Architect).
4. Unfinished Areas without Ceilings: Provide bronze upright. Protect sprinkler heads against mechanical injury with standard guards where required.
5. Sidewall heads: Recessed horizontal sidewall type heads with white enamel finish and matching push on escutcheon plate may be utilized, where indicated on drawings.
6. Cold Rooms (≤ 42°F.) and Areas below Heated Ceiling/Soffit Spaces Susceptible to Freezing: Provide dry pendant type with chrome finish and two-piece escutcheon. (Areas include but not limited to; walk-in freezers, exterior overhangs, canopies, etc.).
7. Elevator Equipment Rooms: Provide 212°F intermediate temperature classified heads.
8. MRI Rooms: Provide non-ferrous concealed type chrome plated head and escutcheon.
9. Animal Vivarium, Pharmacies, Laboratories, Sterile areas: Provide Concealed heads with gasket covers.

B. An approved protective guard in accordance with NFPA 13 Section 6.2.8 shall be installed on each sprinkler head located in rooms/areas where there is a potential to receive damage or where the head is less than 7 feet above the floor level. Sprinkler heads guards shall be listed for use with the sprinklers on which they are installed.

C. The use of UL listed and FM approved flexible type head assemblies is permitted. Flex type head assembly shall consist of 304 stainless steel braided hose with zinc plated steel 1” NPT male threaded nipple, factory tested at 400 psi, complete with one piece head securing bracket assembly, tamper resistant screws. The drop shall include a UL approved braided hose with a bend radius to 2” to allow for proper installation in confined spaces.

2.3 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.

B. Riser Manifold Assembly: Factory assembled unit of painted ductile iron body with brass and galvanized trim, containing a dedicated water flow detector switch with two sets of electrical contacts; a pressure gauge with three-way isolation valve; a built-in drain port with a test and drain valve assembly; and a pressure relief kit. Entire assembly shall be UL Listed and FM approved as a unit for installation in either horizontal or vertical position and shall have cast on lettering to identify manifold pipe size, flow direction, and gauge and drain outlets.

C. Floor Control Assembly: Factory assembled unit of stainless steel or painted ductile iron body with brass and galvanized trim, containing a dedicated water flow detector switch with two sets of electrical contacts; a pressure gauge with three-way isolation valve; and a built-in drain port with a test and drain valve assembly. Entire assembly shall be UL Listed and FM approved as a unit for installation in either horizontal or vertical position and shall have cast on lettering to identify manifold pipe size, flow direction, and gauge and drain outlets.

D. Fire Department Connections: Refer to Section 21 05 00.

E. Backflow Preventer Assembly: Refer to Section 21 05 00.

F. Electric Alarm and Water Motor Alarm: Refer to Section 21 05 00.

G. Water Flow Switches and Supervisory (Tamper) Switches: Refer to Section 21 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13, and in accordance with local Fire Department requirements.

B. Install equipment in accordance with manufacturer’s instructions.

C. Locate outside alarm gong on building wall as indicated.

D. Place pipe runs to minimize obstruction to other work.

E. Center sprinklers in ceiling tile in one direction and provide piping offsets as required with location in other direction variable, dependent upon spacing and coordination with ceiling elements.

F. Apply cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

G. Install guards on sprinklers where indicated.

H. Locate drains and inspectors test as indicated on drawings or in a location approved by the Architect/Engineer.

I. Flush entire piping system of foreign matter.

J. Hydrostatically test entire new piping system per NFPA 13, as noted below.

K. Provide both a Hydraulic Design Information Sign and a General Information Sign near each systems control riser. Signs shall be of permanently marked weatherproof material and shall include all information outlined in NFPA 13.

L. Paint all exposed sprinkler piping as specified in Section 21 05 00.

M. Under no conditions shall paint be applied to sprinkler heads, escutcheons, or covers. If paint is so applied, replacement of the affected parts shall be required.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

3.3 CLEANING

A. Division 01 – Execution and Closeout Requirements: Final cleaning.

B. Flush entire system of foreign matter.

3.4 TESTING

A. The installing contractor shall do the following:

1. Notify the Fire Marshal, any other authority having jurisdiction and the Owner's authorized representative of the time and date testing will be performed.
2. Perform all acceptance tests required by Chapter 25 of NFPA 13; including hydrostatic tests, main drain test, system operational tests, backflow prevention assembly test and pressure reducing valve tests.
3. Complete and sign the appropriate Contractor's Material and Test Certificate, and forward Certificate(s) to the authority having jurisdiction.
4. The contractor shall coordinate with the Owner's insurance provider for a system inspection and approval and for the completion of the Contractor's Material Test Certificate (CMTC).

3.5 OCCUPANCY CLASSIFICATIONS

Location	Occupancy Classification
Offices	Light Hazard
Janitor Closets	Ordinary Hazard, Group 1
Electrical Rooms, with Dry Type Transformers	Ordinary Hazard, Group 1

END OF SECTION

SECTION 21 13 16 - DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Dry-pipe sprinkler system.
2. System design, installation and certification.
3. Sprinkler heads.
4. Piping specialties
5. Air Compressors.
6. Nitrogen Generation System.

B. Related Sections:
1. Section 21 00 01 – Basic Fire Protection Requirements
2. Section 21 05 00 – Common Work Results for Fire Suppression.
3. Section 21 05 53 – Identification for Fire Protection Piping.
4. Section 21 13 13 – Wet-Pipe Sprinkler System.
5. Section 26 05 03 – Equipment Wiring Systems.
6. Section 28 31 00 – Fire Detection and Alarm.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 13 – Standard for the Installation of Sprinkler Systems.
2. NFPA 13R – Standard for the Installation of Sprinkler Systems In Low-Rise Residential Occupancies
3. NFPA 14 – Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.
4. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
5. NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
6. NFPA 70 – National Electrical Code.
7. NFPA 72 - National Fire Alarm and Signaling Code

B. Underwriter’s Laboratories (UL):
1. UL – Fire Equipment Directory.
2. UL 199 – Automatic Sprinklers.

1.3 SYSTEM DESCRIPTION

A. System to provide coverage for ambulance canopy as noted on Drawings.

B. Provide hydraulically designed system(s) to meet NFPA 13 requirements for each occupancy classification, as indicated on Drawings.

C. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data are available prior to submittals.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections as indicated on Drawings.

1.4 SUBMITTALS FOR REVIEW

A. Submit under provisions of Division 01 and Section 21 00 01.

B. Submittals shall include all items listed in Section 21 05 00, including but not limited to: fire flow test data, product data, coordination drawings, shop drawings and local Fire Department approval.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Submit under provisions of Division 01 – Execution and Closeout Requirements.

B. Submittals shall include all items listed in Section 21 05 00, including but not limited to Project Record Documents, System Certification forms, Operation and Maintenance data and warranty forms.

1.6 QUALITY ASSURANCE

A. Perform work to the local adopted building and fire codes (as listed on sheet FP1.1), NFPA 13, 24 and 25 as modified herein, the local authority having jurisdiction, FM Global standards (where applicable) and the Architect/Engineer. The greater quality and/or value specified herein for the system(s) and various components and installation procedures shall take precedence over the minimum requirements of NFPA, in all instances.

B. All work shall be supervised by a minimum NICET II certified individual or higher as may be required by the local AHJ. Certification shall be for above grade fire suppression installation.

C. Sprinkler Shop Drawings and hydraulic calculations are to be sealed by a Professional Engineer, knowledgeable in fire protection engineering or a Responsible Managing Employee (RME) licensed by the State of Texas Fire Marshal Office, before submitting for review.

D. Welding Materials and Procedures: Perform to ASME Code.

E. Valves: Bear UL/FM label or marking. Provide manufacturer’s name and pressure rating marked on valve body.

F. Piping: All piping installed on this project shall bear the complete ASTM and manufacturer marking, labeling and identification requirements as required by ASTM. All installed piping 3’-0” or greater in length shall be readily identifiable per ASTM labeling criteria. Piping not bearing this identification upon installation shall be removed and replaced by the correctly labeled piping. Piping shall not be re-stenciled after it is installed to meet these criteria.

G. The system shall also conform to applicable requirements of the Texas Administrative Code Title 28, Chapter 34.

1.7 QUALIFICATIONS

A. The work shall be performed by a person or organization with a current certificate of registration from the State Fire Marshal as an independent fire protection sprinkler contractor (Registered Firm). This contractor shall be fully responsible for all design to meet project requirements, including items exceeding those specifically illustrated or mentioned in the contract documents.

B. The work shall be performed under the supervision of a licensed Responsible Managing Employee (RME) as defined by Texas Insurance Code (TIC), Chapter, Fire Protection Sprinkler

System Service and Installation and the Texas Administrative Code Title 28, Chapter 34, Subchapter G – Fire Sprinkler Rules.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing Work specified in this section with minimum three years of documented experience

E. Although Contractor is responsible for design of system; sizes, routing and equipment shown on drawings and specifications shall be considered as minimum requirements, even if they exceed NFPA, FM and AHJ requirements. Contractor is reminded that other sections of specifications also apply to this work (i.e., refer to “Related Sections” above) and contractor shall comply with these sections even if they exceed NFPA, FM, and AHJ requirements.

F. The system design and installation shall in all respects conform to the latest adopted editions of applicable NFPA, Building Code and Fire Code requirements, and any local modifications and/or amendments thereto. Where latest adopted editions vary between code authorities having jurisdiction (AHJ’s) over this project, system shall meet the most stringent requirements. These requirements include, but not necessarily be limited to:

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
3. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
4. NFPA 45 – Standard on Fire Protection for Laboratories Using Chemicals
5. NFPA 72 – National Fire Alarm and Signaling Code

1.8 DELIVERY, STORAGE AND PROTECTION

A. Division 01– Product Requirements: Transport, handle, store and protect products.

B. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

C. Utilize manufacturer supplied sprinkler caps, covers and bulb protectors. Remove all caps prior to placing system(s) in service.

1.9 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one-year manufacturer warranty for system components.

1.10 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements.

B. Furnish, equip and install spare sprinkler cabinet(s) in accordance with provisions of NFPA 13. Locate near main system riser assembly or as indicated on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Grinnell
   2. Reliable Automatic Sprinkler Co.
   3. Tyco Fire Products
   4. Viking

B. Division 01 – Product Requirements: Product options and substitutions. Substitutions.

2.2 SPRINKLER HEADS

A. Unless otherwise specified or indicated on the drawings, sprinkler heads shall be regular automatic closed type spray heads with temperature ratings as required by National Fire Protection Association Standard No. 13.

   1. Where feasible, all sprinkler heads shall be quick-response type.
   2. The installing contractor is to verify the existing type of sprinkler head installed in area of renovation projects to ensure the response type is the same. Standard response and quick response heads are not to be mixed in a project.
   3. Finished Ceilings: Provide concealed ceiling sprinklers with factory finished (no field painting) cover plate, color to match ceiling finish. (Exception: Provide chrome plated or alternate color cover plates where directed by Architect).
   4. Unfinished Areas without Ceilings: Provide bronze upright. Protect sprinkler heads against mechanical injury with standard guards where required.
   5. Sidewall heads: Recessed horizontal sidewall type heads with white enamel finish and matching push on escutcheon plate may be utilized, where indicated on drawings.

B. An approved protective guard in accordance with NFPA 13 Section 6.2.8 shall be installed on each sprinkler head located in rooms/areas where there is a potential to receive damage or where the head is less than 7 feet above the floor level. Sprinkler heads guards shall be listed for use with the sprinklers on which they are installed.

2.3 PIPING SPECIALTIES

A. Dry Pipe Sprinkler Alarm Valve: positive latching clapper, differential type dry valve. Dry pipe valve shall be resettable with a resetting bar and not require priming. Dry valve shall be UL Listed and Factory Mutual Approved. Air pressure to water pressure area differential to be approximately 6 to 1. Dry valve trim piping shall be galvanized and include a connection for a non-interruptible circuit closer. Valve body shall be ductile iron. Also provide air compressor and trim. The dry pipe system shall be fitted with an alarm bypass test connection so the waterflow device may be tested without opening the dry pipe valves. Each dry pipe valve shall be equipped with an automatic air maintenance device. Provide a U.L. listed and F.M. approved accelerator for dry pipe valves controlling systems having a capacity of more than 500 gallons. Accelerator shall be constructed so the device does not need to be drained after operation, Accelerator shall be of the same manufacturer of the dry-pipe alarm valve. Provide complete trim piping, valves, fittings, pressure gauges, etc.

B. Fire Department Connections: Refer to Section 21 05 00.

C. Backflow Preventer Assembly: Refer to Section 21 05 00.

D. Electric Alarm and Water Motor Alarm: Refer to Section 21 05 00.

E. Water Flow Switches and Supervisory (Tamper) Switches: Refer to Section 21 05 00.

2.4 AIR COMPRESSOR

A. Acceptable Manufacturers:

1. General Air Products
2. Gast Manufacturing.
3. Substitutions: Permitted, under Division 01 – Product Requirements: Product options and substitutions.

B. Compressor: Single unit, tank-mounted, oil-less piston air compressor, electric motor driven, motor, motor starter, safety valves, check valves, air pressure gauge, air maintenance device incorporating electric pressure switch and unloader valve.

C. Compressor size shall be based on its ability to fill the volume of the dry-pipe sprinkler piping system to the required pressure in the time prescribed by NFPA 13.

D. Unit shall be UL 2125 listed and air receiver shall be ASME rated.

E. Provide desiccant-type air dryer mounted on the air supply piping sized correctly for the air compressor, system volume and average ambient condition (average temperature and humidity) for the area.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13, and in accordance with local Fire Department requirements.

B. Install equipment in accordance with manufacturer’s instructions.

C. Locate outside alarm gong on building wall as indicated.

D. Place pipe runs to minimize obstruction to other work.

E. Center sprinklers in ceiling tile in one direction and provide piping offsets as required with location in other direction variable, dependent upon spacing and coordination with ceiling elements.

F. Apply cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

G. Install guards on sprinklers where indicated.

H. Locate drains and inspectors test as indicated on drawings or in a location approved by the Architect/Engineer.

I. Flush entire piping system of foreign matter.

J. Hydrostatically test entire new piping system per NFPA 13, as noted below.

K. Provide both a Hydraulic Design Information Sign and a General Information Sign near each systems control riser. Signs shall be of permanently marked weatherproof material and shall include all information outlined in NFPA 13.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

3.3 CLEANING

A. Division 01 – Execution and Closeout Requirements: Final cleaning.

B. Flush entire system of foreign matter.

3.4 TESTING

A. The installing contractor shall do the following:

1. Notify the Fire Marshal, any other authority having jurisdiction and the Owner's authorized representative of the time and date testing will be performed.
2. Perform all acceptance tests required by Chapter 25 of NFPA 13, Owner including hydrostatic tests, main drain test, system operational tests, backflow prevention assembly test and pressure reducing valve tests.
3. Complete and sign the appropriate Contractor's Material and Test Certificate, and forward Certificate(s) to the authority having jurisdiction.
4. The contractor shall coordinate with the Owner's insurance provider for a system inspection and approval and for the completion of the Contractor's Material Test Certificate (CMTC).

3.5 OCCUPANCY CLASSIFICATIONS

Location	Occupancy Classification
Offices	Light Hazard
Janitor Closets	Ordinary Hazard, Group 1
Electrical Rooms, with Dry Type Transformers	Ordinary Hazard, Group 1

END OF SECTION

SECTION 21 13 19 - PREACTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

A. Perform all Work required to provide and install pipe, fittings, valves, connections, hangers, supports, sleeves, appurtenances, detection control panel, detection devices, notification devices and interface equipment for complete preaction system with all supplementary items necessary for complete, code compliant and approved installation.

B. This section covers design equipment, installation, testing and all materials required for the preaction fire sprinkler protection system.

C. Contractor shall be responsible for the complete system design, layout, hydraulic calculations, and preparation of shop drawings, field installation, coordination and completion in accordance with project requirements and applicable codes and standards.

D. Work or equipment not indicated or specified which is necessary for the complete and proper operation of the work of this section in accordance with the true intent and meaning of the contract documents shall be provided by this Contractor and incorporated under this section of the work at no additional cost to the owner.

E. Contractor shall include within his bid all materials and work to provide complete preaction system, preaction detection panel and devices, and 100% sprinkler protection for all areas covered by the preaction system.

F. The preaction system shall be a standard or double interlock type.

G. Size all branches and mains by hydraulic calculations. Contractor shall provide a water flow test at the Site to determine actual available volume and pressures as a design basis for system and storage tank replenishment. Hazard classifications for fire protection system design, installation and water supplies shall be in accordance with NFPA Standards.

H. Interface preaction detection control panel with building fire Alarm system.

I. Preaction fire detection and notification devices shall be dedicated for the preaction system and are not intended to provide coverage for the building fire alarm system.

J. Provide temporary fire protection during the construction phase of Project. Obtain approval from the Owner and General Contractor for any interruptions of the fire protection system prior to each and every shutdown.

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. Factory Mutual System (FM) - Approval Guide and Loss Prevention Data Sheets
2. NFPA 13 - Installation of Sprinkler Systems
3. NFPA 24 - Private Fire Service Mains
4. NFPA 25 -Inspection, Testing and Maintenance of Water-Based Fire Protection Systems
5. NFPA 70 - National Electric Code
6. NFPA 72 - National Fire Alarm Code
7. State of Texas, State Fire Marshal Rules.
8. City of Houston, Texas, Fire Department Standards.

D. Test system in accordance with requirements of the authority having jurisdiction with the fire inspector present for system certification.

1.4 QUALITY ASSURANCE

A. Sprinkler system design, testing; cleaning, certification, materials, equipment and installation shall meet the requirements of the latest editions of Referenced Standards.

B. Obtain and become familiar with requirements of Owner's insurance underwriter, and incorporate all applicable provisions for compliance.

C. Thoroughly and clearly document all Project related communications with code and regulatory agents and expediently forward communication documentation to the Owner’s Project Manager.

D. Equipment and components shall bear FM label or marking. Provide manufacturer’s name and pressure rating marked on valve body.

E. All hose threads, coupling types, etc., utilized in the fire protection systems shall conform to the standards and requirements of the local Fire Department.

F. Maintain at least one copy of all system related documents on Site.

G. Design sprinkler system under direct supervision of a R.M.E.’s (Responsible Managing Employee) experienced in design of this Work and licensed in the State of Texas. All design submittal documents and Shop Drawings shall bear the R.M.E.’s signed and dated registrations number. The system shall be installed by a firm having minimum three years experience regularly engaged in the design and installation of automatic fire protection systems in accordance with requirements of the National Fire Protection Association and the State of Texas Fire Marshal’s office. Evidence to support the above requirements shall be submitted with Shop Drawings

1.5 SUBMITTALS

A. General:

1. No Work shall be performed until the Shop Drawings, calculations and product data have been approved by Engineer, local Fire Department and the Owner's insurance underwriter.

This will require early processing of all submittals. The Contractor is solely liable for any Work performed or material purchases made prior to this approval.

2. Refer to Division 01 for Submittal Procedures.

B. Product Data:

1. Provide data on sprinkler heads, piping materials, joining methods, supports, valves, flow switches, tamper switches and all other components and accessories intended to be installed. Include manufacturers' catalog information, Code and Standards compliance, performance ratings, rough-in details, weights, finishes, support and connection requirements.

C. Sequence of Operations

1. Submittal shall include a complete written sequence of operations of all functions of the system.
2. In addition to the written sequence of operations, all sequence functions shall be depicted using a sequence of operations matrix chart of all functions showing how the system will react to the activation of each type of device.
3. Submittal shall include details of all interfaced functions. Details shall include all fire detection system functions and interconnections applicable to each interface.

D. Record Documents

1. Submit preliminary layout showing head locations within coordinated ceiling grid and inspector's test station locations for review by Architect/Engineer, Owner's Project Manager and local Fire Department.
2. Submit certification letter by engineer of record stating that the fire protection systems design and installation complies with Referenced Standards.
3. Submit verification of Contractor's design and installation qualifications.
4. Provide full written description of manufacturer's warranty.
5. Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests. Refer to paragraph 3.04 B, within this specification section.
6. Shop Drawings:

    a. Submit detailed and accurate Shop Drawings of entire systems prior to fabrication. Indicate system controls, hydraulic reference points, detailed pipe layout, valves, hangers and supports, components and accessories.
    b. Hydraulic calculations: Submit flow test results and comprehensive hydraulic data sheets complying with NFPA 13. Verification of the adequacy of water pressure and other pertinent water supply data shall be the responsibility of the design engineer.
    c. Sprinkler heads shall be shown on Drawings and specifically identified by the style or series designation as published in the appropriate agency listing or approval.
    d. Floor plans showing the entire project area, all fire alarm devices (new and existing) and conduit and wire run.

7. Record Drawings:

    a. Provide Record Drawings indicating actual installed locations, sizes and types of sprinkler heads, piping, valves, supports, equipment and all other system components. Identify all deviations from approved submittal Drawings.

E. Operation and Maintenance Data:

1. Include components of system, servicing requirements, inspection data, replacement part numbers, location and numbers of service depot. Provide a preventive maintenance schedule for all applicable equipment and systems.
2. Include complete operating and maintenance instructions for fire detection panel and components.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be new, undamaged, and free of rust. Protect installed piping, valves and associated materials during progression of the construction period to avoid clogging with dirt, and debris and to prevent damage, rust, etc.

B. Accept valves on Site in shipping containers and maintain in place until installation. Provide temporary protective coating and end plugs on valves not packaged within containers. Maintain in place until installation.

C. Protect all materials that are to be installed within this Project from exposure to rain, freezing temperatures and direct sunlight. EXCEPTION: Materials manufactured for exterior locations.

1.7 EXTRA MATERIALS

A. Refer to Division 01 for Maintenance Materials requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. All piping, materials and equipment used in the installation of sprinkler and standpipe systems shall be new and listed as approved by the Underwriters' Laboratories, Inc., List of Inspected Fire Protection Equipment and Materials and the Factory Mutual Testing Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard and shall be the latest design of the manufacturer.

C. Pressure ratings of pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed.

D. The installing Contractor shall identify piping, fire department connections, valves and hydraulic design information in accordance with applicable NFPA Standards.

2.2 MANUFACTURER

A. Sprinkler Heads: Reliable, Grinnell, Viking.

B. Flow Switches: Notifier, Potter-Roemer, System Sensor.

C. Tamper Switches: Notifier, Potter-Roemer, System Sensor.

D. Gate Valves: Mueller, Nibco, Stockham, Kennedy.

E. Butterfly Valves: Milwaukee, Nibco, Grinnell, Victaulic, Kennedy.

F. Ball Valves: Milwaukee, Nibco, Stockham, Victaulic.

G. Check Valves: Mueller, Nibco, Stockham, Grinnell, Victaulic.

H. Grooved Fittings and Couplings: Grinnell, Anvil, Victaulic.

I. Preaction Control Panel: Simplex, Fike

2.3 SPRINKLER HEADS

A. Unless otherwise specified or indicated on the Drawings, sprinkler heads shall be automatic closed type spray heads with temperature ratings as required by National Fire Protection Association Standard No. 13.

1. Sprinkler heads shall be quick-response type.
2. Where there are no listed quick response sprinklers in the temperature range required, standard response sprinklers shall be permitted to be used.
3. Finished Ceilings: Provide concealed ceiling sprinklers with factory finished (no field painting) cover plate, color to match ceiling finish. [Exception: Provide listed chrome plated or alternate color cover plates where directed by Architect].
4. Unfinished Areas Without Ceilings: Provide bronze upright. Protect sprinkler heads against mechanical injury with standard guards where required.
5. Cold Rooms (42°F.) and Areas Below Heated Ceiling/Soffit Spaces Susceptible to Freezing shall not be protected by a preaction type sprinkler system.
6. Elevator Equipment Rooms: Provide 212°F intermediate temperature classified heads.
7. MRI Rooms: Provide non-ferrous semi-recessed chrome plated head and escutcheon.

2.4 PIPING MATERIALS

A. Pipe shall be schedule 40 (minimum thickness) black steel. Fittings shall be threaded malleable or cast iron, flanged cast iron, welded black steel, grooved ductile iron with gaskets and mechanical fasteners.

1. Exception: All piping within MRI rooms and MRI room ceiling spaces shall be Type “K” hard drawn copper with wrought copper or bronze pressure fittings and brazed joints.
2. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
3. All piping materials downstream of the preaction valve shall be galvanized steel.

2.5 VALVES

A. Similar types of valves shall be the product of one manufacturer; i.e., all butterfly valves shall be of the same manufacture, all ball valves shall be of the same manufacture, etc.

B. All valves used to control the flow of water to and within standpipe and sprinkler systems shall be listed indicating type complete with electric supervisory switches. Coordinate wiring with the electrical Contractor.

2.6 PREACTION CONTROLVALVE

A. The pre-action system’s control valve shall incorporate a double interlock, electric/electric actuation utilizing a deluge valve, a riser check valve and a solenoid valve operated by energizing a releasing circuit from the cross-zone releasing panel. The deluge valve shall be externally

resettable and shall have flanged or grooved inlet and outlet connections. The deluge valve shall be UL Listed and Factory Mutual approved and shall have a working pressure of 250 PSI. The valve trim shall be compatible and shall be installed following the manufacturer's specifications. The deluge valve shall be equivalent to Tyco Model DV-5

B. The valve trim package shall include:

1. Water supply pressure gauge,
2. Diaphragm chamber pressure gauge,
3. Diaphragm chamber connections,
4. Manual control station,
5. Main drain valve,
6. System drain valve,
7. Alarm test valve,
8. Automatic drain valve,
9. System air pressure gauge,
10. Air supply connections,
11. Low air pressure alarm switch,
12. Waterflow pressure alarm switch.

C. Compressed Air Supply: An air supply capable of restoring system pressure within 30 minutes shall be provided. Air supply shall be provided from a riser-mounted compressor listed as an air maintenance compressor.

2.7 PREACTION CONTROL PANEL

A. The system control panel shall be microprocessor-based control capable of protecting multiple hazards in one panel or thru use of an extender. The release panel shall be capable of supervising trouble and alarm audible alarms. The panel enclosure shall be of adequate size to house auxiliary D/C power supply. Panel shall be UL listed and FM approved and shall be compliant with requirements of NFPA 72. Control Panel shall be equivalent to simplex Model 4007 ES Fire Alarm Control Panel with Model 4009 Extender. Also, provide one model 4090-9006 Releasing Device Module for each Pre-Action Valve.

B. Detection: The release system shall incorporate as part of the operation of the system, a compatible electric detection system. Refer to Section 28 31 00 for detection system devices. The detection devices installed shall be compatible with the deluge valve release control panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Install all materials and products in accordance with manufacturer's published recommendations. Use tools manufactured for the installation of the specific material or product.

D. Sprinkler heads shall be located in a symmetrical pattern related to ceiling features such as grid, beams, light fixtures, diffusers, etc. and where applicable, heads shall be located symmetrically with the ceiling grid, centered in two directions. Locate heads to provide code required distances

away from lights, exit signs, etc., and all other items that could interfere or effect sprinkler discharge.

E. Apply temporary protective covers during construction to ensure that sprinkler heads and escutcheons do not receive field paint.

F. Protect sprinkler heads susceptible to mechanical injury with standard guards.

G. Inspector's test valves shall be installed for each flow switch and located in areas non-accessible by the public or unauthorized personnel and as approved by Owner. Discharge water shall be piped to suitable drain having sufficient capacity to accept discharge.

H. Provide hangers for horizontal piping at intervals not exceeding twelve feet for pipe sizes 1-1/4" and smaller or fifteen feet for pipe sizes 1-1/2" and larger, and as recommended within NFPA.

I. Route piping in orderly manner, plumb and parallel to building structure and concealed above ceilings where possible. Locate concealed valves, switches and alarm connections in accessible location, and coordinate size and location of access panels/doors with General Contractor.

J. Install piping to conserve building space and not interfere with use of space and other Work. Coordinate with other trades to avoid conflicts and provide all required offsets, piping, auxiliary drains, etc. to properly install system.

K. Group piping whenever practical at common elevations.

L. Install piping to allow for expansion and Contraction without stressing pipe, joints or connected equipment.

M. Pipe joints, clamps, groove couplings, flanges, unions, etc., shall not directly contact or be encased in concrete, or be located within wall, floor or roof penetrations.

N. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

O. Prepare pipe, fittings, supports and accessories for finish painting where required.

P. Do not penetrate building structural members unless indicated otherwise on Contract Drawings.

Q. Penetrations through fire rated walls, floors and partitions shall be sealed to provide a U.L. rating equal to or greater than the wall, floor or partition.

R. Install valves with stems upright, not inverted. All valves shall be located such that the removal of their bonnets is possible. Valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. Valves shall be installed as nearly as possible to the locations indicated in the Construction Drawings. Any change in valve location must be so indicated on the Record Drawings. Remove protective coatings after installation.

S. Provide drain valves at main shutoff valves, low points of piping and apparatus.

T. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary and all rust or dirt from storage or lying on the ground shall be removed. Flush entire system of foreign matter.

U. Heat generated by welding or soldering procedures shall not be transmitted to valves, groove couplings, or any other components installed within the piping system that may be damaged due to high temperatures. Contractor shall take all precautions necessary and allow heated piping to cool to ambient temperature before attachment.

V. All screw joints shall be made with taper threads, properly cut. Joints shall be made tight with Teflon tape or non-toxic joint compound applied to the pipe threads only and not to fittings. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Before installing pipe that has been cut and threaded, the lengths of pipe shall be upended and hammered to remove all shavings and foreign material.

3.2 DETECTION SYSTEM INSTALLATION

A. Detection system installation shall comply with NFPA 13, NFPA 70, NFPA 72 and as applicable.

B. Installation of the fire detection panel and peripherals shall comply with the Execution section of Division 28 31 00 Fire Alarm and Smoke Detector System.

C. Where separate contractors are used to provide the sprinkler portion and the detection portion of the preaction system, both contractors are required to coordinate the installation activities to ensure a complete and compliant preaction system.

D. Detection panels shall not be installed in locations where water damage may occur due to routine system testing or maintenance operation or preaction system charging.

E. Electronic control modules or NAC modules shall not be mounted above ceilings. Modules shall be accessible without ladders or special equipment. Modules shall be identified as to circuit number and function.

F. The detection system shall be interfaced with the building fire alarm system. The detection system shall have three interface relays mounted adjacent to the detection panel. The interface relays shall not be mounted above or below the detection panel. The relays shall provide detection alarm, supervisory and trouble signals for the building fire alarm system.

G. Wherever relays are used to interface with control functions the relay shall include an LED indicator which indicates the activated state of the relay. The LED indicator shall allow for visual verification of relay activation without disassembly of the relay or the relay enclosure. Where the relay or electronic module’s led cannot be observed without lifting ceiling tiles a remote indicator shall be installed. The remote indicator shall be wall mounted except where a hard ceiling is available. Remote indicators mounted in ceiling tiles shall not be acceptable. If necessary to provide this visual indication of relay activation, a second relay and 24 volts control power may be required in addition to the module relay.

3.3 WELDED PIPING

A. Welding of pipe/fittings in normally occupied buildings is prohibited. Offsite welding is acceptable. Should welding be required in a normally occupied building for connecting to an existing welded system, obtain written approval from Owner’s representative and comply with NFPA 51 B requirements.

B. All welding materials, procedures, qualifications and records shall comply with applicable NFPA requirements

3.4 SYSTEM TESTING AND FLUSHING

A. Testing, cleaning, flushing and inspection shall be done in accordance with NFPA requirements.

B. The installing Contractor shall complete and sign the appropriate Contractor's Material and Test Certificates included within NFPA 13. Tests and signing of test certificates shall be witnessed by an Owner's representative or designee.

3.5 TRAINING

A. Contractor shall provide for the service of a competent, trained and experienced agent to instruct and acquaint the Owner with the proper functioning, operation and maintenance of the fire protection systems and all installed components.

3.6 WARRANTY

A. The complete system shall be warranted in writing against defects in materials or Workmanship under normal use and service for a period of one year after date of Substantial Completion.

END OF SECTION

SECTION 22 00 01 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Basic Plumbing Requirements specifically applicable to each Division 22 Section, in addition to Division 01 - General Requirements.

1.2 REFERENCES

A. All references in Division 22 to codes, standards or other publications shall be the latest edition/version, unless noted otherwise.

1.3 PLANS

A. These specifications are accompanied by plans indicating typical layouts, pipe and equipment location, etc. The plans and these specifications are complimentary each to the other and what is called for by one shall be as binding as if called for by both. Should there be a conflict between drawings and specifications regarding a material shown of work described or detailed then the material of work having the greater value shall be provided.

B. The plans as prepared are in general diagrammatic. The contractor shall carefully lay out his work at the site to conform to the architectural, mechanical, electrical and structural conditions to provide grading of piping, to avoid all obstructions and to conform to details of installation as shown on the plans and supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated satisfactorily operating installation. **The General Contractor must coordinate the work of all trades.** All necessary offsets in piping, fittings, ductwork, etc. required to avoid interferences between piping, equipment, structural and architectural work are not shown but shall be furnished and installed by the contractor without additional expense to the Owner.

C. These specifications and plans accompanying same are intended to cover systems which will not interfere with the design of the building, which will fit into the available spaces, and which will insure complete and satisfactory systems. Each contractor shall, therefore, carefully examine the plans and the building and shall be responsible for the proper fitting of his material and apparatus into the building.

D. The size of plumbing equipment indicated on the plans is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space with the manufacturer’s recommended clearances allocated for same on the plans. It shall be the Contractor’s responsibility to furnish data to evidence that sufficient space can be provided for the installation of proposed equipment and that adequate access will exist for servicing and maintenance of equipment. Should changes become necessary during construction, the contractor shall make such necessary changes at his (the Contractor's) own expense.

E. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect’s attention no later than ten (10) days prior to the bid date, unless specified otherwise in Division 1. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus or equipment.

1.4 CHANGES

A. Any changes from the plans necessary to make this work conform to the building as it is constructed, to make this work fit the work of other trades or to make this work conform to the rules of city and municipal bodies having jurisdiction shall be made by this contractor at no additional cost to the Owner. However, no changes shall be made from the work described on the plans and these specifications except on written order from the Architect.

B. If any changes are required other than those mentioned above and the changes involve extra work on the part of the contractor, no charges for this extra work shall be allowed unless authorized in advance of the work by a written order from the Owner and/or Architect stating the charges to be made for the work.

C. Proposed use of item or equipment other than that specified or indicated may require redesign of structure, partitions, foundations, piping, wiring, or other parts of mechanical, electrical, or architectural layout. Redesign, new drawings, and detailing required shall be prepared and submitted to Architect/Engineer for approval.

D. Where approved deviation requires different quantity, size and arrangement of wiring, conduit, equipment, etc. from that specified or indicated; provide such items and all other additional equipment required by system at no additional cost to the Owner.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection:

1. 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.
2. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
3. Damaged equipment or material shall be replaced with new as determined and directed by the Architect or Engineer. In particular, piping insulation which becomes saturated will be rejected and must be removed from the job site. Such repair or replacement shall be at no additional cost to the Owner.
4. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
5. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Owner.
4. Boilers shall be left clean following final internal inspection by the inspector.
5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 SUBSTITUTIONS

A. The materials, products and equipment described and specified establish a standard of quality, function, dimension and appearance to be met by any proposed substitutions.

B. Reference Division 01 – Product Requirements.

C. Substitution requests are only required where specific manufacturers are listed or scheduled.

1.7 SUBMITTALS

A. Submit under provisions of Division 01.

B. The Contractor shall furnish copies of the manufacturer's literature and drawings describing all proposed equipment and materials indicated in the specifications. The proposed use of the exact equipment and materials specified shall not change this requirement of including literature describing the proposed equipment. Manufactured items proposed for use, whether specified or proposed for substitution, shall be the current, catalogued product of the manufacturer, and replacement parts shall be available.

C. Manufacturer's regular catalog sheets will not be acceptable under this requirement unless they indicate completely all of the specification requirements. Where drawings cover several sizes or types of construction they shall clearly indicate the size or type of construction to be used on the project. In cases where several sizes of the same type of equipment are required to be furnished, the submittal shall include a schedule identifying each piece of equipment, complete with all capacity information needed to compare every submitted item with its respective specified item. Annotate all submittal data to indicate exact model, size, and type submitted.

D. Brochures shall contain a certification that the equipment or materials are suitable for conditions shown and specified; that the equipment or materials are believed to be in conformity with the plans and specifications, except as may be specifically described and that approval is recommended. The certification shall be signed by the Contractor. Brochures received not in conformity with these requirements will be returned for required actions. Any deviation from the requirements of the specifications shall be clearly noted and marked for the Engineer's consideration.

E. Approval of the brochures, or any part of the contents therein, shall not eliminate responsibility for compliance with the plans and specifications, unless specific attention has been called in writing to proposed deviations at the time of transmittal of the brochures and such deviations have been approved, nor shall it eliminate the requirements or the responsibilities, if there are errors of any sort in the data submitted.

1.8 INTERFERENCES AND COOPERATION

A. The plans are generally diagrammatic and the Contractor shall coordinate the work of the different trades so that interferences between piping, equipment, structural and architectural work will be avoided. Not all offsets in piping, ductwork, etc., are shown. The Contractor shall cooperate with the General Contractor and all other contractors to coordinate their work to avoid interferences and delays and arrange all parts of the work to harmonize in service and appearance with all other parts.

B. Provide an overhead coordination submittal per Division 01 The submittal shall include all structural, plumbing, mechanical, electrical, and fire protection components.

1.9 MATERIALS AND WORKMANSHIP

A. All materials shall be new, of the quality specified and free of any defects. Manufacturer's names are listed to establish a standard of quality and construction.

B. The Contractor will be responsible for transportation of his materials to the job and for their storage and protection until the final acceptance of the job.

C. Contractor shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds and all labor required for the safe and expeditious execution of his contract.

1.10 PERMITS AND INSPECTIONS

A. The Contractor will be responsible for all permits and inspections required by law for the completion of his work. Cost of all permits and inspections shall be paid for by the Contractor. The Contractor shall obtain and pay for all certificates of approval which must be delivered to the Architect before final acceptance of the job. All materials and labor furnished by the Contractor shall be in strict accordance with the rules and requirements of the National Board of Fire Underwriters, state and municipal regulations and other authorities who may have lawful jurisdiction over the work being done.

B. Each contractor shall be responsible for coordinating their work with the General Contractor and scheduling AHJ required inspections through the General Contractor to allow inspections to be performed without impeding the progress of construction. Generally, the Contractor shall plan for inspections to occur two (2) weeks prior to the scheduled concealment of work in the area of inspection.

1.11 ENGINEERING DESIGN TEAM OBSERVATIONS

A. Each contractor shall be responsible for coordinating their work with the General Contractor and scheduling progress observations through the General Contractor to allow for the following observations to be performed without impeding the progress of construction. Generally the Contractor shall plan for observations to occur two (2) weeks prior to the scheduled concealment of work in the area of observation.

B. In general, observations for this project shall include but not be limited to:

1. Exterior Below Grade: Site utilities and services.
2. Interior Below Grade: Utilities, services and systems.
3. Rough Wall: All utilities, services and systems in-place including wall studs, cross bracing, supports, etc. (No sheetrock or insulation).
4. Corrected Rough Wall: (Before Sheetrock).
5. Above Ceiling: All utilities, services and systems in place, labeling on exposed piping (No insulation on piping systems. Ceiling grid/channels may be installed but no sheetrock or ceiling tile).
6. Above Ceiling Final: All utilities, services and systems complete including hangers, insulation, and labeling (ceiling grid and/or channel may be in place but no sheetrock or ceiling tile shall be installed).
7. Substantial Completion: All surfaces complete, fixtures installed and trim-out complete.
8. Final: Cleaned and ready for occupancy.

1.12 EXAMINATION OF SITE

A. All Contractors submitting proposals for this work shall first examine the site and all conditions thereon and therein. All proposals shall take into consideration conditions as may affect the work under this contract. They shall satisfy themselves as to existing grades and the actual formation, and soil conditions.

B. Contractors shall verify all service locations, depths, sizes, etc. No information given on the plans shall relieve the Contractor of this responsibility.

C. Before starting work, the Contractor shall verify all associated existing systems, pipe sizes, locations, and dimensions so that the new systems can be properly connected as indicated on the documents.

1.13 QUALITY ASSURANCE

A. Perform Work in accordance with all codes listed on the drawing sheets, the local authority having jurisdiction (AHJ), and the Architect/Engineer. As the minimum standard for the level of quality, in all cases the greater quantity or better quality shall be the first consideration for the basis of an acceptable product or process. The local authority having jurisdiction, the Architect and the Engineer shall have the final authority on the approval and/or use of any product or process specified or submitted for substitution. The greater quality and/or value specified herein for the system(s) and various components and installation procedures shall take precedence over the minimum requirements of the herein before mentioned codes.

B. Equipment and Components: Bear UL, ASME, ANSI and/or NSF label or marking, as specified in appropriate Section.

C. Valves: Provide manufacturer’s name and pressure rating marked on valve body.

D. Piping: All piping installed on this project shall bear the complete ASTM and Manufacturer’s marking. Labeling and identification requirements as required by ASTM. All installed piping 5’-0” or greater in length shall be readily identifiable per ASTM labeling criteria. Piping not bearing this identification upon installation shall be removed and replaced by the correctly labeled piping. Piping shall not be re-stenciled after it is installed, to meet this requirement.

E. Lead free components: All wetted surfaces of piping, fittings, valves and other products in contact with the potable water system shall be certified as lead free, as per current requirements of NSF/ANSI 61 and/or NSF/ANSI 372.

F. Welding Materials and Procedures: Perform to ASME Code.

1.14 AUTOMATIC CONTROLS ALLOWANCE

A. Where “automatic controls” are called for in the plans and specifications, all the control instruments, such as motorized valves, etc., shall be provided by the Contractor. The Drawings may show some power connections to controls equipment; however, if more power is required, then the Contractor shall provide this power.

1.15 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

F. Electrical and Pneumatic Interconnection of Controls and Instruments: This is generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.

G. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

H. Work in Existing Building: Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to Cutting and Patching article in Part 3 of this section.

1.16 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities, when required by the phasing or called for specifically on the plans.

1.17 PLUMBING DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor. Such access shall be provided without additional cost or time to the Owner. Where work is in an operating facility, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the facility.

1.18 UTILITIES

A. The Contractor shall coordinate work and arrange and pay for any necessary revisions to existing utility services, including meter deposits and connection fees to all serving utility companies and shall install utilities, where applicable.

B. The Contractor shall be responsible for all costs associated with the extension of utilities to the Building, including but not limited to natural gas, domestic water, sanitary sewage and storm drain piping.

C. The Contractor shall be responsible for gathering all information required by the connecting utility service provider (i.e. drawings, load information, completing and submitting required forms, etc.) The contractor may utilize the design team to obtain information, however, the contractor is responsible for submitting all required documentation to the utility provider. This includes, but is not limited to, new gas service, medium pressure gas request forms, water meter sizing forms, etc.).

D. The Contractor shall provide the utility service provider a date that the utility connection is needed. This date shall be coordinated with the utility service provider to take into consideration the design time and mobilization.

1.19 INDOOR AIR QUALITY CONTROL:

A. All Adhesives, sealants, paints, coatings applied within the weatherproofed interior of the building shall comply with applicable VOC thresholds of SCAQMD 1113 and 1168.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 ESCUTCHEONS AND PLATES

A. Solid plates, 316 Stainless Steel with set screws shall be used where the sectional plates will not stay in place or are not available in the required size, or where other individual specification section(s) require one piece or greater quality escutcheons or plates. All escutcheons shall be triple nickel-chromium plated brass, or type 316L stainless steel.

2.4 INSULATION

A. All insulation materials used inside the building on this project, including finishes and adhesives on the exterior surfaces of ducts, pipes and equipment shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less as determined by an independent testing laboratory in accordance with NFPA 255 as required by NFPA 90A, unless noted otherwise acceptable.

2.5 HEAT TRACING OF PIPING EXPOSED TO FREEZING CONDITIONS

A. Furnish and install a complete UL listed system of heaters, components and controls to prevent freezing of domestic water piping exposed to freezing conditions. The heat trace system utilized on the combined domestic/fire protection water line within the building shall be listed specifically for use on fire suppression piping.

B. Heat trace system shall be equivalent to Raychem “XL-Trace,” utilizing a self-regulating cable with an output 5 watts/foot with 277 VAC supply voltage (Raychem 5XL2-CR).

C. Power connection, end seal, splice and tee kit components shall be applied in the field.

D. The heat trace system shall be controlled by a heat-tracing power distribution panel complete with main circuit breaker, door disconnect switch, alarm relay and alarm horn ground-fault and monitoring for group control of multiple circuits. Panel shall be equivalent to Raychem Model HTPG.

E. The system shall be controlled thru an ambient temperature sensor, Raychem model RTD-200 or equal, set to energize heat trace below 40 degrees F.

F. Heater shall be installed linearly on the pipe after piping has been successfully pressure tested. Heater shall be secured to pipe with cable ties or type PF-1 polyester tape as specified by the manufacturer.

G. System shall be tested in accordance with manufacturer’s recommendations prior to the application of the thermal insulation as specified in Section 22 07 00.

2.6 SOLENOID VALVES

A. All solenoid valves used in piping systems shall be the slow acting type.

2.7 ASBESTOS

A. Materials containing asbestos are not permitted.

B. If any asbestos-containing material is discovered or suspected, the contractor shall immediately cease any and all work in that area. Cover the exposed material in plastic containment without disturbing the exposed material and notify the Architect and the Owner’s representative.

C. Certify in writing that neither the Contractor nor any of Contractor’s subcontractors or suppliers will supply any materials that contain any asbestos in any form for this Project.

PART 3 - EXECUTION

3.1 EXISTING FACILITIES

A. All piping, valves, fittings, switches, starters, conduit boxes and/or any other items of plumbing, mechanical or electrical equipment which are not in service at the completion of this contract shall be removed, unless otherwise noted.

B. Where an existing service to existing building requires disconnection to facilitate installation of this work, this Contractor shall include in his bid the cost of such disconnecting, re-routing and re-connecting. Where any existing facilities, which are to remain occupied, are affected by disconnection, re-routing or re-connection, then such disconnecting, re-connecting and re-routing shall be done in such a manner so as not to interrupt any service to the building. Satisfactory arrangements shall be made with local authorities and/or the various utility companies involved.

The method of disconnecting, re-routing and re-connecting shall be as shown on the Drawings, or if not shown on the drawings, subject to the approval of the Architect and Owner.

C. Unless noted otherwise, all equipment and material indicated or specified to be removed shall become the property of the Contractor.

D. This Contractor shall carefully coordinate work in and around existing services and equipment and adjoining rooms to remodel areas. Coordinate shut-down, removal, capping, and turn-on of existing services with the Owner's facilities' department and general contractor to provide continuous (uninterrupted) service throughout the construction period. This Contractor shall refer to the architectural plans and specifications and thoroughly familiarize himself with the construction phasing in remodel areas before beginning work.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. No storm water or ground water leakage permitted. Provide daily clean up of construction and demolition debris on all floor surfaces and on all equipment being operated by the Owner.

3.2 PLUMBING DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor. Such access shall be provided without additional cost or time to the Owner. Where work is in an operating facility, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the facility.

B. In an operating facility, maintain the operation, cleanliness and safety. The Owner's personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and facility operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of facility operation. Perform all flame cutting to maintain the fire safety integrity of this facility. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards.

C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled. his SHALL include the crawlspace as well. Removed and unused material SHALL be taken out from the crawlspace; daily.

D. At any time work is occurring when the building is occupied, avoid using tools that create excessive noise that might disrupt the building operations (e.g. concrete breaking equipment, excavating equipment, hammer drills, screw guns, etc.). Use other types of tools or schedule work to occur outside of normally occupied hours. Carefully plan water control for all coring and sawing operations to prevent damage and disruption of occupants.

3.3 INTERFERENCES AND COOPERATION

A. The plans are generally diagrammatic and the Contractor shall coordinate the work of the different trades so that interferences between piping, equipment, structural and architectural work will be avoided. Not all offsets in piping, ductwork, etc., are shown. The Contractor shall cooperate with

the General Contractor and all other contractors to coordinate their work to avoid interferences and delays and arrange all parts of the work to harmonize in service and appearance with all other parts.

B. The General Contractor shall coordinate the work of all trades. The various systems to be installed shall follow the normal, common sense priority of systems installation with the highest system to lowest system installation as follows:

1. HVAC ductwork shall be installed up and against building (floor/roof) structural members.
2. Sanitary waste and storm drainage piping system shall begin horizontal routing as high as possible between structural members, offsetting vertically only to avoid conflict with structure or to drop below HVAC ductwork where offset is unavoidable.
3. Electrical conduit shall be installed up, and against building structure, running parallel with HVAC ductwork and offsetting up into structural bay (void) or below HVAC ductwork to obtain a change in direction or branch take-off. Electrical conduit installation shall not control or dictate the routing or installation of the HVAC ductwork storm drain piping or sanitary waste and vent piping.
4. Domestic water piping (hot water, cold water and hot water return), medical gas piping and HVAC piping shall be installed beside and below the HVAC ductwork and electrical conduit. Preferred installation shall be on trapeze, wall brackets, or racked on vertical channel on the wall above the ceiling line. The completed installation shall not conflict with the installation or removal of ceiling system components of tile. All main and branch take-off isolation valves, strainers, sensors and other plumbing equipment shall be readily identifiable and accessible from a standing position on a step ladder**, no more than 18 inches above ceilings**.
5. Fire sprinkler piping system shall be installed below all other systems and components, unless noted otherwise or as coordinated with all other trades. The fire sprinkler piping shall not conflict with the installation or removal of ceiling system components or tile. The fire sprinkler system piping layout and installation shall be coordinated by the fire sprinkler contractor and the General Contractor with all other trades performing work in the affected area, to avoid conflict with the installation or removal of any other systems components, or to prevent ready access to valves, equipment of the other trades. Do not install sprinkler piping until ductwork mains are in place.

C. Provide an overhead coordination submittal per Division 01 The submittal shall include all structural, plumbing, mechanical, electrical, and fire protection components.

3.4 TEMPORARY PIPING AND EQUIPMENT

A. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service.

B. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.

C. When construction is complete, temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs in potable water systems will not be allowed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.5 UNIONS

A. No unions are to be placed in any pipe in a location which will be concealed or inaccessible after completion of the building unless furnished with an access panel either as shown on the drawings

or as specified herein. Unions must be installed on each side of all pieces of equipment such as water heaters, water softeners, thermostatic mixing valves, flow regulators, pumps, etc., so that such equipment may be readily disconnected in location that equipment can be disconnected and removed.

3.6 ACCESS PANELS

A. All valves, traps, drains, cleanouts, equipment, etc., must be accessible. The Contractor shall, wherever required to service his installation, coordinate size and location of access panels with General Contractor. Refer to Section 08 31 13 – Access Doors and Frames.

3.7 FIRESTOPPING

A. Firestopping: Unused slots, sleeves and other penetrations in floors, walls or other general construction shall be closed and sealed with an approved firestopping material.

1. Reference Section 07 84 00 – Firestopping for appropriate firestopping material and method of installation required for each wall rating and penetration size and type to comply with the appropriate UL listing.
2. Floor slots and openings shall be closed with 16 gauge galvanized steel sheet supported on 1-inch by 1-inch by 1/8-inch structural angle drilled or supported with powder-driven studs into the building structure. Firestop with a layer of silicone elastomer not less than 1-inch thick which completely fills the opening. The top surface of the silicone elastomer shall be approximately 1-inch below the finished floor slab.
3. Openings in walls shall be closed with 16 gauge galvanized steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of the steel sheet with not less than 1/8-inch thick layer of non-sagging silicone elastomer to fully cover the opening.
4. Single or multiple pipes passing through walls and floors shall have the annular space between pipes or between pipes and structure filled with silicone elastomer to provide a rated firestop (rated to match the assembly) for floors and walls.

B. The annulus between exposed pipe and walls or floors in finished spaces shall be refilled, sealed and painted to match adjacent surfaces.

C. Future Slots: Cap ends of sleeve and mark as future.

3.8 SEALING PENETRATIONS

A. The annulus between exposed pipe, sleeves and walls or floors in finished spaces shall be refilled, sealed and painted to match adjacent surfaces. For Rated walls (Fire or smoke) provide the correct UL/FM listed sealing assembly for that application.

3.9 CUTTING AND PATCHING

A. All cutting and patching of floors, walls and ceilings for installation of work covered in these sections will be done by the General Contractor.

B. Where it becomes necessary to drill into or cut through any existing or completed floors, walls or ceilings to permit the installation of any work under this contract or to repair any defects that may appear up to the expiration of the guarantee, such cutting and patching shall be done by the General Contractor under the supervision of the Architect.

C. No joists, beams, girders or columns shall be cut without first obtaining written permission from the Architect or Structural Engineer.

D. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations approved by the Architect/Engineer. Impact type equipment shall not be used except where specifically approved by the Architect/Engineer. Openings in precast concrete slabs for pipes, etc., shall be core drilled to exact size.

E. Where core drilling or saw cutting of concrete floor or wall penetrations is required, work shall be performed in accordance with Division 03 Specifications. Where applicable Division 03 Specifications are not included in the Project, core drilling shall be in accordance with generally accepted standards and be performed by licensed personnel where applicable.

F. Contractor shall use ground penetrating radar (GPR) to scan areas of concrete prior to core drilling or saw cutting for embedments. Contractor shall clearly mark locations of embedments for review by Structural Engineer or owner's construction representative before core drilling or saw cutting.

G. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner approved by the Architect/Engineer.

H. Plaster: All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

I. All drilling methods for expansion bolts, hangers and other supports shall be done subject to be approval of the Architect or Structural Engineer. Labor and materials required to replace or rebuild parts or injured portions shall be furnished at the Contractor's expense, subject to the satisfaction of the Architect.

J. Restoration: All openings shall be restored to "as new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

K. Opening and Closing Pavement and/or Concrete Flatwork: Cut and patch existing pavement, concrete flatwork, etc. as required to perform work in the contract, satisfactory to the Architect/Engineer. Existing construction shall be machine-cut on straight lines. Unless otherwise described in "Excavating and Backfill", sub-base, base course and paving materials shall be equal to existing materials as required by other Divisions of these specifications or as required to match existing conditions. Materials shall be thoroughly compacted to required (or adjacent) densities and thicknesses and shall be finished level with adjacent surfaces.

3.10 PAINTING

A. Types of paint shall be as specified in the Architectural specifications. Surfaces to be painted are identified in Division 09 and on the drawings. All exposed gas piping shall be painted as noted in Section 22 11 23.

B. All surfaces to be painted shall be thoroughly cleaned, all rust scraped off and all oil and grease removed before any paint is applied.

C. Finishing paint coats shall not be applied until all the work is completed. Cloths shall be spread where necessary to prevent drops of paint, oil, etc. from defacing walls, floors, etc., and the Contractor shall be held responsible for all damage by neglect of such precautions. The finished conditions of the painting shall be subject to the approval of the

D. Architect, who may require retouching or repainting of surfaces not properly finished.

3.11 SLEEVES, ESCUTCHEONS AND PLATES

A. Where pipes pass through ceilings (any type: i.e. lay-in, gypsum, etc.), floors and/or walls in ALL spaces, install sleeves.

B. Where pipes pass through ceilings or walls in finished spaces, install sectional plates or escutcheons to cover the annular opening between pipe and sleeve.

C. The annulus between pipe and walls or floors, shall be filled with A One-component, elastomeric, gun-grade polyurethane sealant; Sonolastic NP or equal; unless fire wall or barrier then the approved UL listed fire assembly shall be used.

D. Inside diameter of escutcheons shall fit around insulation and around pipe when not insulated; outside diameter shall cover sleeve. Secure escutcheons or plates to pipe or sleeve but not to insulation. All escutcheons shall be triple nickel-chromium plated brass, or Type 316L stainless steel.

3.12 PRODUCTS NOT FURNISHED BUT INSTALLED UNDER DIVISION 22.

A. Rough-in for and make final connection to Owner furnished fixtures and equipment requiring plumbing services.

B. Rough-in for and make final connection to fixtures and equipment furnished under other divisions of these Contract Specifications requiring plumbing services.

3.13 EXCAVATING AND BACKFILLING

A. The Contractor shall do all excavating and backfilling necessary for the installation of the work, including shoring, bailing and pumping to maintain his trenches and keep them in dry condition until the work in question has been tested and approved.

B. Care shall be taken that piping is properly and uniformly graded and that trench beds are well rammed and that ground under pipelines is firm and secure before piping is laid. All trenches must be backfilled with clean sand, four inches under pipe, rammed down, soaked with water and made solid. All surplus material shall be removed and carted away.

C. The Contractors will be responsible for resurfacing all areas after trenches have been backfilled.

D. The Contractor is directed to comply with all OSHA Requirements and State Requirements regarding trench safety.

E. Perform all work with the highest regard to safety and in accordance with U.S. 29 CFR 1926 “Safety and Health Regulations for Construction”. Special attention shall be directed to Subpart P – Excavations. Refer also to 230010.1.12 – Safety.

1. Safety Precautions and Programs

    a. In excavations that are four (4) feet or more in depth, means of egress shall be provided by stairway, ladder, ramp or other safe means so as to require no more than twenty-five (25) feet of lateral travel for employees.
    b. In addition, on projects in which trench excavation will have a depth of five feet or more, the Contractor, and all of their subcontractors, shall comply with all

requirements of 29 CFR 1926 Subpart P 652 “Safety and Health Regulations for Construction – Excavations” and all Appendices related thereto.

c. Before commencing any trench excavation that will be five (5) feet deep or deeper, provide Owner, through A/E, with detailed plans and specifications regarding the safety systems to be utilized. Said plans and specifications shall include a certification from a registered professional engineer indicating full compliance with the 29 CFR 1926 Subpart P -- Excavations.

d. Contractor shall ascertain, prior to proposal, whether or not such conditions prevail and services are needed, and shall include cost of same in proposal.

2. All shoring and bracing shall be designed so that it is effective to the bottom of the excavation. Sheeting, sheet piling, bracing, shoring, trench boxes, and other methods of protection, including sloping, shall be based upon the condition and nature of the materials to be retained, and by loads (including surcharge) imparted to the sides of excavation by equipment and stored materials.
3. Store excavated or other materials a minimum of two feet (2') from the edge of any excavation. Retain such materials to prevent their falling or sliding into the excavation, and to prevent excessive pressure on the sides of the excavation.
4. Maintain sides and slopes of excavations in a safe condition by scaling, benching or barricading.
5. Take other precautions via shoring and bracing to prevent slides or cave-ins. Take special precautions when trenches are located adjacent to backfilled excavations, or subjected to vibrations from railroads, highway traffic, operation of machines, etc.

F. Verify locations of all existing utilities in the area prior to start of excavation (gas, electrical, water, sanitary, storm, telephone, cable TV, optical cable, etc.). Coordinate with utility companies as required.

1. Excavation within four feet (4') of existing utilities shall be done by hand digging only.

G. Where conditions require concrete or other materials to be placed against undisturbed earth surfaces, any loosened or disturbed materials shall be removed from such surfaces.

H. Trenching

1. Trenches shall be large enough to permit handling of pipe and accessories and making connections. Trench bottom width shall exceed bell or coupling diameters by at least twelve inches (12").
2. Trenches in rock, soil containing rocks larger than two (2) inches in any dimension, and other non-uniform materials, shall be four (4) inches minimum and twelve inches (12") maximum below the bottom of the pipe to provide for a bedding course.

I. Preparation of Trench Bottom

1. If the excavation is carried below the finished flow line grade of the pipe in order to remove unsuitable material or for any other reason, the trench shall be course bedded to within six inches (6") of the finished flow line grade of the pipe bottom with compacted load-bearing backfill. A bedding course as specified below shall then be placed over the load-bearing backfill.
2. Trenches shall be dry when the trench bottom is prepared. A continuous trough with compacted bedding course shall be prepared to receive the bottom quadrant of the pipe barrel. Remove loose or disturbed material and bring the trench bottom up to grade with bedding material as follows:

a. Washed pea gravel with material no larger than 1/2 inch in largest dimension shall be utilized. Provide a minimum of 8” of bedding under all the pipe, fittings and valves.
b. Provide a Bentonite plug in the trench at the building perimeter where site drainage or other conditions could permit water intrusion into the trench under the building. Bentonite plug to extend 2 ft. on either side of the perimeter grade beam.

3. In addition, for bell joint pipe, excavation for the bell or coupling shall be so that the pipe will bear on the trench bottom along the entire length of the barrel.
4. Prepare the trench bottom carefully so that when placed in its final position, the pipe will be true to line and grade and uniformly supported.

J. Laying Pipe

1. All pipe shall be clean at the time it is placed in the line. Open ends of pipe sections already in place shall be tightly plugged to prevent the entrance of trench water, mud, dirt, etc.
2. Keep trench bottom free of frost, frozen earth or standing water at the time of pipe laying and jointing.

K. Compaction

1. Where compaction is indicated by specifications, accomplish same with vibratory or rammer type compactor, minimum of two full width passes.
2. Compaction below slabs, roads, flatwork, or other construction elements shall be performed to the requirements of compaction for those elements. Coordinate with general construction trades and other Division’s specifications.

L. Backfilling

1. Clean trenches and backfill material of any organic material, roots, trash, lumber, other debris and frozen material prior to backfilling. Backfill material shall contain no organic material, roots, trash, lumber, other debris or frozen material. Backfill material under slabs inside building shall match adjacent materials and be of density acceptable to the A/E.
2. Backfilling by means of sluicing or flooding with water is not permitted. Backfill shall not be placed on frozen ground.
3. Partially backfill immediately after the pipe is laid (unless other methods for anchoring pipe are provided). Leave joints exposed for hydrostatic testing. Water shall not be permitted to rise in unbackfilled trenches after pipe has been placed.
4. Whenever timber or other sheeting is driven to a depth below the elevation of the top of the pipe, that portion of the sheeting below a point four feet above the elevation of the top of the pipe shall not be disturbed or removed.
5. Pipe layer backfill (bedding material under the bottom quadrant of the pipe, around sides, and up to a point one foot above the top of the pipe) shall be: sand or select material containing rocks no larger than 1/2 inch in greatest dimension (sand only shall be used with all plastic piping systems or plastic jacketed piping systems); except that pipe layer backfill below slabs in active soils shall be washed pea gravel of 1/2 inch minus dimensions. Backfill below slabs may utilize flowable fill.
6. Backfill material shall be placed and compacted in six inch (6") layers. Backfill shall be brought up evenly on both sides of the pipe simultaneously to avoid damage or displacement from unbalanced loading.
7. Joints shall not be covered with backfill until pressure and leak testing is completed.
8. Backfill to grade (above pipe layer).

a. Active Soils: Where active soils are encountered backfill to grade within ten (10) feet of building line shall be uncompacted washed pea gravel to match the pipe layer backfill specified above.

M. The Contractor shall also comply with requirements set forth in Division 31 Drawings and Specifications.

3.14 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Owner operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Restore building to original condition upon completion of rigging work.

3.15 CLOSE OUT DOCUMENTATION AND TESTING REPORTS

A. Contractor shall provide Project Record Documents, Operation and Maintenance data and all product warranty data as specified in Division 01.

B. Contractor shall also provide copies of all plumbing system test and certification reports for inclusion in project close out documents. Reports shall include, but shall not be limited to, the following:

1. Piping system pressure test reports (per Sections 22 11 00, 22 11 23, 22 13 00 and 22 14 00),
2. Domestic water disinfection tests (per Section 22 11 00),
3. Backflow prevention assembly certifications (per Section 22 11 00),
4. Domestic hot water systems tests (per Section 22 11 00),
5. Boiler certification (per Section 22 33 00 or 22 34 00), and
6. Medical Gas system verification tests (per Section 22 60 13).

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Perform all Work required to provide and install supports, hangers, anchors, sleeves and bases for all plumbing piping, equipment, system components and accessories, indicated by the Contract Documents with all supplementary items necessary for complete, code compliant and approved installation.

B. Section Includes:

1. Pipe hangers and supports.
2. Accessories.
3. Flashing.
4. Sleeves.
5. Mechanical sleeve seals.
6. Formed steel channel.
7. Equipment bases (housekeeping pads).
8. Exterior pipe supports.
9. Roof pipe chase housing.

C. Related Sections:

1. Division 03 – Concrete Forming and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
2. Division 03 – Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Division 07 – Firestopping: Product requirements for firestopping for placement by this section.
4. Division 07– Joint Protection: Product requirements for sealant materials for placement by this section.
5. Section 22 00 01 – General Plumbing Requirements.
6. Section 22 05 48 – Vibration Controls for Plumbing Piping and Equipment.
7. Section 22 0700 Plumbing Insulation
8. Section 22 11 00 – Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
9. Section 22 13 00 – Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.
10. Section 22 14 00 – Facility Storm Drainage: Execution requirements for placement of hangers and supports specified by this section.
11. Section 22 17 00 – Facility Natural Gas Piping: Execution requirements for placement of hangers and supports specified by this section.
12. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
13. Section 22 05 53 – Identification for Plumbing Piping and Equipment
14. Section 22 31 00_Domestic Water Softeners
15. Section 22 33 00_Electric Domestic Water Heaters
16. Section 22 40 00_Plumbing Fixtures
17. Section 22 45 00_Emergency Shower and Eyewash Equipment
18. Section 22 60 13_Medical Gas and Vacuum Systems

1.2 REFERENCES

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.2 – Fuel Gas Piping.
2. ASME B31.9 – Building Services Piping.

B. ASTM International:

1. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 – Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 – Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 – Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 – Structural Welding Code – Steel.

D. FM Global:

1. FM – Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
2. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.
3. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
4. MSS SP 90 – Guidelines on Terminology for Pipe Hangers and Supports.

F. Underwriters Laboratories Inc.:

1. UL 263 – Fire Tests of Building Construction and Materials.
2. UL 723 – Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 – Fire Tests of Through-Penetration Firestops.
4. UL 2079 – Tests for Fire Resistance of Building Joint Systems.
5. UL – Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH – Certification Listings.

1.4 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog data including load capacity of hangers and supports.

C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

E. Manufacturer's Installation Instruction: Submit special procedures and assembly of hanger and support components.

F. UL/FM assembly sheets or WH assembly sheets for fire rated penetrations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years of documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years of documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – Product Requirements: Environmental conditions affecting products on site.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Contractor shall review all drawings, including structural drawings, for details regarding pipe supports, housekeeping pads, anchors, hangers, and guides.

1.10 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Refer to individual system and equipment Specification Sections for additional support requirements. Comply with MSS SP-69 for support selections and applications that are not addressed within these Specifications.

C. Utilize hangers and supports to support systems under all conditions of operation, allowing free expansion and contraction, and to prevent excessive stresses from being introduced into the structure, piping or connected equipment.

D. All pipe supports shall be of the type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

E. Design hangers to impede disengagement by movement of supported pipe.

F. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

G. Wire or perforated strap iron will not be acceptable as hanger material. Perforated strap iron may only be used to secure and support vertical sanitary sewer and sanitary vent pipe located inside walls to achieve vertical pipe support requirements.

H. Hanger rods shall be threaded on both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

I. Fasteners requiring explosive powder (shooting) or pneumatic-driven actuation will not be acceptable under any circumstances.

J. Nail drive anchors, plastic anchors or plastic expansion shields will not be permitted under any circumstances.

K. Each hanger shall be properly sized to fit the supported pipe or fit the outside of the insulation on lines, hangers shall not penetrate insulation. Hangers shall bear on the outside of the insulation, which shall be protected by support shields as specified. For piping larger than 2”, protect insulation from crushing by means of a section of rigid insulation to be installed at hanger points. Refer to Section 22 07 00.

L. Hangers and clamps supporting and contacting individual non-insulated brass or copper lines shall be copper or copper plated. Support individual non-insulated brass or copper lines 4 inches and smaller with adjustable swivel ring hangers. Where non-insulated brass or copper lines are supported on trapeze hangers or channels, the pipes shall be isolated from these supports with approved flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp. Plastic tape is not acceptable.

M. Hangers and clamps supporting and contacting plastic piping shall be in accordance with the piping manufacturer’s published recommendations and shall be factory coated or padded to prevent damage to piping.

N. Hangers, rods and hanger assemblies located in exposed areas, outside or in crawlspaces shall be stainless steel or galvanized.

O. Field fabricated supports shall be constructed from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.

P. Finishes:

1. All ferrous hangers, rods, inserts, clamps, stanchions, and brackets on piping within interior non-corrosive environments, shall be dipped in Zinc Chromate Primer before installation.

Rods may be galvanized, or cadmium plated after threading, in lieu of dipping zinc chromate.

2. All hangers and supports exposed to the weather, including roofs and building crawl space areas, shall be galvanized or manufactured from materials that will not rust or corrode due to moisture. All hangers and supports located within corrosive environments shall be constructed from or coated with materials manufactured for installation within the particular environment.

Q. Trapezes:. Trapeze members including suspension rods shall be properly sized for the quantity, diameters, and loaded weight of the lines they are to support.

2.2 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping – DWV / Storm Drain:

1. Conform to ASTM F708, MSS SP58, MSS SP69, MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
10. Crawl Space: Hangers and accessories shall be hot-dipped galvanized.

B. Plumbing Piping – Water, Natural Gas, Medical Gases.

1. Conform to ASTM F708, MSS SP58, MSS SP69, MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp at every floor.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring. Provide non-metallic coatings or inserts on attachments for electrolytic protection where attachments are in direct contact with copper piping.

2.3 ACCESSORIES

A. Hanger Rods: Galvanized mild steel; threaded both ends, threaded on one end, or continuous threaded.

B. Pipe Shields: Provide pipe shields at each support location of insulated piping in accordance with insulation manufacturer's published recommendations. Install MSS SP-58, Type 39 protection shields, if insulation without vapor barrier is indicated. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier.

C. Refer to Section 22 07 00 for additional data on insulation shields.

D. Concrete Inserts:

1. Cast in place concrete inserts shall comply with MSS SP 58 – Pipe Hangers and Supports Materials, U.L. and F.M. standards and shall be sized to suit threaded hanger rods.
2. Inserts shall have malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
3. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction. If the inserts are later found not to be in the proper location for the placement of hangers, then drilled anchors shall be installed. Drilled anchors in concrete or masonry shall be submitted for the approval.
4. Manufactured inserts for metal deck construction shall have legs custom fit to rest in form valleys.
5. Shop fabricated inserts shall be submitted and approved by Owner prior to installation.
6. Inserts shall be of a type that will not interfere with structural reinforcing and that will not displace excessive amounts of structural concrete.

E. Power-actuated fasteners (shooting) will not be acceptable under any circumstances.

F. Note: Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.

2.4 FLASHING

A. Metal Flashing: 20 gage thick galvanized steel.

B. Metal Counterflashing: 20 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: Compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-Fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Refer to Division 07.

D. Provide UL/FM or Warnock Hersey approved assembly for sleeves through fire rated floors or walls.

2.6 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12-gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8-inch minimum strut or stronger as required. with holes 1-1/2 inches on center.

B. Floor support: U-Post, Square Base Type; Zinc Electroplated Finish; 3-1/2 Inch Post Height; 3.678 Pound Weight; 6-Inch Length x 6-Inch Width Pad Size; 1 Channel(s); Flush to Side Channel Position; 4 Pad Mounting Hole(s); ¾ Inch Diameter Pad Mounting Hole Size.

2.8 BASE STANDS AND STANCHIONS

A. Product Description: Base/pipe stands, adjusters and saddles supports. Provide product equal to Eaton B-line B3088 (pipe stand) and B3092 (pipe saddle).

B. Stainless-Steel stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.9 EQUIPMENT BASES (HOUSEKEEPING PADS)

A. Provide minimum 3-1/2-inch reinforced concrete pads with chamfered corners and equipment bases for all outdoor equipment on grade, floor mounted equipment in main central plant area, mechanical rooms, areas with floors below grade, penthouse equipment rooms, and where shown on Drawings.

B. Refer to Division 03 for concrete requirements.

C. Housekeeping pads shall extend minimum of 6 inches on all sides beyond the limits of the mounted equipment unless otherwise noted.

D. Provide galvanized anchor bolts for all equipment placed on concrete pads or on concrete slabs of the size and number recommended by the equipment manufacturer.

2.10 EXTERIOR PIPE SUPPORTS

A. The following exterior supports may be utilized as non-penetrating type roof supports or as grade mounted supports on concrete pads.

B. Adjustable height, single pipe support for pipe sizes 3” and smaller: UV resistant, high density polypropylene, polycarbonate or fiberglass reinforced nylon base with support strut channel,

threaded rod, nuts, washers and pipe clamp. All metal components to be hot dipped galvanized or stainless steel. Provide with optional neoprene pad adhered to the base for added protection of the roof.

1. PHP model PP10
2. Miro Industries, Inc. model 2.5-SB-HCS
3. Mapa model MS-12SA10
4. Substitutions: Under provisions of Division 01.

C. Adjustable height, single pipe support for pipe sizes 4” and larger: Two base type support system with UV resistant high density polypropylene, UV resistant polycarbonate or stainless steel bases. Provide with support hangers appropriate for the type of pipe as specified in this section. Provide with threaded rod, nuts and washers. All metal components, unless indicated otherwise, to be hot dipped galvanized or stainless steel. Provide with optional neoprene pad adhered to the base for added protection of the roof.

1. PHP model PS-1-2
2. Miro Industries, Inc. models 6-H, 8-H or 16-H as appropriate
3. Mapa model MB series
4. Substitutions: Under provisions of Division 01.

D. Adjustable height, multiple pipe support: Two base type support system with UV resistant high density polypropylene, UV resistant polycarbonate or stainless steel bases. Provide with support hangers appropriate for the type of pipe as specified in this section. Provide with threaded rod, nuts and washers. All metal components, unless indicated otherwise, to be hot dipped galvanized or stainless steel. Provide with optional neoprene pad adhered to the base for added protection of the roof.

1. PHP model PSE series
2. Miro Industries, Inc. models 6-H, 8-H or 16-H as appropriate
3. Mapa model MB series
4. Substitutions: Under provisions of Division 01.

E. Gas piping shall be mounted not less than 10” above the roof.

2.11 ROOF PIPE CHASE HOUSING

A. Manufacturers:

1. Roof Penetration Housing, LLC: The Vault
2. Substitutions: Under provisions of Division 01.

B. Roof Pipe Chase Housing:

1. Constructed of heavy gage powder coated welded aluminum with stainless steel hardware consisting of three pieces, a removable vandal resistant lid, a middle housing and a wide flanged 14 inch high curb.
2. Size, unless noted otherwise on drawings:

    a. Length: 20 ½ inches.
    b. Width: 14 ½ inches.
    c. Height: 12 inches.

3. Exit seals to be of aluminum or stainless steel using SilX14 gasket seal. Each seal shall accommodate the specified size of the pipe, cable or conduit ranging in size from .25 inches up to 7.09 inches OD.

    a. Where noted on the drawings, provide pipe chase housing prepped with a hole and cover plate for a GFCI outlet to be installed by the electrician.

4. ICC-500 and FEMA 320/361 wind rated and rain tight.
5. Furnish each unit with factory installed one-inch-thick insulation in the curb, housing and lid. Insulation to have a minimum R value of 4.3.

C. Warranty:

1. The rooftop pipe chase housing shall carry an insured 20-year warranty accommodating multiple penetrations including piping and conduits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Do not drill or cut structural members, unless written permission is obtained from the Structural Engineer.

B. All auxiliary steel required for supports, anchors, guides, etc. shall be provided by the Contractor unless specifically indicated to be provided by others.

C. All supports shall be of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

D. Contractor shall be responsible for structural integrity of all supports, anchors, guides, etc. All structural hanging materials shall have a minimum safety factor of 5 built in.

3.3 INSTALLATION – GENERAL

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. Application, sizing and installation of piping, supports, anchors and sleeves shall be in accordance with manufacturer's printed installation instructions.

C. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc.

D. All piping shall be installed with due regard to expansion and contraction and the type of hanger method of support, location of support, etc. shall be governed in part by this Specification.

E. Install hanger so that rod is vertical under operating conditions.

F. Provide for vertical adjustments after erection and during commissioning, where feasible, to ensure pipe is at design elevation and slope.

G. Install hangers and supports to allow controlled thermal movement of piping systems, permitting freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Supports hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.

I. The load and spacing on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including any concrete that holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required. Contractor shall be responsible for engaging a structural engineer as required for design and review at support systems.

J. Do not hang pipe or any plumbing item directly from a metal deck or locate on the bottom chord of any truss or joist unless approved by the Structural Engineer of Record.

K. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc.

L. All piping supports shall be designed and installed to allow the insulation to be continuous through the hangers.

M. Adjustable clevis hangers shall be supported at rods with a nut above and below the hanger.

N. All hanger rods shall be trimmed neatly so that 1 inch of excess hanger rod protrudes beyond the hanger nut. In the event a rod is intentionally but temporarily left excessively long (for sloped or insulated lines for example), the Contractor shall take appropriate measures to protect the pipe or other materials from damage.

O. Install hangers to provide minimum ½ inch space between finished covering and adjacent structures, materials, etc.

P. Provide adjustable spring type hangers/isolators on all pipe hangers on the first 15 feet of pipe entering the building and where piping offsets vertically from one floor level to another.

Q. Provide adjustable spring type vibration isolation hangers for piping connected to isolated equipment (i.e. pumps, etc.). Refer also to Section 22 05 48.

3.4 INSTALLATION – PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME 31.9, ASTM F708, MSS SP 69 and MSS SP 89.

B. Support horizontal piping as scheduled at end of this section.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Locate hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every floor and at maximum 10’ on center. Support vertical cast iron pipe at each floor and at each hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide non-metallic coatings or inserts on attachments for electrolytic protection where attachments are in direct contact with copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

N. Insulated piping lager than 2” diameter shall be supported with inserts of the same thickness as the insulation, or with other approved methods. Refer also to Section 22 07 00 – Piping Systems Insulation.

O. Supports, hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.

P. Cast iron soil pipe 6 inches and smaller shall be supported at each joint, within 18 inches of joint. Cast iron soil pipe 8 inches and larger shall be supported on both sides of each joint when horizontal run exceeds five (5) feet.

Q. Vent through roof pipe: Support vertical pipe through roof with riser clamp and vertical support members attached to structure. Support of pipe through roof shall not bear the weight on the no-hub coupling.

R. Horizontal supports within chases and partitions that are attached to studs shall be attached at both ends. Supports shall not exceed four feet in length.

S. Design hangers to impede disengagement by movement of supported pipe.

T. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

U. Wire or perforated strap iron will not be acceptable as hanger material. Perforated strap iron may only be used to secure and support vertical sanitary sewer and sanitary vent pipe located inside walls to achieve vertical pipe support requirements.

V. Hanger rods shall be threaded on both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

W. Each hanger shall be properly sized to fit the supported pipe or fit the outside of the insulation on lines, hangers shall not penetrate insulation. Hangers shall bear on the outside of the insulation, which shall be protected by support shields as specified. For piping larger than 2”, protect

insulation from crushing by means of a section of rigid insulation to be installed at hanger points. Refer to Section 22 07 00.

X. Hangers and clamps supporting and contacting individual non-insulated brass or copper lines shall be copper or copper plated. Support individual non-insulated brass or copper lines 4 inches and smaller with adjustable swivel ring hangers. Where non-insulated brass or copper lines are supported on trapeze hangers or channels, the pipes shall be isolated from these supports with approved flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp. Plastic tape is not acceptable.

Y. Hangers and clamps supporting and contacting plastic piping shall be in accordance with the piping manufacturer's published recommendations and shall be factory coated or padded to prevent damage to piping.

Z. Hangers, rods and hanger assemblies located in exposed areas, outside or in crawlspaces shall be stainless steel or galvanized.

AA. Supports for pipe (i.e. sanitary vent, water supply) within a plumbing chase shall be supported by vertical formed steel channel with floor support. Do not support pipe from other piping systems (i.e. water lines supported from the vent pipe). Universal pipe bracket supporting water lines from vent pipe is not allowed.

BB. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on manufactured channel, suspended on rods or pipes. Trapeze members including suspension rods shall be properly sized for the quantity, diameters, and loaded weight of the lines they are to support.

CC. Vertical Piping:

1. Supports for vertical riser piping in concealed areas shall utilize double bolt riser clamps, with each end having equal bearing on the building structure at each floor level.
2. Supports for vertical riser piping at floor levels in exposed areas (such as fire protection standpipe in stairwells) shall be attached to the underside of the penetrated structure utilizing drilled anchors, two hanger rods (sized as specified), and socket clamp with washers.
3. Two-hole rigid pipe clamps or four-hole socket clamps with washers may be used to support pipe directly from adequate structural members where floor-to-floor distance exceeds required vertical support spacing and lines are not subject to expansion and contraction.
4. Support vertical pipe in walls at 5ft intervals. Utilize Holdrite support systems, BASSET or Owner-approved equivalent.

DD. Fixture and Equipment Service Piping:

1. Piping at local connections to plumbing fixtures and equipment shall be supported to prevent the weight of the piping from being transmitted to fixtures and equipment.
2. Makeshift, field-devised methods of plumbing pipe support, such as with the use of scrap framing materials, are not allowed. Support and positioning of piping shall be by means of engineered methods that comply with IAPMO PS 42-96. These shall be Holdrite support systems, BASSET or Owner-approved equivalent.
3. Supports within chases and partitions shall be corrosion resistant metal plate, clamps, angles or channels, and aligned with structure in the vertical or horizontal position. Plastic supports are not allowed unless approved by Owner.

4. Horizontal supports within chases and partitions that are attached to studs shall be attached at both ends. Drywall shall not be relied upon to support the piping.
5. Supports for plumbing fixture water service piping within chases and partitions may be attached to cast iron drain and vent pipe with approved brackets and pipe clamps.
6. Piping exposed on the face of drywall shall be supported with corrosion resistant metal channels that are attached to wall studs. Drywall shall not be relied upon to support the piping.
7. Piping supported from the floor shall utilize corrosion resistant metal channels or brackets that are anchored to the floor slab.

3.5 INSTALLATION – MOTOR DRIVEN EQUIPMENT

A. Provide adjustable spring type hangers/isolators on all pipe hangers on the first 15 feet of pipe entering the building and where piping offsets vertically from one floor level to another.

B. Provide adjustable spring type vibration isolation hangers for piping connected to isolated equipment (i.e. pumps, etc.). Refer also to Section 22 05 48.

3.6 INSTALLATION – ATTACHMENT TO STRUCTURE

A. Hangers shall be attached to the structure as follows.

1. Poured-In-Place Concrete: Where pipes and equipment are supported under poured in place concrete construction, each hanger rod shall be fitted with a nut at its upper end, which nut shall be set into an Underwriters Laboratories, Inc. listed universal concrete insert placed in the form work before concrete is poured. Where inserts are placed in the bottom faces of concrete joists which are too narrow to provide adequate strength of concrete to hold the insert properly or where a larger insert would require displacement of the bottom joist steel, the hanger rod shall be suspended from the center of a horizontal angle iron, channel iron, I-beam, etc. spanning across two adjacent joists. The horizontal support shall be bolted to nonadjustable concrete inserts of the "spot" type, of physical size small enough to avoid the bottom joist steel.

2. Pre-Cast Tee Structural Concrete: Hanger supports, anchors, etc. required for mechanical systems attached to the precast, double tee, structural concrete system are to be installed in accord with approved shop Drawings only. Holes required for hanger rods shall be core drilled in the "flange" of the double tee only; impact type tools are not allowed under any circumstances. Core drilling in the "stem" portions of the double tee is not allowed. Holes core drilled through the "flange" for hanger rods shall be no greater than 1/4" larger than the diameter of the hanger rod. Hanger rods shall be supported by means of bearing plates of size and shape acceptable to the Architect/Engineer, with welded double nuts on the hanger rod above the bearing plate. Cinch anchors, lead shields, expansion bolts, and studs driven by explosion charges are not allowed under any circumstances in the lower 15" of each stem and in the "shadow" of the stem on the top side of the "double tees”.

3. Steel Bar Joists: Where pipes and loads are supported under bar joists, hanger rods may be run through the space between the bottom angles and secured with a washer and two nuts. Where larger lines are supported beneath bar joists, hanger rods shall be secured to angle irons of adequate size; each angle shall span across two or more joists as required to distribute the weight properly and shall be welded to the joists or otherwise permanently fixed thereto.

4. Steel Beams: Where pipes and loads are supported under steel beams, approved type beam clamps shall be used.

5. Wood Framing: Where pipes and loads are supported from wood framing, hanger rods shall be attached to framing with side beam brackets or angle clips.

B. Concrete Inserts.

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.7 INSTALLATION – FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal all drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

F. Coordinate all roof flashing with requirements of Division 07.

3.8 INSTALLATION – SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel or stainless-steel escutcheons at finished surfaces.

G. Where installed in fire rated wall, floors, etc., install in accordance with UL/FM or Warnock Hersey fire rated assembly instructions.

H. Install sleeves for all piping passing through penetrations in floors, partitions, roofs, and walls. All penetrations shall pass through sleeves.

I. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls. Sleeves are not required for core-drilled holes.

J. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

K. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants

3.9 INSTALLATION – EQUIPMENT BASES AND SUPPORTS

A. Provide concrete housekeeping pads, per requirements in Part 2 of this section.

B. Install anchor bolts, and accessories for mounting and anchoring equipment. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of sufficient size to provide ½ inch clearance around bolt.

C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.10 INSTALLATION – EXTERIOR PIPE SUPPORTS

A. Install exterior pipe supports per manufacturer’s recommendations.

B. Locate bases and support framing as specified herein. Provide complete and adequate support of all piping and ducts, whether or not all required devices are shown.

C. The use of wood for supporting piping is not permitted.

D. Install supports at spacing indicated in schedule at end of this section.

E. Accurately locate and align bases.

1. Consult manufacturer of existing or new roofing system as to the type of isolation pads required between the roof and base.
2. Set isolation pads in adhesive if required by manufacturer's instructions.
3. Place bases on isolation pads.
4. Adhere or mechanically attach if required by code.
5. Where applicable, replace gravel around bases.

F. Use galvanized fasteners for galvanized framing and stainless-steel fasteners for stainless steel framing.

3.11 INSTALLATION – ROOF PIPE CHASE HOUSINGS

A. Install in accordance with manufacturer’s recommendations.

1. Coordinate size of the exit seals with HVAC, plumbing, electrical and telecommunications contractor.
2. All penetrations shall use the appropriate exit seal furnished by the manufacturer. All penetrations shall only pass through the housing portion of the assembly. Support each penetration within 12 inches of exiting the unit.

3.12 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

3.13 CLEANING

A. Division 01 – Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.14 PROTECTION OF FINISHED WORK

A. Division 01 – Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.15 SCHEDULE

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	MIN. HANGER ROD DIAMETER (Inches)
Cast Iron, up to 2 inches	5	3/8
Cast Iron, 3 inches	5	1/2
Cast Iron, 4 inches	5	5/8
Cast Iron, 6 thru 8 inches	5	3/4
Cast Iron, 10 thru 12 inches	5	7/8
Copper Tube, 1-1/4 inches and smaller	6	3/8
Copper Tube, 1-1/2 thru 2-1/2 inches	8	1/2
Copper Tube, 3 inches and larger	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
PEX, 1 inch and smaller	32”	3/8
PEX, 1-1/4 inches and larger	4	3/8
Polypropylene, 1 inch and smaller	32”	3/8
Polypropylene, 1-1/4 inches and larger	4	3/8
PVC (All Sizes)	4	3/8
PVDF (All Sizes)	4	3/8
Steel Pipe, 1-1/2 inches and smaller	8	3/8
Steel Pipe, 2 thru 3 inches	10	1/2
Steel Pipe, 4 inches and larger	12	5/8

Support all vertical piping at each floor level and at maximum 5 feet spacing.
Support all cast iron piping at each floor level and at each hub or at each coupling on hubless pipe.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment markers.
2. Valve tags.
3. Valve schedules.
4. Pipe markers.
5. Ceiling tacks.
6. Signs.
7. Detectable Underground Warning Tape.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 – Scheme for the Identification of Piping Systems.

B. American National Standards Institute:

1. ANSI Z535.1 – Safety Color Standard.
2. ANSI Z535.2 – Environmental and Facility Safety Signs.

C. National Fire Protection Association:

1. NFPA 99 – Health Care Facilities Code.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer’s catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification. Submit a valve chart and schedule, including valve tag number, location, function and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 and ANSI Z535.1 for color scheme for identification of piping systems and accessories.

B. Conform to ASME A13.1 for length of field and letter height for pipe markers.

C. Conform to ANSI Z535.1 and ANSI Z535.2 for emergency operating information and warning signs.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing Work of this section with minimum three years of experience.

PART 2 - PRODUCTS

2.1 PIPE MARKERS

A. General: Conform to ASME A13.1 for background and letter colors, length of color field and letter height.

B. Self-Adhesive Pipe Markers: Flexible, indoor/outdoor grade vinyl with factory-applied pressure-sensitive adhesive. Provide with minimum 1-1/2 inch wide banding tape.

C. Mechanically Applied Pipe Markers:

1. For pipes with an overall diameter up to 6 inches, including insulation, provide semi-rigid plastic wrap around pipe marker that extends 360 degrees around the pipe at each marker location. The semi-rigid marker should include the legend and a directional flow arrow. Pipe size shall also be on label of all insulated pipes. The marker shall be supplied as a pre-tensioned device and be equipped with a 1/2 inch strip of adhesive on the inside to further secure the marker in a permanent position on vertical locations.

2. For pipes with an overall diameter greater than 6 inches, including insulation, provide a semi-rigid plastic strap-on pipe marker with a height no less than 3 times the letter height. The marker shall include a legend and a directional flow arrow. Pipe size shall also be on label of all insulated pipes. Markers to be installed indoors shall be supplied with no less than two nylon straps to secure the marker in place. Markers to be installed outdoors shall be supplied with stainless steel or aluminum strapping.

2.2 DIRECTIONAL ARROWS

A. Flow Direction: Provide flow directional arrows either as part of pipe markers, banding tape or separately, attached to pipes.

1. Conform to requirements for markers.
2. Size to conform to ANSI A13.1 (1 inch wide minimum).

2.3 DETECTABLE UNDERGROUND WARNING TAPE

A. Description: Polyethylene tape resistant to acids, alkalis and other destructive soil components with metallic core for detection and location of piping with metal detector. Tape shall be a minimum of 6 inches wide with a minimum thickness of 5 mils. Utilize manufacturer's standard legends to identify water lines, pipe lines, gas lines, fuel lines, steam lines and sewer lines. Provide a continuous printed message with bold black lettering similar to "Caution Buried Water Line Below." Tape color and lettering shall be unaffected by moisture and other substances contained in the backfill material. The tape color shall conform to the American Public Works Association Uniform Color Code.

2.4 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. Green: Plumbing valves.

2.5 PLASTIC EQUIPMENT MARKERS

A. General: Provide laminated plastic equipment markers for all scheduled items of plumbing equipment installed indoors.

B. Size: Size laminated plastic markers not less than one inch in height and three inches in length with engraved lettering white on black not less than 1/4 inch in height. For larger pieces of equipment, size markers 1-1/2 inch in height by 4-1/2 inches long, of 3/32 inch laminated plastic melamine with white on black lettering engraved not less than 1/16 inch deep and 1/2 inch high.

C. Attachment: Attach nameplates with rivets, stainless steel screws or bolts. On equipment such as tanks and pumps which cannot be drilled or pierced, attach nameplates with brass chains and "S" hooks.

D. For plumbing equipment installed above ceiling, provide 3/4 inch by 2-1/2 inches laminate tags attached with rivets to the ceiling grid below.

2.6 ALUMINUM EQUIPMENT MARKERS

A. General: Provide aluminum equipment markers for all scheduled items of mechanical equipment installed outdoors. Aluminum markers shall have either engraved or laser etched lettering.

B. Size: Size aluminum markers not less than 1 inch in height and 3 inches in length with lettering white on black background not less than 5/8 inch in height. For larger pieces of equipment, size markers not less than 2 inches in height by 6 inches long, with lettering not less than 1 inch in height.

C. Attachment: Attach nameplates with rivets, stainless steel screws or bolts. On equipment such as tanks and pumps which cannot be drilled or pierced, attach nameplates with stainless steel chains and "S" hooks.

2.7 VALVE TAGS

A. Materials: Provide indoor valve tags of solid brass with stamped or engraved lettering or numbers. Provide outdoor valve tags of aluminum with stamped or engraved lettering or numbers.

1. Fill lettering and numbers with black paint.
2. Lettering shall be not less than 1/4 inch in height.

3. Numbers shall be not less than 1/2 inch in height.

B. Attachment: For valve tags in mechanical rooms, provide with brass jack chain and “S” hook attachment. For all other indoor valve tags, provide with brass beaded chain attachment. For all outdoor valve tags, provide with stainless steel jack chain and “S” hook attachment.

2.8 ENGRAVED PLASTIC LAMINATE SIGNS

A. General: Where indicated in other sections of the specifications, provide engraved instruction signs, warning signs, operational instructions or other signs designated.

B. Emergency Operating Signs: For emergency operating instructions, provide engraved, laminate, melamine plastic, white on red, not less than 1/8 inch thick.

1. Provide concise written instructions on the emergency operation of the device.
2. Letters shall be not less than 5/16 inch in height, engraved 1/16 inch deep in block capital letters.

C. Information and Warning Signs: Provide general information and warning signs of laminated, melamine plastic, not less than 1/8 inch thick, with white engraved lettering on black, with letters not less than 1/4 inch in height, block capitals.

D. Attachment: Attach signs directly to the equipment with rivets, bolts or screws, if possible. Otherwise, attach signs with angle brackets, U-bolts, or metal plates held in place to piping with stainless steel draw-bands.

1. Attachment with adhesives will not be permitted.
2. Locate signs not less than 4 feet nor more than 6 feet above the operating floor, directly visible from an operating aisle.
3. Locate signs to preclude damage during maintenance and repair or by operating traffic.

2.9 VALVE SCHEDULES AND FRAMES

A. General: Provide valve schedules for all valves provided by Division 22.

B. Schedules: Provide typed or machine printed schedules, one item per line, double spaced.

1. Printing shall be black on 8-1/2-inch by 11-inch white paper. Paper shall be waterproof or laminated after printing.
2. For each valve, list the valve number, location, size and use or operating function.
3. Support schedules in full extruded aluminum frames with removable, non-yellowing, clear plastic faces.
4. Screw or bolt schedules to equipment room walls where directed.
5. Coordinate valve numbers with valve tags so that no two valves or scheduled devices have the same number.

PART 3 - EXECUTION

3.1 GENERAL

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Install identifying devices after completion of coverings and painting.

C. Install labels with sufficient adhesive for permanent adhesion. For unfinished canvas covering, apply paint primer before applying labels.

D. Every Backflow preventer Shall have a Phenolic Sign mounted above it that indicates the equipment served. If located in a separate room the sign shall identify what room the equipment is located

3.2 CONCEALED VALVES AND EQUIPMENT

A. Equipment Above Ceilings: Provide valve tagging and identification to equipment located above ceilings, such as valves, trap primers and other items before the ceilings are installed.

B. Finished Surfaces: Where identification is to be provided on surfaces which require insulation, painting and finishing, install identification after covering and painting is complete.

C. Provide plastic nameplates adhered to the ceiling grid to locate valves, equipment, or sensors above T-bar type panel ceilings. Locate in corner of panel closest to equipment. Label with tag of equipment.

3.3 PIPING SYSTEM IDENTIFICATION

A. Install pipe markers on all piping systems and include arrows to show the normal direction of flow. Where flow can be in both directions, arrows in both directions shall be displayed.

B. Identify piping exposed to view and concealed by accessible ceilings, including hard ceilings provided with access panels. Identify piping outdoors, in crawlspaces, on roof, above grade and within parking structures. Only piping located within walls or inaccessible areas need not be identified.

C. Identify the temperature of domestic hot water piping systems, i.e. “140°F HOT WATER.”

D. Locate pipe markers as follows:

1. Every 15 feet on straight runs.
2. At each valve and control device.
3. At each branch or take-off. Provide flow arrows on the branch pipe as well as on the main on both sides of the branch.
4. At any change in piping direction.
5. Above and below every floor or roof penetration.
6. On either side of every wall or partition. Ensure there is a minimum of one marker per pipe in every room.
7. On either side of large obstructions, ductwork or equipment that piping passes above.
8. At 5-foot intervals where piping is obscured by close proximity to walls or other pipes.
9. Provide only one label per unit drain connection for condensate drain piping on roof.

E. Install pipe markers so they are visible and legible from a normal standing position.

F. Secure each end of self-adhesive pipe markers with a full wrap of banding tape of the same background color. Banding tape shall overlap itself a minimum of 3 inches.

G. Provide mechanically applied pipe markers for all piping in mechanical rooms and outdoors.

H. Install detectable underground warning tape 12 inches below finished grade, directly above buried pipe. If piping is buried more than 36 inches below finished grade, then provide an additional continuous length of tape buried 12 inches above the piping.

3.4 VALVE IDENTIFICATION

A. General: Provide a valve tag on every valve, cock and control device in each piping system. Exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs and shut-off valves at plumbing fixtures. List each tagged valve in valve schedule for each piping system. In existing buildings, coordinate valve tags and schedules such that no valve numbers are duplicated.

1. Tagging Schedule: Comply with requirements of "Valve Tags" and "Valve Schedules and Frames" paragraph.

B. Install valve schedule frames and schedules in machine rooms where indicated or where directed.

3.5 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install equipment markers on or near each major item of plumbing equipment. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves.
2. Meters and gauges.
3. Fuel-burning units including boilers and water heaters.
4. Pumps, compressors and motor-driven units.
5. Heat exchangers.
6. Primary balancing valves.
7. Packaged booster pump units.
8. Tanks and pressure vessels.
9. Filters and water treatment systems.

B. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

3.6 COLOR AND IDENTIFICATION SCHEDULE

A. Provide all pipe labels and lettering of colors listed below.

FLUID SERVICE TYPE	PIPE MARKER LEGEND	PIPE MARKER BACKGROUND / LETTERING COLOR	VALVE TAG LETTERING
Domestic Cold Water	COLD WATER	Green / White	CW
Domestic Hot Water - 110°F	110°F HOT WATER	Green / White	HW
Domestic Hot Water Recirculation - 110°F	110°F HOT WATER RETURN	Green / White	HWC
Domestic Hot Water - 115°F	115°F HOT WATER	Green / White	HW
Domestic Hot Water Recirculation - 115°F	115°F HOT WATER RETURN	Green / White	HWC
Domestic Hot Water - 140°F	140°F HOT WATER	Green / White	HW
Domestic Hot Water Recirculation - 140°F	140°F HOT WATER RETURN	Green / White	HWC
Sanitary Waste	SANITARY WASTE	Green / White	
Sanitary Vent	SANITARY VENT	Green / White	
Storm or Roof Drain	STORM DRAIN	Green / White	
Grease Waste	GREASE WASTE	Green / White	
Acid Waste	ACID WASTE	Orange / Black	
Acid Vent	ACID VENT	Orange / Black	
Softened Water	SOFT WATER	Green / White	SW
Deionized Water	DEIONIZED WATER	Green / White	DI
Natural Gas	NATURAL GAS	Yellow / Black	GAS
Propane Gas	PROPANE GAS	Yellow / Black	GAS
Compressed Air	COMPRESSED AIR	Blue / White	CA
Non-Potable Water	CAUTION: NON-POTABLE WATER, DO NOT DRINK	Purple / Yellow	NP
Reclaimed / Re-use Water	CAUTION: NON-POTABLE RECLAIMED WATER, DO NOT DRINK	Purple / Black	RC

END OF SECTION

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhesives, mastics and sealants.
2. Piping – Glass Fiber.
3. Piping – Jackets.
4. Cellular Foam.
5. Equipment Jackets.
6. Insulation Shields and Inserts.
7. Plenum wrap.

B. Related Sections:

1. Division 07 – Firestopping: Product requirements for firestopping for placement by this section.
2. Division 09 – Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.
3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
4. Section 22 05 53 – Identification for Plumbing Piping and Equipment.

1.2 REFERENCES

A. ASTM International:

1. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
4. ASTM C195 – Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C335 - Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.
6. ASTM C449 – Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
7. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
8. ASTM C533 – Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
9. ASTM C534 – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
10. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.
11. ASTM C552 – Standard Specification for Cellular Glass Thermal Insulation.
12. ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
13. ASTM C591 – Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C592 – Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

15. ASTM C610 – Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
16. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
17. ASTM C795 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
18. ASTM C921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
19. ASTM C1104 – Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
20. ASTM C1126 – Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
21. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
22. ASTM C1393 – Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks.
23. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
24. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
25. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
26. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. International Code Council:

1. International Energy Conservation Code.
2. International Plumbing Code.

C. Green Seal Standard GS-11

1. GS-11 – Paints and Coatings (flat insulation coatings); Edition 3.2, October 2015.
   a. Vapor Barrier Coatings: Maximum VOC content 50 g/L.
   b. Weather Barrier Mastics: Maximum VOC content 50 g/L.
   c. Lagging Adhesive/Coating: Maximum VOC content 50 g/L.

D. South Coast Air Quality Management District:

1. SCAQMD Rule 1168 – Adhesive and Sealant Applications, including all amendments through October 2017
   a. PVC welding: Maximum VOC content 510 g/L.
   b. Adhesive primer for plastic: Maximum VOC content 550 g/L.
   c. Contact adhesive: Maximum VOC content 80 g/L.
   d. Fiberglass adhesive: Maximum VOC content 80 g/L.
   e. Insulation joint sealant: Maximum VOC content 420 g/L.
   f. Other: Maximum VOC content 420 g/L.

E. Underwriters Laboratories:
1. UL 723 – Test for Surface Burning Characteristics of Building Materials
2. UL 2818 – GREENGUARD Standard for Building Materials, Finishes and Furnishings.
3. UL 2821 – GREENGUARD Test Method for Building Materials, Finishes and Furnishings.

1.3 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers published literature for each type of insulation. Data shall include product description, thermal characteristics, moisture absorption rating, flame spread and smoke developed ratings for each product.

C. Submittal shall include a schedule indicating the following for each type of insulation:

1. Pipe system
2. Location (interior, exterior, mechanical room, etc.)
3. Insulation and jacketing material
4. Fitting insulation and jacketing material
5. Pipe size range
6. Insulation thickness

D. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALITY ASSURANCE

A. Products shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds or polybrominated diphenyl ether fire retardants.

B. Glass Fiber (Fiberglass) insulations shall have a minimum of 50% recycled glass content certified and UL environment validated.

C. Glass Fiber (Fiberglass) insulations shall have a 100% bio-based, formaldehyde-free binder and shall be UL GREENGUARD Gold certified, AAFA Asthma & Allergy Friendly®, and AAFA Verified Healthier Air, where available.

D. All plumbing piping and equipment insulation used within the interior portions of the building on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature during and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 ADHESIVES, MASTICS AND SEALANTS

A. All adhesives, mastics and sealants utilized for pipe insulation shall have a maximum VOC content as specified in Part 1 of this Section.

2.2 PIPING – GLASS FIBER

A. Glass Fiber (Fiberglass), Preformed Pipe Insulation: Fiberglass bonded with a bio-based thermosetting resin. Preformed and factory pre-slit pipe covering insulation complying with ASTM C 547, Type I (850 degrees F) or Type IV (1000 degrees F); ASTM C 585, ASTM C 411, ASTM C 795, and UL/ULC Classified. Provide insulation with factory-applied white ASJ SSL or white ASJ+ SSL+ vapor retarder jacket complying with ASTM C 1136.

B. Acceptable manufacturers:

1. Knauf Insulation “Earthwool” 1000 Pipe Insulation with ECOSE.
2. Manson Insulation “Alley-K” Pipe Insulation with ECOSE.
3. Johns Manville “Micro-Lok.”
4. Owens Corning “SSLII with ASJ Max Fiberglas” Pipe Insulation.

C. Insulation shall meet the following properties:

1. Thermal Conductivity 'K' value: ASTM C335, 0.23 or less at 75°F.
2. Service Temperature: 0°F. to 850°F.
3. Maximum Water Vapor Sorption: less than 5% by weight, per ASTM C1104.
4. Density: 4.0 lbs./cu.ft., minimum.
5. Maximum Flame Spread: 25 per ASTM E84.
6. Maximum Smoke Developed: 50 per ASTM E84.
7. UL Environment GREENGUARD Gold certified and validated formaldehyde-free.

D. Vapor Barrier Jacket

1. Provide insulation with an ASJ or ASJ+ white vapor retarder jacket constructed of kraft paper reinforced with glass fiber yarn and bonded to aluminized film and with an SSL or SSL+ closure system, meeting ASTM C1136.
2. Water Vapor Permeance: ASTM E96; 0.02 perm or less.
3. Secure with self-sealing longitudinal laps and butt strips.
4. Secure with vapor barrier mastic.

E. Vapor Barrier Lap Adhesive

1. Compatible with insulation.

F. Insulating Cement/Mastic

1. ASTM C195; hydraulic setting on mineral wool.

G. Reinforcing Mesh:

1. Foster Mast-a-Fab 42-24; 9 x 8 synthetic fiber mesh.
2. Childers Chil Glas #10; 10 x 10 glass mesh.

H. Indoor Vapor Barrier Coating:

1. Compatible with below ambient piping insulation with a white color finish. Permeability shall be a maximum of 0.08 perms or less at 37 mils dry tested at 100 degrees F (38 degrees C) and 90 percent RH per ASTM F1249. Coating shall meet ASTM D5590 with 0 growth rating.
2. Foster 30-80 AF.

2.3 PIPING AND EQUIPMENT - CELLULAR FOAM

A. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. 'K' Value: ASTM C177 or C518; 0.28 at 75°F.
2. Service Temperature: -40°F. to 220°F.
3. Water Absorption: ASTM D1056; 1.0% by volume.
4. Water Vapor Permeability: ASTM E96; 0.10 perm-inches.
5. Maximum Flame Spread: ASTM E84; 25.
6. Maximum Smoke Developed: ASTM E84; 50.
7. Connection: Waterproof vapor barrier adhesive.
8. GEI Greenguard indoor air quality certified for low chemical and particle emission.

B. Elastomeric Foam Adhesive

1. Air dried, contact adhesive, compatible with insulation.
   a. Foster 85-75.
   b. Childers CP-82.
   c. Armacell 520.

2.4 PIPING – JACKETS

A. PVC Plastic

1. Jacket: ASTM C921, Comply with ASTM C1917 Standard Specification for Rigid Polyvinyl Chloride (PVC) Jacketing for Insulation. ASTM C921, one-piece molded type fitting covers and sheet material, off white color.
   a. Service Temperature: -40°F. to 150°F.
   b. Water Vapor Permeance: ASTM E96; 0.05 perm or less.
   c. Thickness: 20 mil.
   d. Maximum Flame Spread: 25 per ASTM E84.
   e. Maximum Smoke Developed: 50 per ASTM E84.
   f. Connections: Brush on welding adhesive.

2. Covering Adhesive Mastic
   a. Compatible with insulation.

B. Aluminum Jacket: Comply with ASTM C1729 Standard Specification for Aluminum Jacketing for Insulation.

1. Thickness: 0.016 inch.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 mm thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 EQUIPMENT JACKETS

A. Canvas Equipment Jacket:

1. UL listed.
2. Fabric: 6 oz/sq yd, plain weave cotton.
3. Fire retardant lagging adhesive. Composite of insulation, jacket and lagging adhesive having flame spread index not greater than 25 and smoke developed index not greater than 50 when tested to ASTM E84.

2.6 INSULATION SHIELDS AND INSERTS

A. Insulation Shields:

1. Application: All insulated piping, except for below grade direct buried piping.
2. Shields shall be made of galvanized steel or made of black iron painted on both sides with a minimum of two coats of aluminum paint. Minimum metal shield sizes shall be as listed within the following table. Provide thicker/longer shields where recommended by insulation manufacturer's published product installation data:

Nominal IPS (inches)	Minimum Metal Thickness (gage)	Minimum Length (inches)
1/2 to 1-1/4	18	12
1-1/2 to 2	16	12
2-1/2 to 8	14	18
10	12	24

3. Provide MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier.
4. Depending on the type of pipe support design, stainless steel bands or aluminum bands may be required to keep shield material next to the jacketing material.
    a. Insulation Bands: 3/4 inch wide; 0.007 inch thick galvanized steel when exposed to interior environment, 0.010 inch thick stainless steel or 0.015 inch thick aluminum when exposed to humid interior environment or outside environment.
    b. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel to match jacket.

B. Insulation Inserts:

1. Application: All insulated piping larger than 2-inch diameter, except for below grade direct buried piping.
2. Inserts for shields shall be manufactured of corrosion resistant insulating material; cellular glass, phenolic or polyisocyanurate, of minimum 5.0 lb./cu. ft. density, suitable for the planned temperature range.
3. Inserts shall be the same thickness and contour as the adjacent insulation and shall be at least as long as the metal shield.

4. Factory fabricated inserts with integral galvanized pipe shields will be acceptable.

2.7 PLENUM WRAP

A. High-temperature fiber blanket thermal insulation encapsulated in fiberglass-reinforced aluminized foil. Plenum wrap shall have a nominal density of 6 psf and have a nominal ½ inch thickness. The fiber blanket shall have a continuous use limit in excess of 1800°F.

B. Plenum wrap shall be equivalent to 3M™ Fire Barrier Plenum Wrap 5A+.

C. The Flame Spread Index and Smoke Developed Index of the foil encapsulated blanket shall be less than 25 and 50, as per ASTM E 84/UL 723 Flammability Test.

D. Accessory Materials:
1. Min. 3/4 in. wide Filament Tape, equivalent to Scotch® 898.
2. FSK facing tape, equivalent to 3M™ FSK Facing Tape 3320, used to seal cut edges of blankets.
3. Banding material: Minimum 1/2-inch-wide, no less than 0.015 inches thick, carbon steel or stainless steel.
4. Banding cutter, banding tensioner and crimping tool.
5. Insulation Pins: Minimum 12-gauge galvanized steel, length sufficient to penetrate through plenum wrap insulation; capped with minimum 1-1/2-inch galvanized steel insulation clips.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify piping and equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 COMMON INSULATION REQUIREMENTS

A. Insulation shall not be installed until all testing and inspection of pipe, vessel, etc. has been completed and approved by Engineer/Owner’s representative.

B. Replace insulation damaged by either moisture or other means. Insulation which has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also replace any materials damaged by the condensation.

C. 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.

D. 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.

E. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

F. Install insulation with longitudinal seams at top and bottom of horizontal runs.

G. Install multiple layers of insulation with longitudinal and end seams staggered.

H. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

I. Keep insulation materials dry during application and finishing.

J. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

K. Install insulation with the least number of joints practical.

L. Install insulation continuously through hangers and sleeves and around anchor attachments.

M. Where penetrating fire and/or smoke rated walls, partitions, barriers, or floors, provide UL-approved pipe and duct penetration assemblies that maintain the rating of the penetrated wall, partition, barrier, or floor.

N. Insulation on all pipes conveying liquids below the ambient temperature is required to have a continuous vapor barrier. On all insulation with a vapor barrier, seal the joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with a vapor-barrier coating/mastic as specified in the individual insulation sections.

1. 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 coating/mastic.
2. 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.
3. 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.

O. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

P. Insulation in the walls shall carry continuously through the framing members. Provide protection for insulation and penetrations.

Q. Exterior insulation or located in a crawlspace shall have an aluminum jacket to protect the insulation.

R. All joints shall be complete and shall not have loose ends or made of scrape insulation.

3.3 PAINTING OF INSULATION

A. Where indicated on the construction documents, paint piping insulation in exposed areas, not including mechanical and equipment rooms. Do not paint insulation located in return air plenums.

B. Prior to painting, wipe insulation jacket clean with a mild cleaning solution that will not leave a residue and allow to dry completely. Paint jacket with water based (latex) paint in accordance with manufacturer’s recommendations and as required in the specification Division 09- Painting and Coating.

3.4 INSTALLATION – PIPE INSULATION

A. Install materials in accordance with manufacturer's installation instructions and practices detailed by the North American Commercial and Industrial Insulation Standards manual (latest edition).

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

D. Insulated pipes conveying fluids below ambient temperature:

1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips sealed with vapor retarder mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

E. Insulated pipes conveying fluids above ambient temperature:

1. Furnish factory-applied or field-applied standard jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips sealed with vapor retarder mastic.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Provide neck extensions or extended stems for valves installed in insulated lines. Refer to Section 22 11 00.

G. Insulation Shields and Inserts:

1. Application: Provide shields for all insulated piping, except for below grade direct buried piping. Provide insulation inserts for all piping or equipment larger than 2-inch diameter.
2. Shields: Install between pipe hangers, pipe supports or pipe hanger rolls and inserts.
3. Insert location: Install between support shield and piping and under finish jacket.

H. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers or aluminum jacket.

J. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket.

K. PVC or Aluminum Jacket: Install with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.

1. Refer to Section 22 11 00 for heat tracing.

3.5 INSTALLATION – EQUIPMENT INSULATION

A. Install materials in accordance with manufacturer's installation instructions and practices detailed by the North American Commercial and Industrial Insulation Standards manual (latest edition).

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

F. For all insulated equipment, insulate flanges and unions with removable sections and jackets.

G. Finish insulation at supports, protrusions, and interruptions.

H. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.6 INSTALLATION – PLENUM WRAP

A. For all plastic piping that carries a flame spread rating over 25 or a smoke developed rating over 50 (when tested in accordance with ASTM E84) and installed within a return air planum or where otherwise noted on the plans, install a plenum wrap insulation so that entire assembly including the carrier pipe meets the 25/50 flame spread / smoke developed rating.

B. The plenum wrap system shall be installed by a qualified contractor in accordance with the manufacturer's instructions.

C. Cut the plenum wrap to a length sufficient to wrap completely around the perimeter of the pipe with an overlap of at least 1".

D. Aluminum foil tape shall be utilized to seal cut edges of the blanket.

E. Secure the blanket in place temporarily with glass filament tape, until banding or tie wire is in place.

F. Install the next adjacent section of wrap with a minimum longitudinal overlap of 1".

G. Provide steel banding or tie wire around entire perimeter of insulated pipe at maximum 11" centers and ½" from each blanket edge. Tighten the banding or tie wire to hold wrap firmly in place without cutting or damaging the wrap.

3.7 INSTALLATION – TESTING

A. Include up to three (3ea) small area (6 linear inches) of insulation to be removed by the engineer for observation of installation. This shall be included in the base bid for repair of these small areas.

3.8 PIPING – GLASS FIBER INSULATION SCHEDULE

A. Domestic Water:

PIPING SYSTEMS	PIPE SIZE (Inches)	THICKNESS (Inches)
Hot Water (105° to 140°F)	1-1/4" & smaller	1”
	1-1/2" & larger	1-1/2”
Hot Water (141° to 180°F)	1-1/4" & smaller	1-1/2”
	1-1/2" & larger	2”
Hot Water Return/Circulating	1-1/4" & smaller	1”
	1-1/2" & larger	1-1/2”
Cold Water	1-1/4" & smaller	1/2”
	1-1/2" & larger	1”
All Heat-Traced Piping	1-1/4" & smaller	1”
	1-1/2" & larger	1-1/2”

B. Storm Drain:

Horizontal piping from roof drains and overflow drains (including underside of drain bodies)	ALL	1”

C. For insulation outside the specified conductivity range, the minimum thickness shall be adjusted by the correction factor noted in the applicable energy conservation code.

D. Field Applied Jackets:

1. Pipe located outdoors or in crawl spaces: Finish with aluminum jacket and fitting covers.
2. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC or aluminum jacket and fitting covers.

3.9 PIPING – CELLULAR FOAM INSULATION SCHEDULE

A. Sanitary Drain:

Above floor piping receiving condensate from AC equipment. (Insulate drain body, trap, trap arm, tailpiece, and 20 ft of pipe vertical and horizontal and/or when it ties into the main.)	ALL	1”

B. Condensate Drains All 1/2”

C. Exterior pipe All 1”

D. Field Applied Jackets:

1. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

2. Pipe located outdoors: Finish with aluminum jacket and fitting covers.
3. Pipe located outdoors: Finish with two coats of specified polyacrylate copolymer emulsion coating.

END OF SECTION

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic water piping, below grade.
2. Domestic water piping, above grade.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.
6. Pressure gauges and taps.
7. Thermometers.
8. Flow control valves.
9. Relief valves.
10. Strainers.
11. Hose bibs and hydrants.
12. Recessed valve box.
13. Backflow preventers.
14. Water hammer arrestors.
15. Thermostatic mixing valves.
16. Diaphragm-type compression tanks.
17. In-line circulator pumps.
18. Di-electric connections.
19. Trap primers.
20. Thermowells.

1.2 Related Sections:

1. Division 03 – Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
2. Division 07 – Firestopping: Product requirements for firestopping for placement by this section.
3. Division 08 – Access Doors and Frames: Product requirements for access doors for placement by this section.
4. Section 22 00 01 – General Plumbing Requirements.
5. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
6. Section 22 05 53 – Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
7. Section 22 07 00 – Plumbing Insulation: Product and execution requirements for pipe insulation.
8. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.22 – Relief Valves for Hot Water Supply Systems.
2. ANSI/NSF 61 – Drinking Water Components – Health Effects.
3. NSF/ANSI 14 – Plastic Piping System Components and Related Materials

4. NSF/ANSI/CAN 372 – Drinking Water System Components – Lead Content

B. American Society of Mechanical Engineers:

1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 – Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B16.51 – Copper and Copper Alloy Press-Connect Pressure Fittings
5. ASME B31.9 – Building Services Piping.
6. ASME B40.1 – Gauges - Pressure Indicating Dial Type - Elastic Element.
7. ASME Section VIII – Boiler and Pressure Vessel Code - Pressure Vessels.
8. ASME Section IX – Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:

1. ASSE 1010 – Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 – Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 – Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 – Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1017 – Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
6. ASSE 1019 – Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
7. ASSE 1070 – Performance Requests for Water Temperature Limiting Devices.

D. ASTM International:

1. ASTM A182 – Standard Specification for Forged or Rolled Alloy and Stainless-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
2. ASTM A269 – Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Service.
3. ASTM A276– Standard Specification for Stainless Steel Bars and Shapes.
4. ASTM A312– Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes.
5. ASTM B32 – Standard Specification for Solder Metal.
6. ASTM B42 – Standard Specification for Seamless Copper Pipe, Standard Sizes.
7. ASTM B75 – Standard Specification for Seamless Copper Tube
8. ASTM B88 – Standard Specification for Seamless Copper Water Tube.
9. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications.
10. ASTM E1 – Standard Specification for ASTM Thermometers.
11. ASTM E77 – Standard Test Method for Inspection and Verification of Thermometers.
12. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
13. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
14. ASTM D2765 – Standard Test Method for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
15. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
16. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
17. ASTM F3226 – Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems

E. American Welding Society:

1. AWS A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C651 – Disinfecting Water Mains.
2. AWWA C700 – Cold-Water Meters - Displacement Type, Bronze Main Case.
3. AWWA C701 – Cold-Water Meters - Turbine Type, for Customer Service.
4. AWWA C702 – Cold-Water Meters - Compound Type.
5. AWWA C706 – Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
6. AWWA M6 – Water Meters – Selection, Installation, Testing and Maintenance.
7. AWWA M14 – Backflow Prevention and Cross-Connection Control.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
2. MSS SP 67 – Butterfly Valves.
3. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.
4. MSS SP 70 – Cast Iron Gate Valves, Flanged and Threaded Ends.
5. MSS SP 71 – Cast Iron Swing Check Valves, Flanged and Threaded Ends.
6. MSS SP 78 – Cast Iron Plug Valves, Flanged and Threaded Ends.
7. MSS SP 80 – Bronze Gate, Globe, Angle and Check Valves.
8. MSS SP 85 – Cast Iron Globe & Angle Valves, Flanged and Threaded.
9. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
10. MSS SP 110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association:

1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

I. Plumbing and Drainage Institute:

1. PDI WH201 – Water Hammer Arrester Standard.

J. Plastic Pipe Institute

1. PPI TR-3 / 2007 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

K. Underwriters' Laboratories

1. ANSI/UL 263 – Standard Fire Tests of Building Construction and Materials

1.4 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings and accessories. Submit manufacturer's catalog information and pipe joining methods: Solder, primer and glue, brazing, etc.

2. Valves: Submit manufacturer's catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturer's catalog information including load capacity.
4. Domestic Water Specialties: Submit manufacturer's catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Shop Drawings of water system.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 – Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

D. Record actual locations of valves, etc. and prepare valve charts.

E. Test reports and inspection certification for all systems listed herein.

F. Provide a certificate of completion detailing the domestic water system chlorination procedure and all laboratory test results.

G. Submit location of access panels which vary from quantities or locations indicated on Contract Drawings.

H. Provide full written description of manufacturer's warranty.

I. Backflow preventer test report.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years of documented experience.

C. Backflow prevention assembly tester shall be licensed by the State of Texas.

1.7 QUALITY ASSURANCE

A. All work shall be in accordance with Texas Commission on Environmental Quality (TCEQ) Chapter 290 – Public Drinking Water.

B. All piping materials shall be manufactured and tested according to applicable ANSI, ASTM, ASME, AWWA and CISPI standards.

C. Unless otherwise noted, all piping materials shall be domestically manufactured in the USA.

D. Piping Systems Materials:

1. Note: Piping systems shall use consistent materials throughout each system. Materials for each piping system shall not be "mixed". Exception: where required due to above/below grade conditions; allowed due to inside building/outside building conditions; or where indicated by drawings or specifications.
2. Note: Lead containing solders shall not be used at any place in any system.
3. All domestic water piping, equipment, fittings, tanks, gauges, valves and all appurtenances shall be certified to ANSI/NSF 61.

E. Manufacturer’s name and pressure rating shall be permanently marked on valve body.

F. The Contractor shall notify the manufacturer's representative prior to installing any copper press fittings. The Contractor shall obtain the representative’s guidance in any unfamiliar installation procedures. The manufacturer's representative of copper press fittings shall conduct periodic inspections of the installation and shall report in writing to the Contractor and Owner of any observed deviations from manufacturer’s recommended installation practices.

G. Manufacturer Qualifications: Company shall have minimum three years documented experience specializing in manufacturing the products specified in this section.

H. All grooved joint couplings, fittings, flanges, valves, and specialties of the same type shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

I. Installer Qualifications:

1. Company shall have minimum three years documented experience specializing in performing the work of this section.
2. Installation of plumbing systems shall be performed by individuals licensed by the Texas State Board of Plumbing Examiners as a Journeyman or Master Plumber. Installation may be performed by Apprentice Plumbers provided they are registered with the Texas State Board of Plumbing examiners and under direct supervision of a licensed plumber. All installation shall be supervised by a licensed Master Plumber.
3. All installers of copper press fittings shall be trained by the fitting manufacturer's appointed representative. Written notification of training shall be submitted to Owner prior to any installation.
    a. Installers shall attend a manufacturer’s installation training class as having been trained and qualified to join piping with press-connect fittings. On-site training and credentialing by manufacturer’s representative is acceptable.
    b. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of press-connect bronze, copper, carbon steel or stainless steel fittings.
    c. Press-connect bronze, copper, carbon steel or stainless steel fittings shall be installed using proper tool, actuator, jaws, and rings as instructed by the manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

F. Store piping and equipment in a safe place, dry, enclosed, under cover in a well-ventilated area.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 3-year manufacturer warranty for domestic water piping.

C. Furnish 5-year manufacturer warranty for the entire pump assembly package (i.e. pumps, motors, controllers, sensors, gauges, pipe, valves, unions and fittings, etc).

1.12 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish 1 packing kit for each size valve, 1 loose key for outside hose bibs, service kits for 1 pump seal for each pump model.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING – BELOW GRADE

A. Copper Tubing: ASTM B88, Type K, annealed.

1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
2. Joints: Brazed, AWS A5.8, lead free, BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing: ASTM B42, annealed.

1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F. or Braze, AWS A5.8 lead free, BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

C. Buried pressurized piping sizes 2” and smaller shall be type “K” soft copper. No joints shall be allowed below slab.

D. Building service riser: Riser shall be composed of a single extended 90-degree fitting of fabricated 304 stainless steel tubing, maximum working pressure 200 psi. The fitting shall have a flanged connection on the inlet (building) side and a CIPS coupler on the inlet (underground) side. Riser shall be equivalent to Ames Fire & Waterworks Series IBR In-Building Riser.

2.2 DOMESTIC WATER PIPING – ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F. or Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F. Fittings for copper piping 4 inches and larger shall be brazed.
3. Thread fitting: Pipe joint compound shall be lead free, non-toxic, low VOC and ANSI/NSF6/compliant. Temperature service range 10°F to 300°F.

B. Polypropylene Piping: At contractor’s option, polypropylene piping meeting requirements of Section 22 11 17 may be utilized for above ground domestic water piping.

C. Buried pressurized piping sizes 2 inches and smaller shall be type “K” soft copper. No joints shall be allowed below slab.

D. PEX Piping: If approved by Owner and Engineer, refer to specification 22 11 16.

E. Building service riser: Riser shall be composed of a single extended 90-degree fitting of fabricated 304 stainless steel tubing, maximum working pressure 200 psi. The fitting shall have a flanged connection on the inlet (building) side and a CIPS coupler on the inlet (underground) side. Riser shall be equivalent to Ames Fire & Waterworks Series IBR In-Building Riser.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.

2.4 GATE VALVES

A. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, ASTM B584, bronze trim, non-rising stem, hand-wheel, inside screw, solid wedge disc.

B. 2-1/2 inches and Larger: MSS SP 70, Class 125, ductile iron body, stainless steel and bronze trim, bolted bonnet, non-rising stem, hand-wheel, outside screw and yoke or square operating nut (for underground applications), resilient solid wedge disc with bronze seat rings, and flanged ends.

1. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.
2. Underground valves provide valve stem extension. Provide bonnet box and louver; bonnet box extension and S.S. centering ring.

2.5 GLOBE VALVES

A. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, hand wheel, Buna-N composition discs.

2.6 BALL VALVES

A. 2 inches and Smaller: MSS SP 110, 400 psi WOG two-piece bronze body, chrome-plated brass ball, full port, Teflon seats, blow-out proof stem, locking lever handle with balancing stops.

B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two-piece body, chrome-plated bronze ball, full port, Teflon seats, blow-out proof stem, locking lever handle with balancing stops.

C. Neck Extensions: Provide valves with extended round stem/necks where valves are installed in piping to be insulated. Stem/necks must permit operation of valve without damage to the insulation vapor barrier system. Nibco Nibseal or equal.

2.7 BUTTERFLY VALVES

A. 2 inches and Larger: MSS SP 67, Class 150, AWWA C-504, Lead Free.

1. Body: Ductile iron, lug ends, stainless steel stem, extended neck.
2. Disc: stainless steel.
3. Seat: Resilient replaceable Buna N.
4. Handle and Operator: 10 position lever handle.

2.8 CHECK VALVES

A. Horizontal Swing Check Valves:

1. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc.
2. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast-iron disc, renewable disc seal and seat, flanged ends.

B. Spring Loaded Check Valves:

1. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat.
2. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

2.9 PRESSURE GAUGES AND TAPS

A. Gauges shall comply with ASME B40.1, Grade 2A, and have ±0.5 percent of full-scale accuracy, with type 304 stainless steel or aluminum case, bronze wetted parts and brass socket. Dial face shall be 3½" diameter where installed within eight feet of floor level and 6" diameter where installed higher than eight feet above floor level. Dial face shall be aluminum with white background, black graduations and black markings. Pointer shall be adjustable with black finish. Provide remote read-out gauges for isolated or hard to access monitoring points.

B. Units of measure shall be in pounds per square inch (psi). The proper range shall be selected so that the average operating pressure falls approximately in the middle of the scale selected.

C. All pressure gauges shall be equipped with brass or stainless-steel needle valves and pressure snubbers.

D. Pressure Gauge Taps:

1. Needle Valve: Brass or stainless steel, 1/4-inch NPT for minimum 300 psi.
2. Ball Valve: Brass or stainless steel 1/4-inch NPT for 250 psi.
3. Pulsation Damper: Pressure snubber, brass or stainless steel with 1/4-inch (6 mm) NPT connections.

2.10 STEM TYPE THERMOMETERS

A. Thermometers shall be vapor or liquid actuated, direct-mounted, universal adjustable angle dial type with stainless steel or cured polyester powder coated cast aluminum case, stainless steel friction ring and glass window. Dial face shall be white with black figures; pointer shall be friction adjustable type. Movement shall be brass with bronze bushings. Bourdon tube shall be phosphor bronze with a brass socket.

B. Thermometer range shall be 30 - 240° Fahrenheit and have an accuracy of ±1 scale division.

C. Dial face shall be 4½" diameter where installed within eight feet of floor level and 6" diameter where installed higher than eight feet above floor level. Provide remote read-out gauges for isolated or hard to access monitoring points.

D. Provide a brass or stainless steel separable thermowell for each thermometer.

E. Thermometers shall have a sensing bulb with an insertion length of roughly half of the pipe diameter; minimum insertion length shall be 2". Thermometers installed on tanks shall have a minimum insertion length of 5".

F. Where insulation thickness exceeds 2", provide proper bulb length and an extension neck thermowell at least 2" long.

2.11 FLOW CONTROL VALVES

A. The valve shall be NSF61 certified lead free.

B. Type 1: Automatic flow regulating valve with stainless steel cartridge factory set to desired flow Sizes ½" and ¾".

C. Type 2: Self Actuating thermostatic balancing valve; stainless steel cartridge.

1. The valve shall have a wax thermostatic element.
2. The valve shall come in 6 sizes: 1/2”; 3/4”; 1”; 1 1/4”; 1 1/2”; 2”.

D. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

2.12 RELIEF VALVES

A. Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.13 STRAINERS

A. 2 inch and Smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

B. 2-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.

C. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8-inch stainless steel perforated screen.

2.14 HOSE BIBS AND HYDRANTS

A. Manufacturers:

1. Chicago.
2. T&S.
3. MIFAB.
4. Zurn.

B. Refer to Plumbing Miscellaneous Schedule on Project Drawings.

2.15 RECESSED VALVE BOX

A. Washing Machine: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2-inch waste, slip in finishing cover, integral water hammer arrestor.

B. Refrigerator: Plastic preformed rough-in box with brass valves with wheel handle slip in finishing cover, integral water hammer arrestor.

2.16 BACKFLOW PREVENTERS

A. All potable water systems shall be installed to prevent contamination from non-potable liquids, solids or gases through cross connection or any other connection to the system. Provide backflow prevention devices to serve all connections to non-potable water systems.

B. Provide vacuum breakers for all elements or systems requiring vacuum breakers for code, function, and/or protection of equipment/systems. These locations shall include, but not necessarily be limited to service/janitor/mop sinks, etc.

C. All backflow prevention devices and assemblies shall be tested and listed by University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC FCCC&HR) or other agency approved by Texas Commission on Environmental Quality (TCEQ).

D. Backflow preventer types. Provide the correct backflow preventer for each hazard.

1. Double check valve type backflow preventer valve assemblies shall prevent the reverse flow of polluted water from entering into the potable water supply. Double check valve backflow prevention devices shall be used at low hazard sources of contamination where no potential health risks exists.
2. Reduced pressure zone (RPZ) type backflow preventer valve assemblies shall prevent the reverse flow of polluted water from entering into the potable water supply due to backsiphonage and or backpressure. Reduced pressure zone backflow prevention devices shall be used at high hazard sources of contamination where a potential health risk exists and for containment at the water service entrance.

E. Reduced Pressure Backflow Preventers:

1. Comply with ASSE 1013.
2. Bronze body, with bronze internal parts and stainless-steel springs.
3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

F. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion resistant internal parts and stainless-steel springs; two independently operating check valves with intermediate atmospheric vent.

2.17 WATER HAMMER ARRESTORS

A. ASSE 1010: Copper construction, piston type sized in accordance with PDI WH-201.

B. Pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 150 psi working pressure.

1. Bellows Type
2. Piston Operated

C. Where indicated, provide water hammer arrestors integral to the fixture (lavatory, sink etc.) supplies equal to Precision Plumbing Products “Mini-Angle Stop”. Provide all washing machine and icemaker connections with water hammer arrestors integral to the connection box.

2.18 THERMOSTATIC MIXING VALVES

A. Mechanical Mixing Valve:

1. Valve: Chrome-plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment. ASSE 1017 listed.
2. Capacity: Refer to Plumbing Equipment Schedule on project Drawings.

3. Accessories:

    a. Check valve on inlets.
    b. Volume control shut-off valve on outlet.
    c. Stem thermometer on outlet and inlets.
    d. Strainer stop checks on inlets.

B. Electronic Mixing Valve:

1. Master Mixing Valve: electronic lead-free stainless-steel body, integral temperature adjustment Valve shall be ASSE 1017 listed.

    a. +/- 2°F water temperature control
    b. 2°F minimum inlet to outlet water temperature differential
    c. Automatic shutoff of hot water flow upon cold water inlet supply failure.
    d. Automatic shutoff of hot water flow in the event of a power failure
    e. Programmable set point range of 81-158°F (27-70°C)
    f. Programmable thermal disinfection mode
    g. Programmable 1st level hi/lo temp alarm display
    h. Programmable temperature error level for safety shutdown

2. Master Mixer shall have all of the following connectivity capabilities:

    a. SPCO relay outputs which are energized during operation.
    b. LCD display which indicates: set point, delivered temperature, error codes and alarm conditions.
    c. MODBUS 485 port for remote set point adjustment and remote operating temperature visibility.
    d. RS485 Serial Port for connection to a performance matched hot water monitoring system.

3. Capacity: Refer to Plumbing Equipment Schedule on project Drawings.
4. Accessories:

    a. Check valve on inlets.
    b. Volume control shut-off valve on outlet.
    c. Stem thermometer on outlet.
    d. Strainer stop checks on inlets.

5. The thermostatic mixing valves shall come equipped with union end stop and check inlets with removable stainless-steel strainers. The valve shall control temperature from a low flow of 0.5 gpm up to a maximum as indicated in “Thermostatic Mixing Valve Schedule” on plans.
6. The valve shall provide three-way protection from scalding upon:

    a. failure of the thermostat,
    b. shut off of hot water, or
    c. shut off of cold water.

C. Point of use mixing valve. Thermostatic mixing valve shall have body of brass or bronze with paraffin based thermal actuation. Valve shall be complete with integral checks with screens, and an adjustment cap with locking feature. Valve shall be ASSE Standard 1070 listed and shall maintain control down to 0.5 gpm. Valve shall maintain a mixed water temperature from 80° to 120°F ± 3°F. Set to deliver 110°F (unless indicated otherwise). Valve shall be capable of controlling mixed temperature while hot supply temperature ranges from 120°F to 180°F and

withstand a maximum pressure of 150 psi. The minimum required differential between entering cold and hot water and mixed water shall be 15°F or lower.

2.19 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers and Capacity: Refer to plumbing schedules.

B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

2.20 IN-LINE CIRCULATOR PUMPS

A. Casing: Stainless Steel rated for 125 psig working pressure with stainless steel rotor assembly.

B. Impeller: Bronze. SIC bearing plate

C. Shaft: Alloy steel with integral thrust collar.

D. Seal: Carbon rotating against stationary ceramic seat.

E. Performance: Refer to Plumbing Equipment Schedule on project Drawings.

2.21 DIELECTRIC CONNECTION

A. Provide Dielectric isolation between dissimilar metal piping. NOTE: Brass/bronze valves shall not be acceptable for dielectric isolation under this specification.

B. Two-inch connections may be either dielectric union or isolating flange as required.

C. Two and one-half inch and larger connections shall incorporate isolating flange kits. Flanges copper pipe shall consist of Class 150 cast copper alloy companion flange with flat face

D. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

E. Dielectric waterway fittings shall have a copper-silicon casting or a zinc electroplated steel pipe body with high temperature stabilized polyolefin polymer liner; manufactured by Victaulic, Style 647 or PPP, Inc. Series 19000, or Owner approved equal by Anvil.

F. Dielectric unions shall be rated at 250 psi, ground-joint type with inert, non-corrosive thermoplastic sleeve. End connection materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc or Watts. Provide models to suit applicable transitions.

G. Dielectric flanges shall be rated at 175 psi, have nylon bolt isolators and dielectric gasket. Materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc or Watts. Provide models to suit applicable transitions.

H. Flange insulation kit contain one “E: full face Trojan style insulation gasket manufactured from Nema grade G-10 glass reinforced epoxy retainer with a Nitrile seal, two insulation wasjers manufactured from Neman grade G-10, two steel (SEA zinc plated steel) back-up washers and one Nema Grade G-10 sleeve for each bolt.

I. Dielectric Nipples:

1. Manufacturer's: Subject to compliance with requirements.
2. Grinnell Mechanical Products.
3. Precision Plumbing Products, Inc.
4. Victaulic Company.

a. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple, complying with ASTM F1545
3) 300 psig at 250 deg.F
4) End connection: Male Thread or grooved.
5) Lining: Inert and non-corrosive, propylene.

2.22 TRAP PRIMER ASSEMBLIES

A. Trap Priming devices that rely upon line pressure differential for activation are not allowed.

B. Electronic Trap Primers

1. Electronic trap primers shall provide 10 second water injection to traps every twenty-four hours, complete with galvanized steel box and cover, copper inlet connection, brass ball type stop valve, slow closing 24 VAC solenoid valve with integral strainer, 120-24 VAC transformer, brass atmospheric vacuum breaker, and copper waterway. Refer to schedules on drawings for specifics for each device.

C. Sink or Lavatory Tailpiece Type Trap Primers

1. Provide polished chrome plated cast bronze p-trap with ground joint outlet, threaded wall tube, slip joint nuts, washers and escutcheons, 1/2" polished chrome plated bronze primer tube with compression fitting connection at wall. Assembly shall be Jay R. Smith Model 2698, Precision Plumbing Products LTP-1500 or approved equal of a referenced acceptable manufacture. This type of device shall not serve more than one trap.

D. Vacuum Breaker Trap Primer for use with exposed Flushometers:

1. Priming assembly shall consist of one piece, chrome plated flush connection, water deflector to control the amount of water diverted from the flush 3/8" elbow and flex-bend tube connection from vacuum breaker to wall, diverter wall flange and fittings, chrome plated wall flange and fitting to connect ½" NPT pipe, high back pressure vacuum breaker; one-piece bottom hex coupling nut. Basis of design: Sloan Model VBF-72-A1. This type of device shall not serve more than one trap.

2.23 THERMOWELLS

A. Provide thermowells where indicated on the drawings and where temperature measurement is needed for service or troubleshooting. Locations for thermowells shall include, but not be limited to: hot water return. Thermowells shall be matched with thermometers to be used as far as bore and depth. Thermowells shall be sized so that they will penetrate not less than 25 percent nor more than 50 percent of the pipe diameter in which it is installed.

B. Where possible, install thermowells in tee fittings where changes in flow directions occur.

C. Contractor may substitute extended length stainless steel pressure/temperature test ports with integral checks ("Pete's Plugs") for thermowells or where required due to small pipe size (2" or

below). Provide with dual seal core inserts of Nordel, rated 0F to 350F. Test port base/pipe connection size shall be ½", except that ¼" may be substituted for pipe sizes 1" and below.

D. In all cases, ensure installation allows for easy insertion and removal of temperature and pressure probes/instrumentation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION – THERMOMETERS AND GAUGES

A. Install one pressure gauge for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gauge.

B. Install gauge taps in piping

C. Install pressure gauges with pulsation dampers. Provide needle valve or ball valve to isolate each gauge.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.4 INSTALLATION – HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with Section 22 05 29. Provide non-metallic coatings or inserts on attachments for electrolytic protection where attachments are in direct contact with copper piping.

3.5 INSTALLATION – BURIED PIPING SYSTEMS

A. Verify connection to utility piping system size, location and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 24 inches of cover (36 inches below paved areas).

C. Establish minimum separation from sanitary sewer piping in accordance with applicable plumbing code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Section 22 00 01.

F. Install pipe to elevation as indicated on Drawings.

G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

H. Install pipe on prepared bedding.

I. Route pipe in straight line.

J. Install pipe to allow for expansion and contraction without stressing pipe or joints.

K. Install shutoff and drain valves at locations indicated on Drawings.

L. Install plastic ribbon tape continuous buried 9 inches above pipe line.

M. Install trace wire continuous over top of plastic pipe buried 9 inches above pipe line.

N. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section 22 00 01.
2. Maintain optimum moisture content of fill material to attain required compaction density.
3. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
4. Do not use wheeled or tracked vehicles for tamping.

3.6 INSTALLATION – ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.

L. Install domestic water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.

N. Install unions downstream of valves and at equipment or apparatus connections.

O. Install valves with stems upright or horizontal, not inverted.

P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

Q. Install gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

R. Install ball valves for throttling, bypass, or manual flow control services.

S. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

T. Provide spring loaded check valves on discharge of water pumps.

U. Provide flow controls in water circulating systems.

V. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

W. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

X. Install water hammer arrestors complete with accessible isolation valve on hot and cold-water supply piping to each fixture or group of fixtures.

Y. Utilize slow closing valves only. Do not install or allow quick closing valves.

3.7 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.9 and AWS B2.1.

B. Threaded: Treads shall conform to ASME B1.20. Joint compound shall be applied to male threads only and joints shall be made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound for corrosion protection.

C. Soldered: Solder joints shall be made in accordance with ASTM B828. The temperature of the joint during soldering shall not be raised above the maximum temperature limitation of the flux.

3.8 INSTALLATION – IN-LINE CIRCULATOR PUMPS

A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings.

C. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve, balancing valve, and shut-off valve on pump discharge.

D. Provide air cock and drain connection on horizontal pump casings.

E. Provide drains for bases and seals.

F. Check, align and certify alignment of base mounted pumps prior to start-up.

G. Lubricate pumps before start-up.

H. Contractor shall install pumps and packaged pumping systems in accordance with the manufacturer's instructions. All base mounted pumps to be aligned upon receipt at jobsite, during installation, and after system fill. Contractor shall level and grout each pump according to the manufacturer recommendations to insure proper alignment prior to operation.

I. Pipe connections to pumps shall be made in such a manner so as not to exert any stress on pump housings. If necessary to meet this requirement, provide additional pipe supports and flex connectors.

J. Pumps shall NOT be run dry to check rotation.

K. Provide resilient rubber isolators for piping hangers and stanchions for the first two support locations in suction and discharge piping.

L. Ensure pumps operate at specified or intended system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.9 INSTALLATION – SERVICE CONNECTIONS

A. Provide 18-gauge galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.10 BACKFLOW PREVENTORS

A. Backflow prevention devices and assemblies shall be installed in compliance with American Water Works Association Manual M-14 "Backflow Prevention," and the following:

1. Devices and assemblies shall be located as shown on plans.
2. The highest part of any device or assembly shall not be installed over 5 feet above the finish floor. There shall be a minimum of 12 inches clearance above the device/assembly.
3. The lowest part of any double check backflow preventer assembly shall be installed a minimum of 12 inches above finish floor.
4. The service side of any device/assembly shall have a minimum clearance of 24 inches from the outermost dimension.

5. The non-service side of a double check backflow assembly shall have a minimum clearance of 4 inches from the outermost dimension.
6. All backflow and/or back siphonage assemblies/devices shall be tested in accordance with the rules and regulations of Texas Commission on Environmental Quality and the utility supplying the domestic water before substantial completion inspection is requested.
7. Final reports shall be submitted to local code/inspection authorities and to A/E and utility prior to scheduling Substantial Completion reviews by the A/E.
8. Persons performing the test on backflow and/or back siphonage assemblies/devices shall meet the following requirements:

    a. Licensed by the Texas Commission on Environmental Quality as a Backflow Prevention Assembly Technician, and
    b. If required by the utility supplying the water, registered with the utility for testing backflow preventer assemblies.
    c. Testing of backflow preventer assemblies serving fire protection systems shall be performed by a person or organization with a current certificate of registration from the State Fire Marshal as an independent fire protection sprinkler contractor (Registered Firm) under the direct supervision of a licensed Responsible Managing Employee (RME) as defined by Texas Insurance Code (TIC), Chapter 6003 (formerly Article 5.43-3), Fire Protection Sprinkler System Service and Installation and the Texas Administrative Code Title 28, Chapter 34, Subchapter G – Fire Sprinkler Rules.

9. Label all backflow preventers to indicate the equipment that they are protecting and the location. For example, “Ice maker – RM 123”. Provide a phenolic sign; fasten to the wall above the backflow preventer. Letters should be a minimum 1/2” tall.

3.11 WATER-HAMMER ARRESTORS

A. Provide water hammer arrestors as shown on the plans and as necessary to prevent water hammer from occurring. As a minimum, provide as follows.

1. A minimum of one arrestor shall be installed for each fixture header serving up to three fixtures. A minimum of two arrestors shall be installed for each fixture header serving four to seven fixtures. A minimum of three shall be installed for each fixture header serving eight or more fixtures.
2. Note: “Header” refers to horizontal pipe from which adjacent fixtures are directly connected without intervening horizontal or vertical runs or offsets.
3. Provide permanently sealed air chamber type water-hammer arrestor at all water closet locations.
4. Provide an arrestor for each single fixture with a quick closing valve (e.g. single lever handles; wrist blades, push/pull faucets, self-closing faucets, flush valves, solenoid valves, etc.).
5. NOTE: Washing machines and other solenoid operated equipment shall have arrestor (not air chamber) provided for each piece of equipment/fixture.
6. Air chambers are not acceptable under any circumstance.
7. Where indicated, provide water hammer arrestors integral to the fixture (lavatory, sink etc.) supplies equal to Precision Plumbing Products “Mini-Angle Stop”. Provide all washing machine and icemaker connections with water hammer arrestors integral to the connection box.

3.12 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

3.13 CLEANING AND DISINFECTION

A. Domestic Water Piping: Domestic cold water and hot water piping shall be thoroughly flushed, cleaned and disinfected in accordance with the appropriate procedure described in the latest edition of ANSI/AWWA C651 or as described in this section. Cold and hot domestic water piping shall be thoroughly flushed with potable water to remove all foreign particles. The piping shall then be sterilized by filling the systems with a solution of chlorine containing 50 PPM of chlorine this solution shall stay in the piping for a minimum period of 24 hours; or the piping shall be filled with a solution of chlorine containing 200PPM of chlorine and this solution shall stay in the piping for a minimum of 3 hours. During which time all valves shall be opened and closed several times in order that all parts of the valve shall be in contact with the solution. After the sterilization period, the system shall be drained and flushed with clean potable water until the residual chlorine content is not greater than 0.2 PPM.

B. Bacteriological test shall be performed by a third-party testing lab hired by the contractor. SUBMIT testing lab qualification for review and approval by the Owner and A/E. The testing lab shall not have less than five (5) years experience with water testing.

C. The above procedure shall be performed prior to final connections to utility or existing piping systems in the building to assure no chlorine or other contamination migrates into systems.

D. Within one-week (7 days) days after cleaning is completed, submit written report signed by supervising craftsman and contractor principal certifying cleaning and sterilization was conducted as specified.

E. Take samples no sooner than 24 hours after flushing, from at minimum of 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

F. The cleaning and disinfection of water lines shall not be done sooner than 3 weeks prior to owner occupancy. If it has been more than 3 weeks then the contractor shall, at his own expense, clean and disinfect the pipe again not sooner than 3 weeks before owner occupancy.

3.14 TESTING

A. Each system installed under this contract shall be cleaned and tested to appropriate plumbing code for each particular application.

B. Testing shall also include any additional requirements from the authority having jurisdiction.

C. Equipment, material, power, and labor necessary for the cleaning, flushing, sterilization, inspection and testing of systems covered within this Specification Section shall be furnished by the Plumbing Contractor. All testing and inspection procedures shall be in accordance with Division 01 and Special Condition requirements of this Contract.

D. For any requested inspection, the Contractor shall complete prior inspections and tests to ensure that items are ready for inspection and acceptance by the Owner and/or Architect/Engineer. The Contractor shall be responsible for any and all costs incurred by Owner and/or Owner representatives, including consultants, resulting from a review or inspection that was scheduled prematurely.

E. The Contractor shall conduct the tests and the Owner’s Construction Inspector will witness and approve the results.

F. Verify systems are complete, flushed and clean prior to testing. Isolate all equipment subject to damage from test pressure. Test and inspect for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. Piping being tested shall not leak nor show any loss in test pressure for duration specified.

G. Leave piping uninsulated, uncovered and unconcealed until it has been tested and approved. Where any portion of piping system must be concealed before completion of entire system, the portion shall be tested separately as specified for the entire system prior to concealment. Contractor shall expose all untested covered or concealed piping.

H. In cases of minor installation and repairs where specified water and/or air test procedures are deemed impractical, Contractor shall obtain written approval from Owner's Representative to perform alternate testing and inspection procedures. Alternate testing and inspection procedures for minor installation and repairs shall include visual evaluation of installed components by Owner's Representative during a simulation of use.

I. The water utilized for tests shall be obtained from a potable source of supply.

J. Prepare testing reports. If testing is performed in segments, submit separate report for each segment, complete with diagram or clear description of applicable portion of piping. After inspection has been approved or portions thereof, certify in writing the time, date, name and title of the persons reviewing the test. This shall also include the description of what portion of the system has been approved. Obtain approval signature by Owner's Representative. A complete record shall be maintained of all testing that has been approved, and shall be made available at the job Site. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Owner's Representative before final payment is made.

K. Gauges used for testing shall have increments as follows:

1. Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi or less.
2. Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
3. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.

L. Separately test above and below ground piping.

M. Do not introduce test water into piping systems when exposure to freezing temperatures is possible.

N. Do not introduce test water into sections of piping located above existing sensitive areas and/or equipment that may be damaged or contaminated by water leakage. Coordinate with Owner's Representative to determine areas and/or equipment considered as being sensitive.

O. Defective work or material shall be reworked and replaced, and inspection and test repeated. Repairs shall be made with new materials. Pipe dope, caulking, tape, dresser couplings, etc., shall not be used to correct deficiencies.

P. The Contractor shall be responsible for cleaning up any leakage during flushing, testing, repairing and disinfecting to the original condition any building parts subjected to spills or leakage.

Q. All backflow and/or back siphonage assemblies/devices shall be tested in accordance with the rules and regulations of Texas Commission on Environmental Quality and the utility supplying the domestic water before substantial completion inspection is requested.

1. Final reports shall be submitted to local code/inspection authorities and to A/E and utility prior to scheduling Substantial Completion reviews by the A/E.
2. Persons performing the test on backflow and/or back siphonage assemblies/devices shall meet the following requirements:

    a. Licensed by the Texas Commission on Environmental Quality as a Backflow Prevention Assembly Technician, and
    b. If required by the utility supplying the water, registered with the utility for testing backflow preventer assemblies.

R. Domestic hot water system:

1. Test Remote fixtures to determine hot water is available within 30 seconds. Provide a report and a drawing indicated fixtures tested and the duration of time to provide 110 °F.
2. Record temperature at each return pump.

S. Pressure test all water piping in accordance with the applicable plumbing code and local AHJ.

T. All testing of pumps shall be by owner representative and a report shall be provided.

U. Equipment, material, power, and labor necessary for the cleaning, flushing, sterilization, inspection and testing of systems covered within this Specification Section shall be furnished by the Plumbing Contractor. All testing and inspection procedures shall be in accordance with Division 01 and Special Condition requirements of this Contract.

V. For any requested inspection, the Contractor shall complete prior inspections and tests to ensure that items are ready for inspection and acceptance by the Owner and/or Architect/Engineer. The Contractor shall be responsible for any and all costs incurred by Owner and/or Owner representatives, including consultants, resulting from a review or inspection that was scheduled prematurely.

END OF SECTION

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewer and vent piping – below grade.
2. Sanitary sewer and vent piping – above grade.
3. Floor drains, Area Drains and Floor sinks.
4. Cleanouts.

B. Related Sections:

1. Division 03 – Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Division 07 – Firestopping: Product requirements for firestopping for placement by this section.
3. Division 08 – Access Doors and Frames: Product requirements for access doors for placement by this section.
4. Division 09 – Painting and Coating: Product and execution requirements for painting specified by this section.
5. Section 22 00 01 – Basic Plumbing Requirements.
6. Section 22 05 13 – Common Motor Requirements for Plumbing Equipment: Product requirements for motors for placement by this section.
7. Section 22 05 16 – Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.
8. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
9. Section 22 05 53 – Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
10. Section 22 07 00 – Plumbing Insulation: Product and execution requirements for pipe insulation.
11. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
12. Division 31 sections for excavation, trench and backfill required by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.14.1 – Backwater Valves.
2. ASME A112.21.1 – Floor Drains.
3. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
4. ASME B16.3 – Malleable Iron Threaded Fittings.
5. ASME B16.4 – Gray Iron Threaded Fittings.
6. ASME B31.9 – Building Services Piping.

B. ASTM International:

1. ASTM A47/A47M – Standard Specification for Ferritic Malleable Iron Castings.

2. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234/A234M – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A395/A395M – Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 – Standard Specification for Ductile Iron Castings.
7. ASTM A746 – Standard Specification for Ductile Iron Gravity Sewer Pipe.
8. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
9. ASTM C478M – Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
10. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
11. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
12. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
13. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
14. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
15. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
16. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
17. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
18. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
19. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
20. ASTM D3311 – Standard Specification for Drain, Waste and Vent (DWV) Plastic Fitting Patterns.
21. ASTM F493 – Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
22. ASTM F2618 – Standard for Chlorinated Poly Vinyl Chloride (CPVC) Chemical Waste Drainage Systems

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
2. CISPI 310 – Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports: Materials, Design and Manufacturer.
2. MSS SP 69 – Pipe Hangers and Supports: Selection and Application.
3. MSS SP 89 – Pipe Hangers and Supports: Fabrication and Installation Practices.

E. Plumbing and Drainage Institute:

1. Standard PDI G101 – Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS

A. Refer to Division 01 for Submittal procedures.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.

C. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 – Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one-year manufacturer warranty for material.

1.10 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of pump seals.

PART 2 - PRODUCTS

2.1 SANITARY SEWER AND VENT PIPING – BELOW GRADE

A. All cast iron soil, waste and vent pipe and fittings shall conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International. Acceptable manufacturers of cast iron soil pipe and fittings are AB&I, Charlotte Pipe and Tyler Pipe.

B. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.
2. Joints: Hub-and-spigot with compression gaskets conforming to the requirements of ASTM C-564 and ASTM C-1563.

C. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.
2. Joints: Hubless pipe and fittings shall be joined by No-Hub couplings conforming to CISPI Standard 310 and listed by NSF International.
3. Below grade piping shall be joined by super duty shielded stainless steel couplings with rubber sleeves and stainless-steel bands and tightening devices, conforming to ASTM C564; equivalent to Husky SD 4000.

2.2 SANITARY SEWER AND VENT PIPING – ABOVE GRADE

A. All cast iron soil, waste and vent pipe and fittings shall conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International. Acceptable manufacturers of cast iron soil pipe and fittings are AB&I, Charlotte Pipe and Tyler Pipe.

B. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron, ASTM A74.
2. Joints: Hub-and-spigot with compression gaskets conforming to the requirements of ASTM C-564 and ASTM C-1563.

C. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.
2. Joints: Hubless pipe and fittings shall be joined by No-Hub couplings conforming to CISPI Standard 310 and listed by NSF International.

Above grade waste piping shall be joined by heavy-duty shielded stainless-steel couplings with rubber sleeves and stainless-steel bands and 80 PSI torqued tightening devices conforming to ASTM C564; equivalent to Tyler Wide Body, Mission Rubber Co. Heavyweight, Fernco Heavy Duty or Husky HD 2000.

Above grade vent piping joined by standard duty shielded stainless steel couplings with rubber sleeves and stainless-steel bands and tightening devices, conforming to ASTM C564; as manufactured by Tyler Pipe, Mission Rubber Co. or ANACO.

2.3 FLOOR DRAINS, AREA DRAINS AND FLOOR SINKS

A. Refer to Plumbing Equipment Schedule on Drawings.

2.4 CLEANOUTS

A. Refer to Plumbing Equipment Schedule on Drawings.

B. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.

C. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.

D. Interior Finished Floor Areas: Galvanized cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

E. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless-steel access cover secured with machine screw.

F. Interior Unfinished Accessible Areas: Calked or threaded type.

2.5 ESCUTCHEONS AND PLATES

A. Solid plates, 316 Stainless Steel with set screws shall be used where the sectional plates will not stay in place or are not available in the required size, or where other individual specification section(s) require one piece or greater quality escutcheons or plates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION – HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with Section 22 05 29:

3.4 INSTALLATION – BURIED PIPING SYSTEMS

A. Verify connection to site utility piping system; size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 1.5 ft of cover.

C. Establish minimum separation of other services piping in accordance with Plumbing Code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Section 22 00 01 and Division 31 specifications.

F. Install pipe to elevation as indicated on Drawings.

G. Place bedding material at trench bottom to provide uniform bedding for piping.

H. Place bedding materials in one continuous layer not exceeding six inches compacted depth; compact to 95 percent maximum density.

I. Install pipe on prepared bedding.

J. Route pipe in straight line.

K. Install plastic ribbon tape continuous over top of pipe, 9 inches above pipe line.

L. Install trace wire continuous over top of plastic pipe buried 9 inches above pipe line.

M. Below grade installation shall comply with the Geotech report, DIV 22 requirements, and ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

N. Pipe Cover and Backfilling:

1. Install underground Thermoplastic piping soil and waste drainage piping according to ASTM D 2321.
2. Backfill trench in accordance with Section 22 00 01 and Division 31 specifications.
3. Maintain optimum moisture content of fill material to attain required compaction density.
4. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.

5. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
6. Do not use wheeled or tracked vehicles for tamping.

3.5 INSTALLATION – ABOVE-GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom. Do not spread piping, conserve space.

H. Group piping whenever practical at common elevations.

I. Support cast iron drainage piping at every joint.

J. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

L. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

M. Install piping penetrating roofed areas to maintain integrity of roof assembly.

N. Where pipe support members are welded to structural building framing, scrape, brush clean and apply one coat of zinc rich primer to welding.

O. Prepare exposed, unfinished pipe, fittings, supports and accessories ready for finish painting. Refer to Division 09.

P. Install bell and spigot pipe with bell end upstream.

Q. Sleeve pipes passing through partitions, walls and floors. Refer to Division 07.

R. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 05.

S. PVC is not allowed in Hospitals or Licensed facilities.

T. PVC is not permitted in Return air plenums.

3.6 DRAINS, CLEANOUTS AND SIMILAR COMPONENTS

A. Extreme care shall be used to set the top elevation of floor drains and floor sinks to meet the low point elevation of the finished floor. Final mounting elevation of floor drain strainers, floor sink grates, cleanouts tops, etc. shall be flush with finished floor.

B. Coordinate with General Contractor to ensure floor is sloped to floor drain and/or floor sink locations for a minimum of 2-foot radius from the floor drain.

C. Provide floor drains and/or floor sinks complete with trap primer connections, piping, and trap primer assemblies.

D. Exterior cleanouts, single or double, shall be set in reinforced concrete (minimum 18 inches by 18 inches by 6 inches thick or as indicated on Drawings) at finished grade level. Provide countersunk brass cleanout plugs in cast iron ferrules. PVC plugs shall not be acceptable. Exception: Where cleanouts are located in architectural flatwork (sidewalks, patios, etc.), cleanouts shall be floor cleanout style as indicated on drawing schedules.

E. Floor drains and/or floor sinks in mechanical rooms:

1. Ensure that all floor drains and/or floor sinks in mechanical rooms are provided with maximum size (e.g., diameter) strainers. In addition, where multiple drains pipe to a floor drain provide a 3-1/2 inch by 8-1/4 inch by 3-1/2 inch high elongated funnel.
2. In addition, where multiple drains pipe to a floor drain, provide a 12-inch diameter by 3 inches (approximately) high schedule 40 black steel pipe segment to serve as a splash guard. Mount splash guard with approximately 1/16-inch gap between bottom of guard and floor to allow drainage to floor drain beneath splash guard.
3. Coordinate funnel/splash guard installation with Mechanical Contractor for proper condensate drain piping heights.

F. Drains located in shower areas, restrooms, Kitchens and other wet areas with water proofing membrane.

1. During slab pour provide an oversized concrete blocking for drain locations. The intent is to be provide the ability to properly level the drain and obtain the correct height of drain for floor finishes, as needed, after the slab
2. Confirm water proof membrane type and floor drain are compatible.
3. Properly protect drain openings to prevent and liquid water proofing membrane or epoxy from entering the drainage system.

G. Drain Locations in Stained concrete.

1. Coordinate drain height and drain location with slab height. Install drain in accordance with the direction of the stained concrete provider.

3.7 PLASTIC PIPE AND JOINT FABRICATION

A. Cut plastic pipe with pipe cutters using a cutting wheel specifically designed for plastic pipe.

B. Remove all burrs, chips, filings, etc. from both the I.D. and O.D. of the pipe before joining. Use a knife, deburring tool, or a half-pound coarse file to remove all burrs.

C. Bevel all pipe ends to minimize the chances of wiping the solvent cement from the I.D. of the fitting as the pipe is socketed. Use a beveling tool designed to bevel pipe at a 10° to 15° angle and a depth of 1/16" to 3/32".

D. Using a clean, dry, cotton rag, wipe away all loose dirt and moisture from the I.D. and O.D. of the pipe end and the I.D. of the fitting. Do not solvent weld wet surfaces.

E. Apply primer to the pipe surface in the same manner, making sure that the length of pipe evenly brushed is at least equal to the fitting socket depth.

F. For checking penetration, scratch or scrape away the primed surface until a few thousandths of an inch can be so removed. Repeat applications of primer to either or both surfaces as necessary. In cold weather, allow more time for proper penetration.

G. Cover the outer pipe surface literally with solvent cement for a length at least equal to that of the fitting socket depth.

H. Continue alternate application to the fitting socket with a medium layer of solvent cement. Avoid puddling in the socket. On belled end pipe, do not coat beyond the socket depth or allow cement to run beyond the bell.

I. Apply a second coat of cement to the pipe. Cement layers must be without voids and sufficient to fill any gaps in the joints.

J. Immediately upon finishing cement application and before it starts to set, insert the pipe to the full socket depth while rotating the pipe or fitting 1/4 turn to ensure complete and even distribution of the cement. Hold joint together for a minimum of 10 to 15 seconds to make sure that pipe does not move back out of the socket.

K. Immediately after joining and before joint is set, gently place joint onto a level surface, and wipe off all excess cement from the circumference of the joint.

L. Do not perform joining operations if ambient temperature is below 40 F. Allow a minimum of 72 hours of joint drying time before subjecting joints to any appreciable internal pressure.

M. Below grade installation shall comply with the Geotech report, DIV 22 requirements, and ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

3.8 DRAIN PIPE AND FITTINGS

A. Offsets and Fittings.

1. Use reduction fittings to connect two pipes of different diameter.
2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eighth-, and sixteenth-bends. Sanitary tees may be used on vertical stacks. Use long sweeps at the base of risers.
3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a Deep Seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
4. For sets of fixtures installed in 4-inch walls, provide a separate waste and vent line for each fixture (do not interconnect in wall). Connect the waste lines underfloor and the vent lines above the ceiling. Maintain structural and aesthetic integrity of walls.
5. Do not route any piping above electrical control panels and related electrical equipment. Prior to installation of any piping, determine the actual space requirements and the location of all electrical panels and related electrical equipment. Make all offsets and adjustments as required.

6. Discharge from the oil separator to a floor drain with a funnel to maintain an indirect connection to the sanitary sewer.

B. Floor Drains. Provide all required floor drains complete with drain lines and vent lines as required by the section on Drains, Hydrants and Cleanouts.

C. Cleanouts.

1. Provide drainage lines with properly specified cleanouts. Provide all as required by the section on drains, hydrants and cleanouts.

3.9 VENT PIPING

A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 30-inches above the roof level.

B. Coordinate location of vent penetrations with roofing trades; flashing to be done by roofer.

C. Offset all vents located near building edge such that no vent through roof piping is located within 5-feet from the building edge (measured from building line not building eave). Make offsets in roof structure space.

D. Terminate vent through roof not less than 15-feet away from any shaft, window or outside air intake openings.

E. All vent and vent branch pipes shall be graded and connected to drip back to sanitary waste piping by gravity.

3.10 ROUGH-IN AND FINAL CONNECTIONS

A. Make rough-in and final connection of all services to all fixtures requiring plumbing connections. Contractor shall be responsible for installing fixtures at locations shown on the Architectural drawings and providing all service connections at required locations.

B. Rough-in and final connection of services to all equipment shall be installed in accordance with the latest edition of the manufacturer's rough-in measurements manual. Contractor shall obtain all such documents.

C. Use threaded sanitary tapped tee pipe fittings for p-trap connections at walls.

D. Provide service connections to all plumbing fixtures specified and to all equipment furnished by others.

E. Install all piping and associated equipment in accordance to manufacturer's recommendations using recommended tools.

F. Provide all fittings and appurtenances required for a complete and working system.

3.11 ESCUTCHEONS AND PLATES

A. Where pipes pass through ceilings or walls in finished spaces, install sectional plates or escutcheons to cover the annular opening between pipe and sleeve..

B. The annulus between pipe and walls or floors, shall be filled with Sonolastic NP unless fire wall or barrier then the approved UL listed fire assembly shall be used.

C. Inside diameter of escutcheons shall fit around insulation and around pipe when not insulated; outside diameter shall cover sleeve. Secure escutcheons or plates to pipe or sleeve but not to insulation. All escutcheons shall be triple nickel-chromium plated brass, or Type 316L stainless steel.

3.12 COORDINATION

A. Making adjustments to field conditions is considered a part of the work required. Do not use contract drawings accompanying these specifications for rough-in locations but only for pipe sizing and general routing.

B. Contractor shall examine and familiarize himself with the Architectural, Structural, Electrical and Mechanical Drawings to be knowledgeable of all plumbing connections required and space limitations.

C. The Drawings are diagrammatic and are not intended to show all the fittings required. Contractor shall include in his bid, costs for items of material and labor which are not specifically called for in drawings or specifications, but which are required to make plumbing installation. Contractor shall make any necessary changes to avoid beams, footings, columns, piers, vents, ducts, equipment or other obstructions.

D. In any case where a pipe shown on a plan sheet differs from that shown on a riser, schematic or detail, use the larger of the two sizes shown.

3.13 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and – Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Test sanitary waste, grease waste, chemical resistant waste and vent piping system in accordance with applicable code and local authority having jurisdiction.

C. Testing:

1. After each section of the sanitary waste, acid waste and grease waste systems have been set within project area, all outlets shall be temporarily "plugged up", except as are required for testing as described herein. Each section of piping shall be tested to a level of at least 10 feet above the pipe being tested. The pipes being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for a minimum of 2 hours. If after 2 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 2-hour retention period, there shall be no perceptible lowering of the water level in the system being tested.
2. Should the completion of these tests leave any reasonable question of a doubt relative to the integrity of the installation, additional tests or measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

D. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work of other trades.

E. Place temporary caps or plugs in ends of uncompleted piping and when work stops at the end of each day.

END OF SECTION

SECTION 22 14 00 - FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm water piping buried below grade.
2. Storm water piping above grade.
3. Roof drains, area drains, planter drains and canopy drains.
4. Cleanouts.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
3. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
4. Division 09 - Painting and Coating: Execution requirements for painting material specified by this section.
5. Section 22 00 01 – Basic Plumbing Requirements.
6. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
7. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment: Product requirements for motors for placement by this section.
8. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.
9. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
10. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
11. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
12. Section 22 14 29 – Sump Pumps: Pump required for storm drainage.
13. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
14. Division 31 sections for excavation, trench and backfill required by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.21.1M - Floor Drains.
2. ASME A112.21.2M - Roof Drains.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
5. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
6. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
7. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
8. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
9. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
10. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
11. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
13. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports: Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports: Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports: Fabrication and Installation Practices.

1.3 SUBMITTALS

A. Refer to Division 01 for Submittal procedures.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump-pumps, catch basins and manholes.

C. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
3. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one-year manufacturer warranty for sump pumps.

1.10 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of pump seals.

PART 2 - PRODUCTS

2.1 STORM WATER PIPING, BELOW GRADE

A. All cast iron soil, waste and vent pipe and fittings shall conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74. All cast iron pipe and fittings shall be marked with the

collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International. Acceptable manufacturers of cast iron soil pipe and fittings are AB&I, Charlotte Pipe and Tyler Pipe.

B. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.
2. Joints: Hub-and-spigot with compression gaskets conforming to the requirements of ASTM C564 and ASTM C1563.

C. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.
2. Joints: Hubless pipe and fittings shall be joined by No-Hub couplings conforming to CISPI Standard 310 and listed by NSF International.
3. Below-grade storm drain piping shall be joined by super duty shielded stainless steel couplings with rubber sleeves and stainless-steel bands and tightening devices, conforming to ASTM C564; equivalent to Husky SD 4000.

2.2 STORM WATER PIPING, ABOVE GRADE

A. All cast iron soil, waste and vent pipe and fittings shall conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International. Acceptable manufacturers of cast iron soil pipe and fittings are AB&I, Charlotte Pipe and Tyler Pipe.

B. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.
2. Joints: Hub-and-spigot with compression gaskets conforming to the requirements of ASTM C564 and ASTM C1563.

C. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.
2. Joints: Hubless pipe and fittings shall be joined by No-Hub couplings conforming to CISPI Standard 310 and listed by NSF International.
3. Above-grade storm drain piping shall be joined by heavy duty shielded stainless steel couplings with rubber sleeves and stainless-steel bands and 80 PSI torque tightening devices, conforming to ASTM C564; equivalent to Tyler Wide Body, Mission Rubber Co. Heavyweight, Fernco Heavy Duty or Husky HD 2000.
4. Provide No-hub fitting thrust restraint at each change of direction. Restraints shall consist of galvanized steel pipe riser clamps on both sides of fitting connected with minimum ½" galvanized steel threaded rods and necessary hardware or engineered no-hub fitting restraints equal to Holdrite #117 series.

2.3 ROOF DRAINS, AREA DRAINS, PLANTER DRAINS AND CANOPY DRAINS

A. Refer to Plumbing Equipment Schedule on Drawings.

2.4 ESCUTCHEONS AND PLATES

A. Solid plates, 316 Stainless Steel with set screws shall be used where the sectional plates will not stay in place or are not available in the required size, or where other individual specification section(s) require one piece or greater quality escutcheons or plates.

2.5 CLEANOUTS

A. Refer to Plumbing Equipment Schedule on Drawings.

B. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.

C. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.

D. Interior Finished Floor Areas: Galvanized cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

E. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless-steel access cover secured with machine screw.

F. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with Section 22 05 29.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to site utility piping system, size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than one ft of cover.

C. Establish minimum separation from other services piping in accordance with applicable Plumbing code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Section 22 00 01 and Division 31 specifications.

F. Install pipe to elevation as indicated on Drawings.

G. Place bedding material at trench bottom to provide uniform bedding for piping.

H. Place bedding materials in one continuous layer not exceeding six inches compacted depth; compact to 95 percent maximum density.

I. Install pipe on prepared bedding.

J. Route pipe in straight line.

K. Install plastic ribbon tape continuous over top of pipe 9 inches above pipe line.

L. Install trace wire continuous over top of plastic pipe buried 9 inches above pipe line.

M. Pipe Cover and Backfilling:

1. Install underground Thermoplastic piping soil and waste drainage piping according to ASTM D 2321.
2. Backfill trench in accordance with Section 22 00 01 and Division 31 specifications.
3. Maintain optimum moisture content of fill material to attain required compaction density.
4. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
5. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
6. Do not use wheeled or tracked vehicles for tamping.

3.5 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearance at cleanout for snaking drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom. Group piping to conserve space.

H. Group piping whenever practical at common elevations.

I. Support cast iron drainage piping at every joint.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

L. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

M. Install piping penetrating roofed areas to maintain integrity of roof assembly.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.

P. Install bell and spigot pipe with bell end upstream.

Q. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.

R. Insulate all horizontal storm drain piping (both primary and overflow pipe) and all roof drain bodies. Refer to Section 22 07 00.

S. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.

T. Provide No-hub fitting thrust restraint at the following locations at each change of direction (horizontal or vertical) and/or each branch connection in above grade storm drain piping (both primary and emergency overflow).

3.6 PLASTIC PIPE INSTALLATION AND JOINT FABRICATION

A. Cut plastic pipe with pipe cutters using a cutting wheel specifically designed for plastic pipe.

B. Remove all burrs, chips, filings, etc. from both the I.D. and O.D. of the pipe before joining. Use a knife, deburring tool, or a half-pound coarse file to remove all burrs.

C. Bevel all pipe ends to minimize the chances of wiping the solvent cement from the I.D. of the fitting as the pipe is socketed. Use a beveling tool designed to bevel pipe at a 10° to 15° angle and a depth of 1/16" to 3/32".

D. Using a clean, dry, cotton rag, wipe away all loose dirt and moisture from the I.D. and O.D. of the pipe end and the I.D. of the fitting. Do not solvent weld wet surfaces.

E. Apply primer to the pipe surface in the same manner, making sure that the length of pipe evenly brushed is at least equal to the fitting socket depth.

F. For checking penetration, scratch or scrape away the primed surface until a few thousandths of an inch can be so removed. Repeat applications of primer to either or both surfaces as necessary. In cold weather, allow more time for proper penetration.

G. Cover the outer pipe surface literally with solvent cement for a length at least equal to that of the fitting socket depth.

H. Continue alternate application to the fitting socket with a medium layer of solvent cement. Avoid puddling in the socket. On belled end pipe, do not coat beyond the socket depth or allow cement to run beyond the bell.

I. Apply a second coat of cement to the pipe. Cement layers must be without voids and sufficient to fill any gaps in the joints.

J. Immediately upon finishing cement application and before it starts to set, insert the pipe to the full socket depth while rotating the pipe or fitting 1/4 turn to ensure complete and even distribution of the cement. Hold joint together for a minimum of 10 to 15 seconds to make sure that pipe does not move back out of the socket.

K. Immediately after joining and before joint is set, gently place joint onto a level surface, and wipe off all excess cement from the circumference of the joint.

L. Do not perform joining operations if ambient temperature is below 40 F. Allow a minimum of 72 hours of joint drying time before subjecting joints to any appreciable internal pressure.

M. Below grade installation shall comply with the Geotech report, DIV 22 requirements, and ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

3.7 ESCUTCHEONS AND PLATES

A. Where pipes pass through ceilings or walls in finished spaces, install sectional plates or escutcheons to cover the annular opening between pipe and sleeve..

B. The annulus between pipe and walls or floors, shall be filled with Sonolastic NP unless fire wall or barrier then the approved UL listed fire assembly shall be used.

C. Inside diameter of escutcheons shall fit around insulation and around pipe when not insulated; outside diameter shall cover sleeve. Secure escutcheons or plates to pipe or sleeve but not to insulation. All escutcheons shall be triple nickel-chromium plated brass, or Type 316L stainless steel.

3.8 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Test storm drainage piping system in accordance with applicable code and local authority having jurisdiction.

C. Testing:

1. After each section of the storm drainage systems have been set within project area, all outlets shall be temporarily "plugged up", except as are required for testing as described herein. Each section of piping shall be tested to a level of at least 10 feet above the pipe being tested. The pipes being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for a minimum of 2 hours. If after 2 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test

repeated until, after a 2-hour retention period, there shall be no perceptible lowering of the water level in the system being tested.

2. Should the completion of these tests leave any reasonable question of a doubt relative to the integrity of the installation, additional tests or measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

D. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work of other trades.

E. Place temporary caps or plugs in ends of uncompleted piping and when work stops at the end of each day.

END OF SECTION

SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial electric water heaters.

B. Related Sections:

1. Section 22 00 01 – General Plumbing Requirements.
2. Section 22 11 00 - Facility Water Distribution: Supply connections to domestic water heaters.
3. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. American Society of Mechanical Engineers:

1. ASME PTC 25 - Pressure Relief Devices.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.

C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.

D. Manufacturer's Installation Instructions: Submit mounting and support requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.5 QUALITY ASSURANCE

A. Conform to ASME for construction of water heaters

B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1.

C. Installer: Company specializing in performing Work of this section with minimum three years of experience.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Products storage and handling requirements.

B. Accept water heaters on site in original labeled cartons. Inspect for damage.

C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish three-year manufacturer warranty for domestic water heaters.

PART 2 - PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS

A. Furnish and install where shown on Drawings water heater(s) equivalent to A.O. Smith “Custom Xi” of capacity and characteristics scheduled on drawings. Water heater(s) shall be U.L. listed and approved by NSF Standard No 5, and ASHRAE 90.1 Compliant.

B. Water heater(s) shall:

1. Water heater shall have LCD display with built in diagnostic and troubleshooting information.
2. Tank(s) shall be rated for 150 PSI working pressure and equipped with dual extruded high-density anodes.
3. All internal surfaces of the heater(s) exposed to water shall be glass-lined with an alkaline borosilicate composition that has been fused to steel.
4. Electric heating elements shall be medium watt density screw-in type with Incoloy sheath and ceramic terminal block.
5. Internal power circuit fusing shall be provided. Element operation shall be linear sequencing through individual magnetic contactors. Control circuit shall be factory fused and include an immersion thermistor temperature probe with built-in ECO control. Control cabinet and jacket shall be of baked enamel finish and shall provide full size control and element compartment and enclose tank with foam insulation.
6. The heater tank shall have a three-year limited warranty and controls and accessories shall have a one-year limited warranty as outlined in the written warranty.

7. Meets or exceeds the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1.
8. Water heater should incorporate the iCOMM™ system for remote monitoring, leak detection and fault alert.

C. Certification and Codes: The complete water heater shall be UL listed and shall meet the standards of ASHRAE 90.1-2010. The water heater shall fit properly in the floor space ("footprint") indicated in the Drawings. Installation must be completed in accordance with the codes and standards listed in Section 23 00 00.

D. Startup: The hot water generators shall be started up by a factory trained technician. The factory technician shall also provide technical and practical operation and maintenance training.

2.2 DOMESTIC HW CIRCULATING PUMPS

A. Refer to Section 22 11 00 for circulation components.

2.3 SUPPORTS

A. Refer to Section 22 05 29 - Hangers and Supports for Plumbing

2.4 DIELECTRIC CONNECTION

A. Refer to Section 22 11 00 for Dielectric Connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base on each side. Refer to Division 03.

C. Connect domestic cold-water piping to supply and return water heater connections.

D. Install the following piping accessories. Refer to Section 22 11 00.

1. On supply:

    a. Thermometer well and thermometer.
    b. Strainer.
    c. Pressure gage.
    d. Shutoff valve.

2. On return:

    a. Thermometer well and thermometer.
    b. Pressure gage.
    c. Shutoff valve.

E. Install discharge piping from relief valves and drain valves to nearest floor drain.

F. Install water heater trim and accessories furnished loose for field mounting.

G. Install electrical devices furnished loose for field mounting.

H. Install control wiring between water heater control panel and field mounted control devices.

I. Install ASTM Expansion tank on cold water supply.

J. Provide Drain Pan.

K. Install hangers and supports in accordance with Section 22 05 29. Provide non-metallic coatings or inserts on attachments for electrolytic protection where attachments are in direct contact with copper piping.

L. Furnish and install an expansion tank on supply side of the water heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacture's recommendations.

M. Expansion tank factory pre-charge pressure may not be correct for this installation. Tank must be charged to system design fill pressure before being filled with water. If the system has been filled, the tank must be isolated from the system and the tank emptied before charging. Verify static pressure within the existing domestic hot water system at the Site and adjust tank pressure accordingly.

N. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.

O. When installed water heaters are not equipped with integral temperature gauge, provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater. Size and locate gauges to be easily readable from a standing position.

P. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

Q. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.

R. Pipe T&P relief valve discharge and all equipment drains indirectly to appropriate floor drain.

S. Set the operating and safety controls.

T. Set thermostats on domestic water heaters to deliver maximum water temperature as indicated on Contract Drawings.

3.2 SCHEDULES – Refer to Drawings

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Lavatories.
3. Sinks.
4. Service sinks.
5. Electric water coolers.

B. Related Sections:

1. Division 07 – Joint Protection: Product requirements for calking between fixtures and building components for placement by this section.
2. Section 22 00 01 – General Plumbing Requirements.
3. Section 22 11 00 – Facility Water Distribution: Supply connections to plumbing fixtures.
4. Section 22 13 00 – Facility Sanitary Sewerage: Waste connections to plumbing fixtures.
5. Section 22 45 00 – Emergency shower and eye wash equipment.
6. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI A117.1 – Accessible and Usable Buildings and Facilities.
2. ANSI Z124.1 – Plastic Bathtub Units.
3. ANSI Z124.2 – Plastic Shower Units.
4. ANSI Z358.1 – Emergency Eyewash and Shower Equipment.

B. Air-Conditioning and Refrigeration Institute:

1. ARI 1010 – Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:

1. ASME A112; Plumbing Fixture Standards

D. National Sanitation Foundation

1. NSF/ANSI 61: Drinking Water System Components- Health Effects for fixtures material that will be in contact with potable water.

E. Texas Department of Licensing and Regulation, Texas Accessibility Standards of the Architectural Barriers Act, Article 9102, Texas Civil Statutes

F. Americans with Disabilities Act, 28 CFR Part 35 Nondiscrimination on the Basis of Disability in State and Local Government Services, Final Rule, as published in the Federal Register

G. ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities" relative to plumbing fixtures for people with disabilities

H. Texas Administrative Code, Title 30, Part 1, Chapter 290, Subchapter G - Water Saving Performance Standards.

I. Refer also to plumbing drawing P1.1 for applicable codes.

1.3 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

1. Submittal shall have all options and all intended included items clearly identified on submittal.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim and finishes.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Record Documents:

1. Provide full written description of manufacturer’s warranty.
2. Manufacturer’s installation instructions.

F. Operation and Maintenance Data:

1. Include installation instructions, exploded assembly views, servicing requirements, inspection data, installation instructions, spare parts lists, replacement part numbers and availability, location and contact numbers of service depot, for all plumbing specialties installed.

G. Division 01 – Product Requirements; Substitution Request.

1. Prior to submitting a product or a manufacturer that is not the basis of design or listed as an approved equal; the contractor and/or the vendor shall submit a substitution request.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 – Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists. Provide contact number and location of supplier.

1.5 QUALITY ASSURANCE

A. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

B. Fixtures, trim, accessories and carriers of any one type shall be by the same manufacturer throughout.

C. All fixtures and trim shall be new, institutional/commercial quality and free from mars, chips, scratches, blemishes or any defects.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage

C. Equipment, fixtures and appurtenances shall not be allowed to be exposed to exterior weather or elements. Equipment, fixtures and appurtenances stored outside shall be covered by a weather-proof covering at all times and shall be stored on pallets or rack systems above the ground. Equipment, fixtures and appurtenances stored inside shall be covered to protect same from construction debris and activities and shall be stored on pallets or rack systems above the floor. Equipment, fixtures and appurtenances shall not be allowed to be stored within the construction area in a disorderly fashion. Cleanliness of the work area and safety of the construction personnel shall be the first consideration.

D. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

E. Do not allow use of installed fixtures or trim, other than testing during construction phase of the project.

1.8 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 1-year manufacturer warranty for plumbing fixtures. Warranty shall not begin until acceptance by Owner.

1.9 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor shall provide plumbing fixtures where indicated on the Drawings. These plumbing fixtures shall be standard products of manufacturers scheduled or listed on Drawings. Where one manufacturer is scheduled or listed on Drawings, the intent is not to limit competition or to write a closed specification, but rather to set a standard of quality. Refer to Division 01 for product options and substitution procedures. The fixtures shall be free from mars or chips and shall be new, first quality and shall be furnished with sufficient supports in order to adequately hang each and every unit.

B. The space between fixtures and masonry walls shall be grouted with White General Electric Silicone flexible grout. The space between fixtures and sheetrock or wood panel walls shall not be grouted but the fixture shall fit flat against the wall surface with no more than 1/16" gap.

C. All faucets, fittings, supply stops and similar devices shall be of one manufacturer unless otherwise specified. All water faucets and valve bodies shall be cast brass with a minimum copper content of 85%. They shall contain standardized interchangeable operating units constructed of a removable and replaceable unit containing all parts subject to wear. All water faucets shall contain an adjustable internal volume control unit. All exposed parts shall be chromium plated.

D. All accessible fixtures shall meet the requirements of ADA, ANSI A117.1, ANSI Z124.2 and the State of Texas Accessibility Standards (TAS). The Contractor shall confirm locations with the Architectural drawings.

E. Provide ADA/TAS compliant molded insulation on exposed water and drain components (piping, stops, etc.) beneath ADA accessible lavatories and sinks. Insulation shall be designed to allow removal and re-installation for pipe servicing. Insulation to be molded vinyl with added cushion and thermal resistance.

F. Provide water hammer arrestors at all quick closing valves such as water closets, sensor faucets, knee or foot operated fixtures, etc.

G. Coordinate special blocking, other wall supports, floor bracing or other structural bracing with General Contractor.

H. Point of use thermostatic mixing valves located under sinks and lavatories shall be secured to the wall with a mounting bracket and located under the sink. Supply hoses shall be ordered to the correct length. Excess supply hose shall be removed; wrapping excess supply tubing around other trim is not allowed.

I. Any condensate connection to the tail piece shall be done with chrome plated brass or copper piping and held tight to the wall. Exposed Rubber hose will not be allowed. Coordinate with mechanical contractor.

J. All fixtures and equipment shall be lead free and shall be assembled and manufactured with lead free solders in accordance with NSF-61-G and NSF 372.

2.2 FITTINGS AND PIPES

A. Fittings and piping shall be brass and, wherever exposed, shall be polished chrome-plated. Provide tight fitting wall or floor escutcheons of chrome-plated brass wherever pipes pass through floors, walls or ceilings.

B. Furnish and install all required water, waste, soil and vent connections to all plumbing fixtures, together with all fittings, supports, fastening devices, cocks, valves, traps, etc., leaving all in complete working order.

C. Supplies for all lavatories, sinks, tank type water closets and drinking fountains shall be loose key angle stops with female inlets and shall include wall flanges, and O.D. flexible risers with bullnose or flared end outlets. All components to be chrome plated. In all cases, all piping, tubing, fittings, and faucets shall be installed using a mechanical non-slip connection, such as bullnose, flared, flanged, ferrule or threaded fittings. Fittings requiring a friction fit using slip-on or gasketed connections are not acceptable.

D. Provide water hammers arrestors as indicated on the drawings and/or at all locations with quick closing valves such as water closets, automatic fixtures, knee operated or foot operated fixtures, ice makers, washer boxes, water softeners, etc.

2.3 PLUMBING FIXTURES

A. Refer to Plumbing Fixture Schedules on the Plumbing drawings for basis of design fixtures and acceptable manufacturers offering equivalent products.

B. All vitreous china shall be white unless noted otherwise

C. Lavatory and sink faucets in patient care areas shall have a minimum of 5-inches clearance from the spout of the faucet to the rim of the sink per DSHS Licensing standards.

D. Fixtures shall have flow control devices to limit flow of water to a maximum rate in accordance with local code or in accordance with the schedules for projects that require a more stringent water use criteria.

2.4 FLUSH VALVE WATER CLOSETS

A. Water Closets:

1. Complies with ASME A112.19.2
2. Tested by an independent MaP-approved laboratory, MaP tested and rated for a minimum of 350 grams or greater.
3. The bowl shall be rated for a maximum of 1.26GPF unless noted otherwise.
4. Water closets installed within non-ambulatory patient toilet rooms shall be furnished with slotted rim or bed pan lugs for bed pan holding.

B. Exposed Flush Valve:

1. Complies with ASME A112.18.1 and ASME A122.19.2.
2. Rated for a maximum 1.28-gallon flush volume unless noted otherwise. Flush valve shall match the rating of the water closet.
3. ADA compliant non-hold open handle, solid non-spinning escutcheon, comply with IAPMO/ANSI 2124.5-2013
4. Water closet and urinal flush valves shall be chrome plated brass when exposed.
5. All electronic flush valves shall be provided with manual override activators. Exception: Flush valves located within specimen collecting toilet rooms shall be hard wired without manual override.
6. Flush valves in non-ambulatory patient rooms shall be manually operated and have integral bed pan washers. Provide offset tail piece as need to avoid conflict with grab bars in ADA/TAS patient toilet rooms.

C. Seat:

1. Water closets seats shall be commercial/institutional grade, white in color, have open front and Self-sustaining check hinges with non-corrosive 300 series stainless steel posts and pintles.

D. Wall-Mounted Carrier: ASME A112.6.1; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, provide optional foot support, threaded fixture studs with nuts and washers.

E. Water closet bowl gaskets shall be neoprene, felt gaskets, cork gaskets and wax rings are not permitted.

F. Bolts and fasteners shall be non-corrosive stainless steel 300 series or solid brass; Brass plated is not allowed.

2.5 LAVATORIES

A. Vitreous China Wall Hung Basin:

1. Manufacturer: As scheduled.
2. Other acceptable manufacturers offering equivalent products.

    a. Kohler.
    b. American Standard.

3. ASME A112.19.2; vitreous china wall-hung lavatory with 4-inch-high back, rectangular basin with splash lip, front overflow, and soap depression.

B. Supply Fitting:

1. Manufacturer: As scheduled.
2. Other acceptable manufacturers offering equivalent products.

    a. Chicago.
    b. T & S Brass.
    c. Delta.
    d. Sloan

3. ASME A112.18.1; chrome-plated supply fitting.

C. Accessories:

1. Chrome plated 17-gage brass P-trap and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Flexible supplies – Braiden 304 stainless steel; heavy duty plated brass nuts sized appropriately. No more than 3 inches of slack permitted.

D. Wall-Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, [threaded studs for fixture hanger,] [concealed arm supports,] bearing plate and studs.

2.6 SINKS

A. Bowl:

1. Manufacturer: As Scheduled.
2. Other acceptable manufacturers offering equivalent products.

    a. JUST.
    b. Kohler.
    c. American Standard.
    d. ELKAY

e. Moen

3. ASME A112.19.3; 18-gage thick, Type 304 stainless steel, self-rimming and undercoated, with 1-1/2-inch chromed brass drain 3-1/2 inch crumb cup and tailpiece, ledge back drilled for trim.

B. Trim:

1. Manufacturer: As scheduled.
2. Other acceptable manufacturers offering equivalent products.

a. American Standard.
b. Chicago.
c. Delta.
d. Kohler.
e. Substitutions: Permitted.

3. Accessories: Chrome-plated 17-gage brass P-trap and arm with escutcheon, screwdriver stop, flexible supplies.

2.7 ELECTRIC WATER COOLERS

A. Fountain:

1. Manufacturer: As Scheduled.
2. All Bottle Fillers located on Bi-level electrical water coolers shall be located on the lower-level drinking water unit to comply with TAS/ADA requirements.
3. Other acceptable manufacturers offering equivalent products.

a. Chicago.
b. Elkay.
c. Halsey Taylor.
d. Oasis.
e. Sunrock.

2.8 SERVICE SINKS

A. Bowl:

1. Manufacturer: As scheduled.
2. Other acceptable manufacturers offering equivalent products.

a. Stern Williams.
b. Fiat.
c. Precast Terrazzo Products.
d. Substitutions permitted.

B. Trim:

1. Manufacturer: As Scheduled.
2. Other acceptable manufacturers offering equivalent products.

a. American Standard.
b. T & S Brass.

c. Chicago.
d. Kohler.
e. Substitutions: Permitted.

3. ASME A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

C. Accessories:

1. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.
2. Hose clamp hanger.
3. Mop hanger for min of 5 mops.

2.9 LAVATORY INSULATION KIT

A. Manufacturers: As scheduled

1. Truebro.
2. Substitutions: Permitted.

B. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16-inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 09 90 00, color to match fixture.

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

G. For ADA accessible water closets, install flush valve with handle to wide side of stall.

H. Tighten all Faucet spouts such they are not loose or rotate (unless they are meant to by design, i.e. double compartment or triple compartment sinks). ALL single sink faucet spouts shall not rotate,

I. Adjust, in the field, ALL point of use thermostatic mixing valves. These are sent from the factory set for 140degF entering Hot Water. Adjust for 120degF entering Hot water.

J. The space between fixtures and masonry walls and tile shall be grouted.

K. The space between fixtures and sheetrock or wood panel walls shall not be grouted but the fixture shall fit flat against the wall surface with no more than 1/16" gap.

L. The space between Anti-ligature fixtures and walls shall be grouted with Pick-proof and tamper resistant flexible grout.

M. Provide ADA/TAS compliant molded insulation on exposed water and drain components (piping, stops, etc.) beneath ADA accessible lavatories and sinks. Insulation shall be designed to allow removal and re-installation for pipe servicing. Insulation to be molded vinyl with added cushion and thermal resistance.

N. Provide water hammer arrestors at all quick closing valves such as water closets, sensor faucets, knee or foot operated fixtures, etc.

O. Coordinate special blocking, other wall supports, floor bracing or other structural bracing with General Contractor.

P. Point of use thermostatic mixing valves located under sinks and lavatories shall be secured to the wall with a mounting bracket and located under the sink. Supply hoses shall be ordered to the correct length. Excess supply hose shall be removed; wrapping excess supply tubing around other trim is not allowed.

Q. Any condensate connection to the tail piece shall be done with chrome plated brass or copper piping and held tight to the wall. Exposed Rubber hose will not be allowed. Coordinate with mechanical contractor.

R. Provide water hammers arrestors as indicated on the drawings and/or at all locations with quick closing valves such as water closets, automatic fixtures, knee operated or foot operated fixtures, ice makers, washer boxes, water softeners, etc.

S. Locate water hammer arrestors above laying ceilings to eliminate access panels in walls.

T. Lavatory and sink faucets in patient care areas shall have a minimum of 5-inches clearance from the spout of the faucet to the rim of the sink per DSHS Licensing standards.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork Shop Drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Division 01 – Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Division 01 – Execution and Closeout Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 – Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

3.8 SCHEDULES – REFER TO PLUMBING DRAWINGS

3.9 FIXTURE MOUNTING HEIGHTS: - REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTINGS HEIGHTS OF ADA/TAS FIXTURES.

A. Water Closet:

1. Adults

    a. Standard: 15 inches to top of bowl rim.
    b. Accessible: 18 inches to top of seat.

B. Water Closet Flush Valves:

1. Adults

    a. Standard: 11 inches min. above bowl rim.
    b. Recessed: 10 inches min. above bowl rim.

C. Lavatory:

1. Adults

    a. Standard: 31 inches to top of basin rim.
    b. Accessible: 34 inches to top of basin rim.

D. Drinking Fountain:

1. Adults

    a. Standard Adult: 40 inches to top of basin rim.
    b. Accessible Adult: 36 inches to top of spout.

END OF SECTION

SECTION 23 00 01 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic HVAC Requirements specifically applicable to Division 23 sections, in addition to Division 01 - General Requirements.

1.2 REFERENCES

A. All references in Division 23 to code standards or other publications shall be the latest edition/version, unless noted otherwise.

1.3 PRE-CONSTRUCTION & PRE-INSTALLATION MEETINGS

A. A pre-construction meeting shall occur between General Contractor/Construction Manager, MEP Engineers of Record, Owner (unless Owner opts out), Commissioning Agent (if applicable) and all relevant MEP trade subs. The focus of the meeting shall be on adherence to the Contract Documents and Owner standards. The General Contractor/Construction Manager shall schedule and conduct this meeting and coordinate with Engineer for agenda.

B. Pre-installation meetings shall be scheduled and conducted by the General Contractor/Construction Manager between General Contractor/Construction Manager, MEP Engineers of Record, Owner (unless Owner opts out), Commissioning Agent (if applicable) and all relevant MEP trade subs for all items indicated below where applicable to the project. The focus of the meeting shall be on adherence to the Contract Documents and maintainability of equipment and accessories.

1. Air terminal unit coil piping
2. Roof-mounted air handlers - hydronic piping vestibule piping layout and roof curb installation
3. Central plant ductwork and piping installation
4. Building automation system tie-in with DX unitary controller
5. Buried piping installation

1.4 PLANS

A. These specifications are accompanied by plans indicating typical layouts, pipe and equipment location, etc. The plans and these specifications are complimentary each to the other and what is called for by one shall be as binding as if called for by both. Should there be a conflict between Drawings and specifications regarding a material shown or work described or detailed then the material of work having the greater value shall be provided.

B. The plans as prepared are in general diagrammatic. The contractor shall carefully lay out his work at the site to conform to the architectural, mechanical, electrical and structural conditions to provide grading of piping, to avoid all obstructions and to conform to details of installation as shown on the plans and supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated satisfactorily operating installation. The General Contractor must coordinate the work of all trades. All necessary offsets in piping, fittings, ductwork, etc. required to avoid interferences between piping, equipment, structural and architectural work are not shown but shall be furnished and installed by the Contractor without additional expense to the Owner.

C. These specifications and plans accompanying same are intended to cover systems which will not interfere with the design of the building, which will fit into the available spaces, and which will insure complete and satisfactory systems. Each contractor shall, therefore, carefully examine the plans and the building and shall be responsible for the proper fitting of his material and apparatus into the building.

D. The size of mechanical and electrical equipment indicated on the plans is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space with the manufacturer's recommended clearances allocated for same on the plans. It shall be the Contractor's responsibility to furnish data to evidence that sufficient space can be provided for the installation of proposed equipment and that adequate access will exist for servicing and maintenance of equipment. Should changes become necessary during construction, the contractor shall make such necessary changes at his (the Contractor's) own expense.

E. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention no later than ten (10) days prior to the bid date, unless specified otherwise in Division 01. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus or equipment.

1.5 CHANGES

A. Any changes from the plans necessary to make this work conform to the building as it is constructed, to make this work fit the work of other trades or to make this work conform to the rules of city and municipal bodies having jurisdiction shall be made by this contractor at no additional cost to the Owner. However, no changes shall be made from the work described on the plans and these specifications except on written order from the Architect/Engineer.

B. If any changes are required other than those mentioned above and the changes involve extra work on the part of the Contractor, no charges for this extra work shall be allowed unless authorized in advance of the work by a written order from the Owner and/or Architect/Engineer stating the charges to be made for the work.

C. Proposed use of item or equipment other than that specified or indicated may require redesign of structure, partitions, foundations, piping, wiring, or other parts of mechanical, electrical, or architectural layout. Redesign, new drawings, and detailing required shall be prepared and submitted to Architect/Engineer for approval.

D. Where approved deviation requires different quantity, size and arrangement of wiring, conduit, equipment, etc. from that specified or indicated, provide such items and all other additional equipment required by system at no additional cost to the Owner.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection:

1. All work, equipment and materials shall be protected at all time to prevent damage or breakage either in transit, storage, installation or testing. All openings shall be closed with caps or plugs during installation.
2. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
3. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Architect. In particular, ductwork insulation which becomes

saturated will be rejected and must be removed from the job. Such repair or replacement shall be at no additional cost to the Owner.

4. Protect interiors of new equipment, ductwork, and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
5. Existing equipment, ductwork, and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping, Ductwork, and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Owner.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 EXISTING FACILITIES

A. All piping, valves, fittings, switches, starters, conduit boxes and/or any other items of mechanical or electrical equipment which are not in service at the completion of this contract shall be removed, unless otherwise noted.

B. Where an existing service to existing building requires disconnection to facilitate installation of this work, this Contractor shall include in his bid the cost of such disconnecting, re-routing and re-connecting. Where any existing facilities which are to remain occupied are affected by disconnection, re-routing or re-connection, then such disconnecting, re-connecting and re-routing shall be done in such a manner so as not to interrupt any service to the building. Satisfactory arrangements shall be made with local authorities and/or the various utility companies involved. The method of disconnecting, re-routing and re-connecting shall be as shown on the Drawings, or if not shown on the drawings, subject to the approval of the Architect and Owner.

C. Unless noted otherwise, all equipment and material indicated or specified to be removed shall become the property of the Contractor.

D. This Contractor shall carefully coordinate work in and around existing services and equipment and adjoining rooms to remodel areas. Coordinate shut-down, removal, capping, and turn-on of existing services with the Owner’s facilities' department and general contractor to provide continuous (uninterrupted) service throughout the construction period. This Contractor shall refer to the architectural plans and specifications and thoroughly familiarize himself with the construction phasing in remodel areas before beginning work.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 50 degrees F minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. No storm water or ground water leakage permitted. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by the Owner.

1.8 SUBSTITUTIONS

A. The materials, products and equipment described and specified establish a standard of quality, function, dimension and appearance to be met by any proposed substitutions.

B. Reference Division 01 – Product Requirements.

C. Substitution requests are only required where specific manufacturers are listed or scheduled.

1.9 SUBMITTALS

A. Submit under provisions of Division 01.

B. The Contractor shall furnish copies of the manufacturer's literature and drawings describing all proposed equipment and materials indicated in the specifications. The proposed use of the exact equipment and materials specified shall not change this requirement of including literature describing the proposed equipment. Manufactured items proposed for use, whether specified or proposed for substitution, shall be the current, catalogued product of the manufacturer, and replacement parts shall be available.

C. Manufacturer's regular catalog sheets will not be acceptable under this requirement unless they indicate completely all of the specification requirements. Where drawings cover several sizes or types of construction they shall clearly indicate the size or type of construction to be used on the project. In cases where several sizes of the same type of equipment are required to be furnished, the submittal shall include a schedule identifying each piece of equipment, complete with all capacity information needed to compare every submitted item with its respective specified item. Annotate to indicate exact model, size, and type submitted.

D. Brochures shall contain a certification that the equipment or materials are suitable for conditions shown and specified; that the equipment or materials are believed to be in conformity with the plans and specifications, except as may be specifically described and that approval is recommended. The certification shall be signed by the Contractor. Brochures received not in conformity with these requirements will be returned for required actions. Any deviation from the requirements of the specifications shall be clearly noted and marked for the Engineer's consideration.

E. Approval of the brochures, or any part of the contents therein, shall not eliminate responsibility for compliance with the plans and specifications, unless specific attention has been called in writing to proposed deviations at the time of transmittal of the brochures and such deviations have been approved, nor shall it eliminate the requirements or the responsibilities, if there are errors of any sort in the data submitted.

1.10 INTERFERENCES AND COOPERATION

A. The plans are generally diagrammatic and the Contractor shall coordinate the work of the different trades so that interferences between piping, equipment, structural and architectural work will be avoided. Not all offsets in piping, ductwork, etc., are shown. The Contractor shall cooperate with the General Contractor and all other contractors to coordinate their work to avoid interferences and delays and arrange all parts of the work to harmonize in service and appearance with all other parts.

B. The General Contractor shall coordinate the work of all trades. The various systems to be installed shall follow the normal, industry standard priority of systems installation with the highest system to lowest system installation as follows (unless superseded by details in the Drawings):

1. HVAC ductwork shall be installed up and against building (floor/roof) structural members.
2. Sanitary waste and storm drainage piping system shall begin horizontal routing as high as possible between structural members, offsetting vertically only to avoid conflict with structure or to drop below HVAC ductwork where offset is unavoidable.
3. Electrical conduit shall be installed up, and against building structure, running parallel with HVAC ductwork and offsetting up into structural bay (void) or below HVAC ductwork to

obtain a change in direction or branch take-off. Electrical conduit installation shall not control or dictate the routing or installation of the HVAC ductwork.

4. HVAC heating and chilled water supply and return piping, domestic hot and cold water supply and hot water circulating return piping, and medical gas piping shall be installed beside and below the HVAC ductwork and electrical conduit. Preferred installation shall be on trapeze, wall brackets, or racked on vertical channel on the wall above the ceiling line. The completed installation shall not conflict with the installation or removal of ceiling system components of tile. All main-run and branch take-off isolation valves shall be readily identifiable and accessible from a standing position on a step ladder.
5. Fire sprinkler piping system shall be installed below all other systems and components. The fire sprinkler piping shall not conflict with the installation or removal of ceiling system components or tile. The fire sprinkler system piping layout and installation shall be coordinated by the fire sprinkler contractor and the General Contractor with all other trades performing work in the affected area, to avoid conflict with the installation or removal of any other systems components, or to prevent ready access to valves, equipment of the other trades. Do not install sprinkler piping until ductwork mains are in place.

C. Provide an overhead coordination submittal per Division 01. The submittal shall include all structural, plumbing, mechanical, electrical and fire protection components.

1.11 MATERIALS AND WORKMANSHIP

A. All materials shall be new, of the quality specified and free of any defects. Manufacturer's names are listed to establish a standard of quality and construction.

B. The Contractor will be responsible for transportation of his materials to the job and for their storage and protection until the final acceptance of the job.

C. Contractor shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds and all labor required for the safe and expeditious execution of his contract.

1.12 PERMITS AND INSPECTIONS

A. The Contractor will be responsible for all permits and inspections required by law for the completion of his work. Cost of all permits and inspections shall be paid for by the Contractor. The Contractor shall obtain and pay for all certificates of approval which must be delivered to the Architect before final acceptance of the job. All materials and labor furnished by the Contractor shall be in strict accordance with the rules and requirements of the National Board of Fire Underwriters, state and municipal regulations and other authorities who may have lawful jurisdiction over the work being done.

B. Each contractor shall be responsible for coordinating their work with the General Contractor and scheduling AHJ required inspections through the General Contractor to allow inspections to be performed without impeding the progress of construction. Generally, the Contractor shall plan for inspections to occur two (2) weeks prior to the scheduled concealment of work in the area of inspection.

1.13 ENGINEERING DESIGN TEAM OBSERVATIONS

A. Each contractor shall be responsible for coordinating their work with the General Contractor and scheduling progress observations through the General Contractor to allow for the following observations to be performed without impeding the progress of construction. Generally, the Contractor shall plan for observations to occur two (2) weeks prior to the scheduled concealment of work in the area of observation.

B. In general, observations for this project shall include but not be limited to:

1. Rough Wall: All utilities, services and systems in-place including wall studs, cross bracing, supports, etc. (No sheetrock or insulation).
2. Corrected Rough Wall: (Before Sheetrock).
3. Above Ceiling: All utilities, services and systems in place, labeling on exposed piping (No insulation on piping systems. Ceiling grid/channels may be installed but no sheetrock or ceiling tile).
4. Above Ceiling Final: All utilities, services and systems complete including hangers, insulation, and labeling (ceiling grid and/or channel may be in place but no sheetrock or ceiling tile shall be installed).
5. Substantial Completion: All surfaces complete, fixtures installed and trim-out complete.
6. Final: Cleaned and ready for occupancy.

1.14 EXAMINATION OF SITE

A. All Contractors submitting proposals for this work shall first examine the site and all conditions thereon and therein. All proposals shall take into consideration conditions as may affect the work under this contract. They shall satisfy themselves as to existing grades and the actual formation, and soil conditions.

B. Contractors shall verify all service locations, elevations, sizes, etc. No information given on the plans shall relieve the Contractor of this responsibility.

C. Before starting work, the Contractor shall verify all associated existing systems, pipe and duct sizes, locations, and dimensions so that the new systems can be properly connected as indicated on the documents.

1.15 QUALITY ASSURANCE

A. Perform Work in accordance with codes listed on the drawing sheets the local authority having jurisdiction (AHJ), and the Architect/Engineer. As the minimum standard for the level of quality, in all cases the greater quantity or better quality shall be the first consideration for the basis of an acceptable product or process. The local authority having jurisdiction, the Architect and the Engineer shall have the final authority on the approval and/or use of any product or process specified or submitted for substitution. The greater quality and/or value specified herein for the system(s) and various components and installation procedures shall take precedence over the minimum requirements of the herein before mentioned codes.

B. Equipment and Components: Bear UL and FM label or marking.

C. Welding Materials and Procedures: Perform to ASME Code.

D. Valves: Bear UL/FM label or marking. Provide manufacturer’s name and pressure rating marked on valve body.

E. Piping: All piping installed on this project shall bear the complete ASTM and Manufacturer’s marking. Labeling and identification requirements as required by ASTM. All installed piping 5’-0” or greater in length shall be readily identifiable per ASTM labeling criteria. Piping not bearing this identification upon installation shall be removed and replaced by the correctly labeled piping. Piping shall not be re-stenciled after it is installed, to meet this requirement.

1.16 CONTROLS

A. Where “automatic controls” are called for in the plans and specifications, all the control instruments, such as motorized valves, etc., shall be provided by the Contractor. The Drawings may show some power connections to controls equipment. However, if more power is required, then the Contractor shall provide this power.

1.17 UNIONS

A. No unions are to be placed in any pipe in a location which will be concealed or inaccessible after completion of the building unless furnished with an access panel either as shown on the drawings or as specified herein. Unions must be installed on each side of all pieces of equipment such as heating/cooling equipment, coils, pumps, etc., so that such equipment may be readily disconnected in location that equipment can be disconnected and removed.

1.18 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.

F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

G. Electrical and Pneumatic Interconnection of Controls and Instruments: This is generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.

H. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

I. Work in Existing Building: Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner.

Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to Cutting and Patching article in Part 3 of this section.

1.19 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

D. Temporary equipment shall be provided when required by the phasing or called for specifically on the plans. The contractor shall maintain and operate temporary equipment or new equipment operated during construction strategically to provide desired indoor air conditions or for “dust” control.

E. Temporary filters shall be provided throughout the entire construction period if the systems are operational. The frequency of replacement shall be directly related to the amount of airborne debris during the particular phase of construction. Different areas in different phases of the construction may require different frequencies of temporary filter replacement.

F. Contractor shall keep building sealed weather tight if HVAC is turned ‘ON’ prior to substantial completion.

1.20 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor. Such access shall be provided without additional cost or time to the Owner. Where work is in an operating facility, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the facility.

B. In an operating facility, maintain the operation, cleanliness and safety. The Owner’s personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and facility operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of facility operation. Perform all flame cutting to maintain the fire safety integrity of this facility. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards.

C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from the property expeditiously and shall not be allowed to accumulate.

E. At any time work is occurring when the building is occupied, avoid using tools that create excessive noise that might disrupt the building operations (e.g. concrete breaking equipment, excavating equipment, hammer drills, screw guns, etc.). Use other types of tools or schedule work to occur outside of normally occupied hours. Carefully plan water control for all coring and sawing operations to prevent damage and disruption of occupants.

1.21 INDOOR AIR QUALITY CONTROL

A. All Adhesives, sealants, paints, coatings applied within the weatherproofed interior of the building shall comply with applicable VOC thresholds of SCAQMD 1113 and 1168.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 ESCUTCHEONS AND PLATES

A. Where pipes or ducts pass through ceilings or walls in finished spaces, install sectional plates or escutcheons to cover the annular opening between pipe and sleeve. Solid plates with set screws shall be used where the sectional plates will not stay in place or are not available in the required size, or where other individual specification section(s) require one piece or greater quality escutcheons or plates.

B. Inside diameter of escutcheons shall fit around insulation and around pipe or duct when not insulated; outside diameter shall cover sleeve. Secure escutcheons or plates to pipe or duct or

sleeve but not to insulation. All escutcheons shall be triple nickel-chromium plated brass, or type 316L stainless steel

2.4 INSULATION

A. All insulation materials used inside the building on this project, including finishes and adhesives on the exterior surfaces of ducts, pipes and equipment shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less as determined by an independent testing laboratory in accordance with NFPA 255 as required by NFPA 90A, unless noted otherwise acceptable.

2.5 SOLENOID VALVES

A. All solenoid valves used in hydronic systems shall be the slow acting type.

2.6 ASBESTOS

A. Materials containing asbestos are not permitted.

B. If any asbestos-containing material is discovered or suspected, the contractor shall immediately cease any and all work in that area. Cover the exposed material in plastic containment without disturbing the exposed material and notify the Architect and the Owner's representative.

C. Certify in writing that neither the Contractor nor any of Contractor's subcontractors or suppliers will supply any materials that contain any asbestos in any form for this Project.

PART 3 - EXECUTION

3.1 ACCESS PANELS

A. All valves, traps, drains, cleanouts, equipment, etc., must be accessible. The Contractor shall, wherever required to service his installation, coordinate size and location of access panels with General Contractor. Refer to Division 08 – Access Doors and Frames.

3.2 FIRESTOPPING

A. Firestopping: Unused slots, sleeves and other penetrations in floors, walls or other general construction shall be closed and sealed with an approved firestopping material.

1. Reference Division 07 – Firestopping for appropriate firestopping material required for each wall rating and penetration size and type.
2. Floor slots and openings shall be closed with 16 gauge galvanized steel sheet supported on 1-inch by 1-inch by 1/8-inch structural angle drilled or supported with powder-driven studs into the building structure. Firestop with a layer of silicone elastomer not less than 1-inch thick which completely fills the opening. The top surface of the silicone elastomer shall be approximately 1-inch below the finished floor slab.
3. Openings in walls shall be closed with 16 gauge galvanized steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of the steel sheet with not less than 1/8-inch thick layer of non-sagging silicone elastomer to fully cover the opening.
4. Single or multiple pipes passing through walls and floors shall have the annular space between pipes or between pipes and structure filled with silicone elastomer to provide a rated firestop (rated to match the assembly) for floors and walls.

B. Pipe and Ducts: The annulus between exposed pipe and ductwork and walls or floors in finished spaces shall be refilled, sealed and painted to match adjacent surfaces.

C. Future Slots: Cap ends of sleeve and mark as future.

3.3 CUTTING AND PATCHING

A. All cutting and patching of floors, walls and ceilings for installation of work covered in these sections will be done by the General Contractor.

B. Where it becomes necessary to drill into or cut through any existing or completed floors, walls or ceilings to permit the installation of any work under this contract or to repair any defects that may appear up to the expiration of the guarantee, such cutting and patching shall be done by the General Contractor under the supervision of the Architect.

C. No joists, beams, girders or columns shall be cut without first obtaining written permission from the Architect or Structural Engineer.

D. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations approved by the Architect/Engineer. Impact type equipment shall not be used except where specifically approved by the Architect/Engineer. Openings in precast concrete slabs for pipes, etc., shall be core drilled to exact size.

E. Where core drilling or saw cutting of concrete floor or wall penetrations is required, work shall be performed in accordance with Division 03 Specifications. Where applicable Division 03 Specifications are not included in the Project, core drilling shall be in accordance with generally accepted standards and be performed by licensed personnel where applicable.

F. Contractor shall use ground penetrating radar (GPR) to scan areas of concrete prior to core drilling or saw cutting for embedments. Contractor shall clearly mark locations of embedments for review by Structural Engineer or owner’s construction representative before core drilling or saw cutting.

G. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner approved by the Architect/Engineer.

H. Plaster: All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

I. All drilling methods for expansion bolts, hangers and other supports shall be done subject to be approval of the Architect or Structural Engineer. Labor and materials required to replace or rebuild parts or injured portions shall be furnished at the Contractor's expense, subject to the satisfaction of the Architect.

J. Restoration: All openings shall be restored to "as new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

3.4 PAINTING

A. Types of paint shall be as specified in the Architectural specifications. Surfaces to be painted are identified in Division 09 and the drawings.

B. All surfaces to be painted shall be thoroughly cleaned, all rust scraped off and all oil and grease removed before any paint is applied.

C. Finishing paint coats shall not be applied until all the work is completed. Cloths shall be spread where necessary to prevent drops of paint, oil, etc. from defacing walls, floors, etc., and the Contractor shall be held responsible for all damage by neglect of such precautions. The finished conditions of the painting shall be subject to the approval of the Architect, who may require retouching or repainting of surfaces not properly finished.

3.5 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Owner operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Restore building to original condition upon completion of rigging work.

3.6 CLOSE OUT DOCUMENTATION AND TESTING REPORTS

A. Contractor shall provide Project Record Documents, Operation and Maintenance data and all product warranty data as specified in Division 01.

B. Contractor shall also provide copies of all piping and ductwork system test and certification reports for inclusion in project close out documents.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project. These requirements shall apply unless otherwise noted within each equipment specification.

B. Related Sections:

1. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 – Identification for Electrical Systems.
3. Section 26 29 13 – Enclosed Controllers.
4. Section 26 29 23 – Variable Frequency Motor Controllers.

1.2 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:

1. NEMA MG 1 – Motors and Generators.

C. International Electrical Testing Association:

1. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems..

1.3 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

B. Testing Agency: Company specializing in testing products specified in this section with minimum ten years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

D. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS

A. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.

1. Where motor will be utilized with a VFD as indicated in the Drawings, motor shall be rated for use with a VFD and provided with shaft grounding ring.
2. Voltage: As indicated on Drawings.
3. Service Factor: 1.15
4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
5. Insulation System: NEMA Class B or better.
6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
9. Sound Power Levels: Conform to NEMA MG 1.

B. Single Phase AC Induction Motors:

1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
2. Motor shall be permanently lubricated, heavy duty ball bearing type.
3. Voltage: As indicated on Drawings.

C. Brushless DC Motor/Electronically Commutated Motor (EC motor):

1. Internal motor circuitry shall convert supplied AC power to DC power to operate the motor.
2. Motors are permanently lubricated, heavy duty ball bearing type to match the equipment load.
3. Motor shall be speed controllable down to 20% of full speed. Speed shall be controlled by either a dial-mounted potentiometer at the motor or a 0-10 VDC signal. Refer to Drawings for specific requirements.
4. Motor shall be a minimum of 85% efficient at all speeds.
5. Voltage: As indicated on Drawings.

D. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

E. Motor Enclosure: meet conditions of the installation unless noted otherwise on the Drawings.

2.2 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned motors.

B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing motors to remain or are to be reinstalled.

3.2 INSTALLATION

A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

B. Install in accordance with manufacturer’s instructions.

C. Ground and bond motors in accordance with Section 26 05 26.

D. Verify that speed control method for brushless DC/electronically commutated motors (ECMs), is provided as scheduled in the Drawings.

3.3 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Perform all Work required to provide and install supports, hangers, anchors, sleeves and bases for all plumbing piping, equipment, system components and accessories, indicated by the Contract Documents with all supplementary items necessary for complete, code compliant and approved installation.

B. Section Includes:

1. Hangers and supports.
2. Accessories.
3. Flashing.
4. Equipment curbs.
5. Sleeves.
6. Formed steel channel.
7. Equipment bases (housekeeping pads).

C. Related Sections:

1. Division 03 – Concrete Forming and Accessories: Execution requirements for placement of inserts or sleeves in concrete forms specified by this section.
2. Division 03 – Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Division 07 – Firestopping: Product requirements for firestopping for placement by this section.
4. Division 07 – Sheet Metal Flashing and Trim: Product and execution requirements for sheet metal flashing and trim for placement by this section.
5. Division 07 – Joint Protection: Product requirements for sealant materials for placement by this section.
6. Division 09 – Painting and Coating: Product and execution requirements for painting specified by this section.
7. Section 23 05 48 – Vibration for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.
8. Section 23 21 13 – Hydronic Piping: Execution requirements for placement of hangers and supports specified by this section.
9. Section 23 22 13 – Steam and Condensate Heating Piping: Execution requirements for placement of hangers and supports specified by this section.
10. Section 23 31 00 – HVAC Ducts and Casings: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.5 – Refrigeration Piping.
2. ASME B31.9 – Building Services Piping.

B. ASTM International:

1. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 – Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 – Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 – Standard Test Method for Fire-Resistive Joint Systems

C. American Welding Society:

1. AWS D1.1 – Structural Welding Code – Steel.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
2. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.
3. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
4. MSS SP 90 – Guidelines on Terminology for Pipe Hangers and Supports.

E. Underwriters Laboratories Inc.:

1. UL 263 – Fire Tests of Building Construction and Materials.
2. UL 723 – Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 – Fire Tests of Through-Penetration Firestops.
4. UL 2079 – Tests for Fire Resistance of Building Joint Systems.
5. UL – Fire Resistance Directory

1.3 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer’s catalog data including load capacity.

C. Design Data: Indicate when requested, load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

E. Manufacturer's Installation Instructions: Submit special procedures and assembly of components.

F. UL/FM assembly sheets or WH assembly sheets for fire rated penetrations.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years of documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical and damage, by storing in original packaging.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Contractor shall review all drawings, including structural drawings, for details regarding pipe supports, housekeeping pads, anchors, hangers, and guides.

1.7 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Refer to individual system and equipment Specification Sections for additional support requirements. Comply with MSS SP-69 for support selections and applications that are not addressed within these Specifications.

C. Utilize hangers and supports to support systems under all conditions of operation, allowing free expansion and contraction, and to prevent excessive stresses from being introduced into the structure, piping or connected equipment.

D. All pipe supports shall be of the type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

E. Design hangers to impede disengagement by movement of supported pipe.

F. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

G. Wire or perforated strap iron will not be acceptable as hanger material.

H. Hanger rods shall be threaded on both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

I. Fasteners requiring explosive powder (shooting) or pneumatic-driven actuation will not be acceptable under any circumstances.

J. Nail drive anchors, plastic anchors or plastic expansion shields will not be permitted under any circumstances.

K. Each hanger shall be properly sized to fit the supported pipe or fit the outside of the insulation on lines, hangers shall not penetrate insulation. Hangers shall bear on the outside of the insulation, which shall be protected by support shields as specified. For piping larger than 2”,

protect insulation from crushing by means of a section of rigid insulation to be installed at hanger points. Refer to Section 23 07 00.

L. Hangers and clamps supporting and contacting individual non-insulated copper lines shall be copper or copper plated. Support individual non-insulated copper lines 4 inches and smaller with adjustable swivel ring hangers. Where non-insulated copper lines are supported on trapeze hangers or channels, the pipes shall be isolated from these supports with approved flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp. Plastic tape is not acceptable.

M. Field fabricated supports shall be constructed from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

N. Provide adjustable spring type hangers/isolators on all pipe hangers on the first 15 feet of pipe entering the building and where piping offsets vertically from one floor level to another.

O. Provide adjustable spring type vibration isolation hangers for piping connected to isolated equipment (i.e. pumps, etc.). Refer to Section 23 05 48.

P. Finishes:

1. All ferrous hangers, rods, inserts, clamps, stanchions, and brackets on piping within interior non-corrosive environments, shall be dipped in Zinc Chromate Primer before installation. Rods may be galvanized or cadmium plated after threading, in lieu of dipping zinc chromate.
2. All hangers and supports exposed to the weather, including roofs and building crawl space areas, shall be galvanized or manufactured from materials that will not rust or corrode due to moisture. All hangers and supports located within corrosive environments shall be constructed from or coated with materials manufactured for installation within the particular environment.

Q. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on manufactured channel, suspended on rods or pipes. Trapeze members including suspension rods shall be properly sized for the quantity, diameters, and loaded weight of the lines they are to support.

R. Vertical Piping:

1. Supports for vertical riser piping in concealed areas shall utilize double bolt riser clamps, with each end having equal bearing on the building structure at each floor level.
2. Supports for vertical riser piping at floor levels in exposed areas (such as piping in mechanical rooms) shall be attached to the underside of the penetrated structure utilizing drilled anchors, two hanger rods (sized as specified), and socket clamp with washers.
3. Two-hole rigid pipe clamps or four-hole socket clamps with washers may be used to support pipe directly from adequate structural members where floor-to-floor distance exceeds required vertical support spacing and lines are not subject to expansion and contraction

2.2 HANGERS AND SUPPORTS

A. Hydronic Piping:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks, carbon steel hooks or carbon steel J-hanger.
9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, carbon steel ring.

B. Refrigerant Piping and Condensate Drain Piping:

1. Conform to ASME B31.5, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. At un-insulated piping provide clamp with a thermoplastic elastomer cushion insert similar to Unistrut’s Cush-A-Clamp or equal.
5. Wall Support: Steel channels with electro-galvanized clamps. At un-insulated piping provide clamp with a thermoplastic elastomer cushion insert similar to Unistrut’s Cush-A-Clamp or equal.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Steel channels with electro-galvanized clamps. At un-insulated piping provide clamp with a thermoplastic elastomer cushion insert similar to Unistrut’s Cush-A-Clamp or equal.
8. Copper Pipe Support: Copper-plated carbon-steel ring.

C. Ductwork Supports:

1. All ductwork shall be supported in accordance with the "Hangers and Supports." Chapter of SMACNA "HVAC Duct Construction Standards - Metal and Flexible" for the service involved unless indicated otherwise in on the drawings.
2. Hanger Spacing. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "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 of each elbow and within 48 inches of each branch intersection. Do not use wire to support ductwork.
3. Horizontal ducts supported using galvanized steel bands shall extend up both sides and onto the construction above, where they shall turn over and be secured with bolts and nuts fitted in inserts set in the concrete, bolted to angles secured to the construction above, or secured in another approved manner.
4. Horizontal Ducts Larger Than 40 Inches. Support horizontal ducts larger than 40 inches in their greatest dimension by means of hanger rods bolted to angle iron (or equivalent unistrut) trapeze hangers. Place supports on at least 8'0" centers according to the following:

Angle Length	Angle	Rod Diameter
4'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
8'-0"	2" x 2" x 1/8"	5/16"
10'-0"	3" x 3" x 1/8"	3/8"

5. Vertical Ducts. Support ducts to ensure rigid installation. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Fig. 4-7, Fig 4-8, Fig 4-9. Support vertical ducts where they pass through the floor lines with 1-1/2 inches x 1-1/2 inches x 1/4 inch angles. Support vertical duct drops more than 6 feet in length with angle iron frames attached to ducts. Provide additional supports for any vertical duct drop more than 20 feet at maximum 15 feet on center.
6. Note that not all hangers are shown on the drawings. The Contractor shall coordinate all hangers with the structure and other trades.

D. Terminal Units:

1. Single duct or dual duct terminal units weighing up to 150 pounds shall be supported by four (4) 1 inch wide sheet metal straps with ends turned under bottom of unit at all corners.
2. Each band shall be secured by not over 3/4 inch in length, 1/4 inch diameter sheet metal screws – two (2) on bottom of unit and one (1) on each side.
3. The other strap end shall be attached to the structure by 1/4 inch diameter threaded bolt into the concrete insert or into drilled-hole threaded concrete expansion anchor.
4. Where interference occurs, overhead of the box, not allowing direct vertical support by straps, provide trapeze channels suspended by 1/4 inch diameter galvanized threaded rods providing such channels do not block access panels of units.
5. Single duct or dual duct terminal units weighing more than 150 pounds shall be supported per the terminal unit manufacturer's installation instructions using threaded rod and hanger brackets located per manufacturer's drawing.
6. Fan-powered terminal units shall be supported per the manufacturer's instructions using threaded rod and hanger brackets per the manufacturer's drawing/diagram.

2.3 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded with adjusting and lock nuts.

B. Pipe Shields: Provide pipe shields at each support location of insulated piping in accordance with insulation manufacturer's published recommendations. Install MSS SP-58, Type 39 protection shields, if insulation without vapor barrier is indicated. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier.

C. Refer to Section 23 07 00 for additional data on insulation shields.

D. Concrete Inserts:

1. Cast in place concrete inserts shall comply with MSS SP 69, U.L. and F.M. standards and shall be sized to suit threaded hanger rods.
2. Inserts shall have malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
3. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction. If the

inserts are later found not to be in the proper location for the placement of hangers, then drilled anchors shall be installed. Drilled anchors in concrete or masonry shall be submitted for the approval.

4. Manufactured inserts for metal deck construction shall have legs custom fit to rest in form valleys.
5. Shop fabricated inserts shall be submitted and approved by Owner prior to installation.
6. Inserts shall be of a type that will not interfere with structural reinforcing and that will not displace excessive amounts of structural concrete.

E. Power-actuated fasteners (shooting) will not be acceptable under any circumstances.

F. Note: Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.

2.4 FLASHING

A. Metal Flashing: 24 gauge thick galvanized steel.

B. Metal Counterflashing: 24 gauge thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft. sheet lead.
2. Soundproofing: 1 lb./sq. ft. sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gauge minimum; 16 gauge at fire-resistant elements.

2.5 EQUIPMENT CURBS

A. Roof mounted equipment:

1. Furnished with roof mounted equipment.
2. Factory insulated with 1-1/2 inches, 3 lb. density rigid insulation.
3. Constructed for the roof slope so that equipment is level.
4. 24-inch-high, galvanized steel construction with sufficient structural capacity to accommodate the imposed load.
5. Factory-installed 2” by 2” wood nailer.
6. Provide rubber curb seal between unit and roof curb.
7. Roof curb shall be compatible with the roof type.
8. Where installed on a metal roof the curb shall match the metal roof profile.
9. Where installed on a sloped roof structure the curb shall have an adjustable pitch to match the slope of the structure, so that the equipment is mounted level.

B. Condensing units, heat pumps, and condensers, roof mounted:

1. Curbs shall be as specified in Division 7. Where curbs are not specified in Division 7, furnish curbs equal to ThyCurb Model TEMS-3, 24 inches high. Each unit to be supported by a minimum of two equipment curbs.
2. Secure units to curb with galvanized steel or stainless steel fasteners. Utilize galvanized steel or stainless steel ell brackets as required to allow for the fasteners to penetrate at the side of the curb and not the top.

C. Vibration isolation curbs:

1. Where specified, scheduled, or noted in the Drawings, a vibration isolation curb shall be furnished and installed for roof-mounted equipment.
2. Curb shall match all requirements of “Standard curbs for roof-mounted equipment” above, where applicable.
3. Curb assembly shall be designed for the equipment and curb to withstand 125 mph winds without the use of guy wires.
4. Curb shall be equal to Kinetics Noise Control model “KSCR 2.1” with 1” deflection spring isolators and weather seal. Isolators shall be designed specifically for the weight distribution of the equipment being supported/isolated.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-Fire-Rated Floors: 18-gauge thick galvanized steel.

B. Sleeves for Pipes Through Non-Fire-Rated Beams, Walls, Footings and Potentially Wet Floors: Steel pipe or 18-gauge thick galvanized steel.

C. Sealant: Refer to Division 07.

D. Provide UL/FM or Warnock Hersey approved assembly for sleeves through fire rated floors or walls.

2.7 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8 inch minimum strut or stronger as required. with holes 1-1/2 inches on center.

2.8 EQUIPMENT BASES (HOUSEKEEPING PADS)

A. Provide minimum 3-1/2 inch reinforced concrete pads with chamfered corners and equipment bases for all outdoor equipment on grade, floor mounted equipment in main central plant area, mechanical rooms, areas with floors below grade, penthouse equipment rooms, floor mounted air handling units, and where shown on Drawings.

B. Refer to Division 03 for concrete requirements.

C. Housekeeping pads shall extend minimum of 6 inches on all sides beyond the limits of the mounted equipment unless otherwise noted.

D. Provide galvanized anchor bolts for all equipment placed on concrete pads or on concrete slabs of the size and number recommended by the equipment manufacturer.

2.9 EXTERIOR PIPE SUPPORTS

A. The following exterior supports may be utilized as non-penetrating type roof supports or as grade mounted supports on concrete pads.

B. Adjustable height, single pipe support for pipe sizes 3” and smaller: UV resistant, high density polypropylene, polycarbonate or fiberglass reinforced nylon base with support strut channel, threaded rod, nuts, washers and pipe clamp. All metal components to be hot dipped galvanized or stainless steel.

1. PHP model PP10
2. Miro Industries, Inc. model 2.5-SB-HCS

3. Mapa model MS-12SA10
4. Substitutions: Under provisions of Division 01.

C. Adjustable height, single pipe support for pipe sizes 4" and larger: Two base type support system with UV resistant high density polypropylene, UV resistant polycarbonate or stainless steel bases. Provide with support hangers appropriate for the type of pipe as specified in this section. Provide with threaded rod, nuts and washers. All metal components, unless indicated otherwise, to be hot dipped galvanized or stainless steel.

1. PHP model PS-1-2
2. Miro Industries, Inc. models 6-H, 8-H or 16-H as appropriate
3. Mapa model MB series
4. Substitutions: Under provisions of Division 01.

D. Adjustable height, multiple pipe support: Two base type support system with UV resistant high density polypropylene, UV resistant polycarbonate or stainless steel bases. Provide with support hangers appropriate for the type of pipe as specified in this section. Provide with threaded rod, nuts and washers. All metal components, unless indicated otherwise, to be hot dipped galvanized or stainless steel.

1. PHP model PSE series
2. Miro Industries, Inc. models 6-H, 8-H or 16-H as appropriate
3. Mapa model MB series
4. Substitutions: Under provisions of Division 01.

2.10 EXTERIOR WALKWAYS AND ACCESS PLATFORMS

A. The following exterior walkways and platforms may be utilized as non-penetrating type roof supports or as grade mounted supports on concrete pads

B. Manufacturers:

1. PHP
2. Miro Industries, Inc.
3. Substitutions: Under provisions of Division 01.

C. Elevated Walkway (Equipment Platform Access)

1. Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without causing damage to the roofing membrane.
2. Custom design system to fit equipment to be installed and actual conditions of service and loading as indicated on the drawings. Provide handrails on sides and ends of walkway where it does not abut equipment. Provide steps to gain access to elevated walkway.
3. Walkways and Platforms: Provide galvanized slotted metal grating, in configurations as indicated, and tubular handrails where indicated.
4. Non Penetrating Bases: High Density Polypropylene plastics with additives for UV protection.

    a. Bases shall be offset on the side where walkway or equipment platform access abuts equipment in order to minimize space between walkway or platform and equipment.

5. Substructure: 12-gauge back-to-back strut G-1012A, or approved equal supported directly from the bases.

    a. Steel Framing: Channel Types: 1-5/8-inch B22TH or 1-7/8-inch BTS22H, as required for loading conditions. Thickness: 12 gage.
    b. Form: Roll-formed 3-sided or tubular shape, perforated with 9/16 inch holes at 1-7/8 inch (47.6 mm) centers on three sides.
    c. Finish: Hot dip galvanize in accordance with ASTM A 123 after fabrication, free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.
    d. Use galvanized steel fasteners.

6. Grating: Mill-galvanized carbon steel in accordance with ASTM A525:

    a. 14-ga. or 18-ga. steel as required to support load.
    b. Section Width: 12 inches
    c. Channel Height: 2 inches.
    d. Flange Options: FM or MM.
    e. Surface Condition: MG-traction grip

7. Removable handrails and intermediate rails: 12 gauge, 1-5/8 inch strut G-5812, or approved equal.
8. Refer to drawings for location and size.

2.11 ROOF PIPE CHASE HOUSING

A. Manufacturers:

1. Roof Penetration Housing, LLC: The Vault
2. Substitutions: Under provisions of Division 01.

B. Roof Pipe Chase Housing:

1. Constructed of heavy gage powder coated welded aluminum with stainless steel hardware consisting of three pieces, a removable vandal resistant lid, a middle housing and a wide flanged 14-inch-high curb.
2. Available Sizes:

    a. Small: 16”x13”x27” high.
    b. Medium: 20”x14”x29” high.
    c. Mega: 34”x34”x40” high.

3. Exit seals to be of aluminum or stainless steel using SilX14 gasket seal. Each seal shall accommodate the specified size of the pipe, cable or conduit ranging in size from .25 inches up to 7.09 inches OD.

    a. Where noted on the drawings, provide pipe chase housing prepped with a hole and cover plate for a GFCI outlet to be installed by the electrician.

4. ICC-500 and FEMA 320/361 wind rated and rain tight.
5. Furnish each unit with factory installed one-inch-thick insulation in the curb, housing and lid. Insulation to have a minimum R value of 4.3.

C. Warranty:

1. The rooftop pipe chase housing shall carry an insured 20 year warranty accommodating multiple penetrations including piping and conduits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Do not drill or cut structural members, unless written permission is obtained from the Structural Engineer.

B. All auxiliary steel required for supports, anchors, guides, etc. shall be provided by the Contractor unless specifically indicated to be provided by others.

C. All supports shall be of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

D. Contractor shall be responsible for structural integrity of all supports, anchors, guides, etc. All structural hanging materials shall have a minimum safety factor of 5 built in

3.3 INSTALLATION – GENERAL

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. Application, sizing and installation of piping, supports, anchors and sleeves shall be in accordance with manufacturer's printed installation instructions.

C. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc.

D. All piping shall be installed with due regard to expansion and contraction and the type of hanger method of support, location of support, etc. shall be governed in part by this Specification.

E. Install hanger so that rod is vertical under operating conditions.

F. Provide for vertical adjustments after erection and during commissioning, where feasible, to ensure pipe is at design elevation and slope.

G. Install hangers and supports to allow controlled thermal movement of piping systems, permitting freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Supports hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system

I. The load and spacing on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including any concrete that holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required.

Contractor shall be responsible for engaging a structural engineer as required for design and review at support systems.

J. Do not hang pipe, duct or any mechanical item directly from a metal deck or locate on the bottom chord of any truss or joist unless approved by the Structural Engineer of Record.

K. Piping and ductwork supports shall be independent from fire protection piping supports or supports for other trade. Combining supports is not permitted

L. All piping and ductwork supports shall be designed and installed to allow the insulation to be continuous through the hangers.

M. Adjustable clevis hangers shall be supported at rods with a nut above and below the hanger.

N. All hanger rods shall be trimmed neatly so that 1 inch of excess hanger rod protrudes beyond the hanger nut. In the event a rod is intentionally but temporarily left excessively long (for sloped or insulated lines for example), the Contractor shall take appropriate measures to protect the pipe or other materials from damage.

O. Install hangers to provide minimum ½ inch space between finished covering and adjacent structures, materials, etc.

3.4 INSTALLATION – PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69 and MSS SP 89.

B. Support horizontal piping as scheduled at end of this section.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Locate hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor and at maximum 10’ on center.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers or non-metallic coatings or inserts on attachments for electrolytic protection where attachments are in direct contact with copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation.

M. Insulated piping lager than 2” diameter shall be supported with inserts of the same thickness as the insulation, or with other approved methods. Refer to Section 22 07 00 – Piping Systems Insulation.

N. Supports, hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.

3.5 INSTALLATION – ATTACHMENT TO STRUCTURE

A. Hangers shall be attached to the structure as follows.

1. Poured-In-Place Concrete: Where pipes and equipment are supported under poured in place concrete construction, each hanger rod shall be fitted with a nut at its upper end, which nut shall be set into an Underwriters Laboratories, Inc. listed universal concrete insert placed in the form work before concrete is poured. Where inserts are placed in the bottom faces of concrete joists which are too narrow to provide adequate strength of concrete to hold the insert properly or where a larger insert would require displacement of the bottom joist steel, the hanger rod shall be suspended from the center of a horizontal angle iron, channel iron, I-beam, etc. spanning across two adjacent joists. The horizontal support shall be bolted to nonadjustable concrete inserts of the "spot" type, of physical size small enough to avoid the bottom joist steel.

2. Pre-Cast Tee Structural Concrete: Hanger supports, anchors, etc. required for mechanical systems attached to the precast, double tee, structural concrete system are to be installed in accord with approved shop Drawings only. Holes required for hanger rods shall be core drilled in the "flange" of the double tee only; impact type tools are not allowed under any circumstances. Core drilling in the "stem" portions of the double tee is not allowed. Holes core drilled through the "flange" for hanger rods shall be no greater than 1/4" larger than the diameter of the hanger rod. Hanger rods shall be supported by means of bearing plates of size and shape acceptable to the Architect/Engineer, with welded double nuts on the hanger rod above the bearing plate. Cinch anchors, lead shields, expansion bolts, and studs driven by explosion charges are not allowed under any circumstances in the lower 15" of each stem and in the "shadow" of the stem on the top side of the "double tees”.

3. Steel Bar Joists: Where pipes and loads are supported under bar joists, hanger rods may be run through the space between the bottom angles and secured with a washer and two nuts. Where larger lines are supported beneath bar joists, hanger rods shall be secured to angle irons of adequate size; each angle shall span across two or more joists as required to distribute the weight properly and shall be welded to the joists or otherwise permanently fixed thereto.

4. Steel Beams: Where pipes and loads are supported under steel beams, approved type beam clamps shall be used.

5. Wood Framing: Where pipes and loads are supported from wood framing, hanger rods shall be attached to framing with side beam brackets or angle clips.

B. Concrete Inserts.

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.6 INSTALLATION – FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

C. Provide curbs for roof installations. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints. Provide continuous shims under curbs as required to install equipment level.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb

3.7 INSTALLATION – ROOF CURBS

A. Install curbs in accordance with manufacturer's instructions and as indicated on Drawings.

B. Coat nailing flange in contact with pressure-treated wood with bituminous paint or isolate flange from pressure-treated wood with a layer of APP or SBS underlayment or separation sheet specified in Division 6.

C. Coordinate installation of components of this section with installation of roofing membrane and base flashings, as specified in Division 07.

3.8 INSTALLATION – SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

G. Where installed in fire rated wall, floors, etc., install in accordance with UL/FM or Warnock Hersey fire rated assembly instructions.

H. Install sleeves for all piping passing through penetrations in floors, partitions, roofs, and walls. All penetrations shall pass through sleeves.

I. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls. Sleeves are not required for core-drilled holes.

J. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

K. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants.

3.9 INSTALLATION – EQUIPMENT BASES AND SUPPORTS

A. Provide concrete housekeeping pads, per requirements in Part 2 of this section.

B. Install anchor bolts, and accessories for mounting and anchoring equipment. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of sufficient size to provide ½ inch clearance around bolt.

C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.10 INSTALLATION – EXTERIOR PIPE SUPPORTS, WALKWAYS AND ACCESS PLATFORMS

A. Install exterior pipe and duct supports and exterior walkways and access platforms per manufacturer's recommendations.

B. Locate bases and support framing as specified herein. Provide complete and adequate support of all piping and ducts, whether or not all required devices are shown.

C. The use of wood for supporting piping is not permitted.

D. Install piping supports at spacing indicated in schedule at end of this section

E. Spacing of duct supports shall be in accordance with SMACNA and where indicated on the drawings.

F. Accurately locate and align bases.

1. Roof installations:

    a. Provide additional adhered or welded roof membrane layer to serve as a base pad for adhered/welded attachment of weighted pipe/duct supports feet, weighted guardrail supports, weighted walkway supports and/or weighted access platform supports.
    b. Consult manufacturer of existing or new roofing system to confirm material of base pads required. Comply with roof warranty.
    c. Adhere base pads to roof using roof membrane manufacturer recommended adhesive.
    d. Adhere supports to base pads using roof membrane manufacturer recommended adhesive.
    e. Where applicable, replace gravel around bases.

G. Use galvanized fasteners for galvanized framing and stainless-steel fasteners for stainless steel framing.

3.11 INSTALLATION – ROOF PIPE CHASE HOUSINGS

A. Install in accordance with manufacturer's recommendations.

B. Coordinate size of the exit seals with HVAC, plumbing, electrical and telecommunications contractor.

C. All penetrations shall use the appropriate exit seal furnished by the manufacturer. All penetrations shall only pass through the housing portion of the assembly. Support each penetration within 12 inches of exiting the unit

3.12 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.13 CLEANING

A. Division 01 – Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.14 PROTECTION OF FINISHED WORK

A. Division 01 – Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.15 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	MIN. HANGER ROD DIAMETER (Inches)
Copper Tube, 1-1/4 inches and smaller	6	3/8
Copper Tube, 1-1/2 thru 2-1/2 inches	8	1/2
Copper Tube, 3 inches and larger	10	5/8
Steel Pipe, 1-1/2 inches and smaller	8	3/8
Steel Pipe, 2 thru 3 inches	10	1/2
Steel Pipe, 4 inches and larger	12	5/8

Support all vertical piping at each floor level and at maximum 10 feet spacing.

B. Plastic Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
PVC (All Sizes)	4	3/8

C. Flexible Plastic Tubing (HDPE) with Continuous Galv. Steel Channel Support Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
HDPE ½" to 2"	8	3/8
HDPE 2-½" to 4"	10	1/2

END OF SECTION

SECTION 23 05 48 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vibration isolators.

B. Related Sections

1. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of isolators in floating floor slabs specified by this section and product requirements for concrete for placement by this section.
2. Division 07 - Joint Protection: Product requirements for joint sealers specified for placement by this section.
3. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
4. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
5. Section 23 33 00 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air Conditioning:

1. ASHRAE 2019 HVAC Applications Handbook, Chapter 49.

B. Sheet Metal and Air Conditioning Contractors' National Association:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

F. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of hangers including attachment points.

1.5 QUALITY ASSURANCE

A. Provide for vibration isolation supports for all equipment, piping and ductwork indicated herein. The transmission of perceptible vibration to occupied areas by equipment installed under this Contract will not be permitted. Install vibration isolators as specified herein or shown on the Drawings or otherwise required to prevent the transmission of vibration which would create objectionable noise levels in occupied areas.

B. The vibration isolation supplier must be a firm capable of dealing effectively with vibration and noise characteristics effects and criteria; and one that can provide facilities and capabilities for measuring and evaluating the aforementioned disturbances.

C. Provide vibration isolation devices, from a single manufacturer or supplier who will be responsible for complete coordination of all phases of this work.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Open Spring Isolators - Type A:

1. Spring Isolators:

    a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
    b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Spring Mounts: Furnish with leveling devices, minimum 0.25-inch-thick neoprene sound pads, and zinc chromate plated hardware.
4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

B. Restrained Spring Isolators - Type B:

1. Spring Isolators:

   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Spring Mounts: Furnish with leveling devices, minimum 0.25-inch-thick neoprene sound pads, and zinc chromate plated hardware.
4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
5. Restraint: Furnish mounting frame and limit stops.

C. Closed Spring Isolators - Type C:

1. Spring Isolators:

   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance.

D. Restrained Closed Spring Isolators - Type D:

1. Spring Isolators:

   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance and limit stops.

E. Spring Hanger - Type E:

1. Spring Isolators:

   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
4. Misalignment: Capable of 20-degree hanger rod misalignment.

F. Neoprene Pad Isolators - Type F:

1. Rubber or neoprene-waffle pads.

a. 30 durometer.
b. Minimum 1/2 inch thick.
c. Maximum loading 40 psi.
d. Height of ribs: not to exceed 0.7 times width.

2. Configuration: 1/2-inch-thick waffle pads bonded each side of 1/4 inch thick steel plate.

3. For outdoor applications: provide material or coating that is UV-resistant.

G. Rubber Mount or Hanger - Type G:

1. Molded rubber designed for 0.5 inches deflection with threaded insert.

H. Glass Fiber Pads – Type H:

1. Neoprene jacketed pre-compressed molded glass fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 EXISTING WORK

A. Provide access to existing piping and ductwork and other installations remaining active and requiring access.

B. Extend existing piping and ductwork installations using materials and methods compatible with existing installations.

3.3 INSTALLATION

A. Install isolation for motor driven equipment.

B. Bases:

1. Set steel bases for 1 inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for 2-inch clearance between housekeeping pad and base.

C. Adjust equipment level.

D. Install spring hangers without binding.

E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

G. Provide pairs of horizontal limit springs on fans with more than 6-inch static pressure, and on hanger supported, horizontally mounted axial fans.

H. Support piping connections to isolated equipment resiliently to nearest flexible pipe connector.

I. Connect wiring to isolated equipment with flexible hanging loop.

J. Pipe Isolation:

1. Provide isolators for supports of all piping connected to isolated equipment for distance indicated on Pipe Isolation Schedule.
2. Isolator deflection shall have 1/2 the static deflection capabilities of the isolation system of the equipment to which it is connected.
3. Suspended piping: Type E spring hangers.

3.4 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

3.5 SCHEDULES

A. Pipe Isolation Schedule: (Type E, Spring Hangers)

Pipe Size (Inch)	Isolated Distance from Equipment (Feet)
1	10
2	15
3	20
4	25
6	30
8	35
10	35
12	35

B. Equipment Isolation Schedule:

Isolated Equipment	Base		Isolator	
	Type	Thickness	Type	Min. Deflection
Unit Heaters	None	-	E	0.5 in.
Air-cooled Condensing Units	None	-	F	0.25 in.
In-Line Fans	None	-	E	0.5 in.
Ceiling Cabinet Fans	None	-	G	0.5 in.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Testing, adjusting, and balancing (TAB) of the air conditioning systems and related ancillary equipment will be performed by a technically qualified TAB Firm.

B. TAB Firm shall be capable of performing the TAB services as specified in accordance with the Contract Documents, including the preparation and submittal of a detailed report of the actual TAB Work performed.

C. TAB Firm shall check, adjust, and balance components of the air conditioning system which will result in optimal noise, temperature, and airflow conditions in the conditioned spaces of the building while the system equipment is operating economically and efficiently. This is intended to be accomplished after the system components are installed and operating as specified in the Contract Documents. It is the responsibility of the Contractor to place the equipment into service. Variable air volume and variable water flow systems shall be balanced in accordance with AABC Standard, Latest Edition or NEBB Standards for Testing, Adjusting, Balancing of Environmental Systems (Latest Edition).

D. TAB Firm shall check, adjust, and balance all hydronic systems including pumps, water distribution systems, chillers, cooling towers, boilers, heat exchangers, coils, and related equipment.

E. During the balancing process, as the TAB Firm discovers abnormalities and malfunctions of equipment or components, the TAB Firm shall advise the Contractor in writing so that the condition can be corrected by the Contractor prior to finishing the TAB scope of Work. Data from malfunctioning equipment shall not be recorded in the final TAB report.

F. The TAB Firm shall make qualified personnel available to conduct spot verification with the Commissioning Agency after TAB has been completed.

1.3 TAB PROCUREMENT

A. The TAB Firm shall be a subcontractor of the General Contractor or Construction Manager and shall report to and be paid by the General Contractor or Construction Manager.

1.4 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. AABC - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
2. NEBB - National Environmental Balancing Bureau, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
3. ASHRAE HVAC Applications Chapter 37: Testing, Adjusting and Balancing.
4. ANSI/ASHRAE Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Buildings, Heating, Ventilation, Air Conditioning and Refrigeration Systems.
5. CTI - Cooling Technology Institute CODE ATC-105.

1.5 QUALITY ASSURANCE

A. TAB Firm shall have operated a minimum of five (5) years under TAB Firm’s current name and shall be in good standing with the State of Texas, Franchise Tax Board. TAB Firm shall submit full incorporated name, Charter Number, and Taxpayer's I.D. Number for proper verification of TAB Firm's status.

B. TAB Firm’s personnel performing Work at the Project Site shall be either professional engineers or NEBB or AABC certified air and water balance technicians, who shall have been permanent, full time employees of the TAB Firm for a minimum of six (6) months prior to the start of Work for this Project.

C. TAB firm shall have a background record of at least five (5) years of specialized experience in the field of air and hydronic system balancing and shall possess properly calibrated instrumentation.

1.6 CONTRACTOR SYSTEM PREPARATION AND COORDINATION

A. The scope of the TAB work as defined herein is indicated in order that the Contractor and/or Mechanical Subcontractor will be apprised of the coordination, adjustment, and system modification which will be required under the project work to complete the Owner's requirements for final TAB.

B. The Contractor shall allow sufficient funds in the project cost estimate and bid proposal to cover all work which may be required in the TAB phases as defined herein and as may be necessary for the preparation of mechanical systems for TAB work and completion of the TAB work as defined by the TAB firm.

C. As a part of this Contract, the Contractor and/or Mechanical Subcontractor shall make any changes in the sheaves, belts, dampers, valves, pump impellers, etc. required for correct balance as required by the TAB firm, at no additional cost to the Owner.

D. The Mechanical Subcontractor shall provide and coordinate services of qualified, responsible subcontractors, suppliers and personnel as required to correct, repair, and/or replace any and all deficient items or conditions found during the testing, adjusting and balancing period.

E. In order that all systems may be properly tested, balanced, and adjusted as required herein by these Sections, the Contractor shall start-up and check-out all systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB. This length of time shall be acceptable to the Owner's Representative.

F. Project contract completion schedules shall provide sufficient time to permit the completion of TAB services prior to commissioning and owner occupancy. Contractor shall develop the project schedules in close coordination with the TAB and commissioning agent. If HVAC functional testing will be performed as part of the commissioning process, TAB work must be completed prior to the start of functional testing. The contractor shall include adequate time for both TAB and functional testing prior to substantial completion.

G. The Drawings and Sections have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access as requested by the TAB firm. Also, any malfunction encountered by TAB personnel and reported to the Contractor or the Inspector shall be corrected by the Contractor immediately so the balancing work can proceed.

H. Contractor must ensure that the necessary systems are scheduled to be in operations for TAB firm so that the access for balancing to diffusers, dampers etc., is not restricted. Contractor must schedule and coordinate activities so that TAB firm is not restricted from performing work, including access to damper operators and air devices.

I. The Contractor shall correct deficiencies in a timely manner and produce a signed copy of the deficiency lists to the Owner. At that time, the TAB firm will return and verify that the deficiencies are corrected.

J. Contractor Responsibilities

1. The Contractor shall have the building and air conditioning systems in complete operational readiness, including proper inspections, testing, and startup of equipment and controls as required in other specifications. Complete operational readiness of the building requires that construction status of the building shall permit the closing of doors and windows, ceilings installed, etc., to obtain simulated or projected operating conditions.
2. Contractor shall perform all other items as described hereinafter to assist the TAB Firm in performing the balancing, testing, and adjusting of the air, hydronic and laboratory systems. He shall promptly correct deficiencies of material and workmanship identified as delaying completion of TAB work. The items shall include the following.
3. All equipment shall be started up in accordance with manufacturers recommendations and the requirements within each applicable specification.

4. Air Distribution Systems:

    a. Verify installation for conformity to design. All supply, return and exhaust ducts terminated.
    b. Verify all volume, splitter, extractor and fire and smoke dampers properly located and functional. Dampers shall provide tight closure and full opening, smooth and free operation.
    c. Verify all supply, return, exhaust, transfer grilles, registers, diffusers, HEPA fan filter units and terminal units installed, leak tested and operational.
    d. Verify air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and/or sealed to eliminate excessively by-pass or leakage of air.
    e. Final clean filters shall be in place, coils shall be clean with fins straightened, bearings properly greased, belts shall be aligned and tightened, and the system shall be completely operational.
    f. The Contractor shall verify that all systems are operating within the design pressure limits of the piping and ductwork.
    g. Verify all fans (supply, return, relief and exhaust) operating and verified for freedom from vibration, proper fan rotation and belt tension; overload heater elements to be of proper size and rating; and clean filters installed.
    h. All terminal units (VAV boxes, unit ventilators, etc.) shall be installed and functional (i.e. controls functioning and checked by Contractor).
    i. Verify laboratory Control Systems (LCS) including fume hood (non-recirculating), lab exhaust and general exhaust valves and supply valves and exhaust fan makeup/bypass dampers are installed and operational.

5. Automatic Controls:

   a. The Control Contractor shall schedule a meeting with the Project Engineer, TAB firm and Owner's representative for a pre-submittal review to establish that their interpretation of the Automatic Controls Operation is correct.
   b. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, dampers sequences, air and water resets, fire and freeze stats, high and low temperature thermostats, safeties, etc. The Control Contractor shall provide two (2) sets of the necessary software and hardware to the TAB Firm for control systems verification.
   c. Verify that all controlling instruments are calibrated and set for design operating conditions with the exception of room thermostats or sensors, which shall be calibrated at the completion of TAB services with cooperation between the TAB firm and Control Contractor.
   d. The Control Contractor shall thoroughly check all controls, sensors, operators, sequences, etc. before notifying the TAB agency that the Building Automation System is operational.
   e. The Control Contractor shall provide technical support (technicians and necessary computers) to the TAB agency for a complete check of these systems.

K. Tabulated Data. The motor amperages, voltages and overload heater size of each piece of electrically driven equipment, including exhaust fans, shall be recorded showing "actual" and "nameplate" data and submit to the owner prior to balancing.

L. The Contractor and the suppliers of the equipment installed shall all cooperate with the TAB Firm to provide all necessary data on the design and proper application of the system components and shall furnish all labor and material required to eliminate any deficiencies or malperformance. Furnish a list of all motors with nameplate data and size of overload heater installed with motor amperage during operation.

M. During the balancing the temperature regulation shall be adjusted for proper relationship between controlling instruments and calibrated by the Control Manufacturer using data submitted by the TAB Firm.

N. It shall be the obligation of the Contractor to furnish or revise fan drives, sheaves, belts, dampers, etc., and/or motors if necessary, without cost to the Owner, to attain the specified air volumes.

O. The Contractor shall assist the TAB Firm after occupancy of the building to ensure that satisfactory conditions are being maintained throughout and to satisfy any unusual condition.

1.7 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Within 60 days after award of contract, submit name of testing, adjusting and balancing agency for approval.

C. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing and equipment data required. Include detailed procedures, agenda, sample report forms and Copy of NEBB Certificate of Conformance Certification.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting and balancing of systems and equipment to achieve specified performance.

E. The activities described in this Section shall culminate in a report to be provided electronically to the Engineer, the Contractor and the Owner. Neatly type and arrange data. Include with the data,

the dates tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation. The intent of the report is to provide a reference of actual operating conditions for the Owner's operations personnel.

F. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been made at the Project Site by the permanently employed technicians or engineers of the TAB Firm.

G. Submit draft copies of report for review prior to final acceptance of Project.

H. Submit reports on electronic forms approved by the Owner and Architect/Engineer which will include the following information as a minimum:

1. Title Page:

    a. Company name.
    b. Company address.
    c. Company telephone number.
    d. Project name.
    e. Project location.
    f. Project Manager.
    g. Project Engineer.
    h. Project Contractor.
    i. Project identification number.

2. Summary Comments:

    a. Notable characteristics of system.
    b. Description of systems operation sequence.
    c. Design versus final performance.
    d. Summary of outdoor and exhaust flows to indicate building pressurization.
    e. Nomenclature used throughout report.
    f. Test conditions.

3. Instrument List:

    a. Instrument.
    b. Manufacturer.
    c. Model.
    d. Serial number.
    e. Range.
    f. Calibration date.
    g. Test instrument purpose.

4. Fan Data (Supply and Exhaust):

    a. Identification and location.
    b. Manufacturer.
    c. Model.
    d. Air flow, design and actual.
    e. Total static pressure (total external), design and actual.
    f. Inlet pressure.
    g. Discharge pressure.
    h. Fan RPM.
    i. Sheave Make/Size/Bore.

5. Air Handler Return Air/Outside Air Data (also provide all fan data noted above and coil data as noted below):

    a. Identification and location.
    b. Design return air flow.
    c. Actual return air flow.
    d. Design outside air flow.
    e. Actual outside air flow.
    f. Return air temperature.
    g. Outside air temperature.
    h. Required mixed air temperature.
    i. Actual mixed air temperature.

6. Cooling Coil Data:

    a. Identification number.
    b. Location.
    c. Service.
    d. Manufacturer.
    e. Air flow (CFM) design and actual.
    f. Air pressure drop (in. w.g.), design and actual.
    g. Entering air temperature (DB & WB), design and actual.
    h. Leaving air temperature (DB & WB), design and actual.
    i. Water pressure flow (gpm), design and actual.
    j. Water pressure drop, design and actual.
    k. Balancing valve water pressure drop, design and actual.
    l. Entering and leaving water temperature, design and actual.
    m. Sensible Capacity (Btu/hr) design, and actual.
    n. Total Capacity (Btu/hr) design, and actual.

7. Heating Coil Data:

    a. Identification number.
    b. Location.
    c. Service.
    d. Manufacturer.
    e. Air flow (CFM), design and actual.
    f. Air pressure drop (in. w.g.), design and actual
    g. Entering air temperature, design and actual.
    h. Leaving air temperature, design and actual.
    i. Water flow (gpm) or Steam mass flow rate (lbs. per hour) design and actual.
    j. Pressure drop water (feet w.g.) or steam (psid), design and actual.
    k. Balancing valve water pressure drop, design and actual.
    l. Entering water or steam temperature, design and actual.
    m. Leaving water or steam temperature, design and actual.
    n. Heating Capacity (Btu/hr) design, and actual.
    o. Electric heat kW, number of stages, kW per stage – design and actual (if applicable).

8. Electric Motors:

    a. Manufacturer.
    b. Horsepower/brake horsepower.
    c. Phase, voltage, amperage, nameplate, actual.
    d. RPM.
    e. Sheave Make/Size/Bore.
    f. Service factor.
    g. Starter size, heater elements, rating.

h. Variable speed drive settings (as applicable).

9. V-Belt Drive:

a. Identification and location.
b. Required driven RPM.
c. Driven pulley, diameter and RPM.
d. Belt, size and quantity.
e. Motor sheave, diameter and RPM.
f. Center-to-center distance, maximum, minimum and actual.

10. Duct Traverse:

a. System zone/branch.
b. Duct size.
c. Area.
d. Design velocity.
e. Design air flow.
f. Test velocity.
g. Test air flow.
h. Duct static pressure.
i. Air temperature.
j. Air correction factor.

11. Air distribution system:

a. Air device number
b. Room number / location (include floor schematic floor plan with air device numbers marked)
c. Air device type
d. Air device size
e. Area factor
f. Design air flow and velocity
g. Test (final) air flow and velocity
h. Percent of design air flow

12. Air Monitoring Station Data:

a. Identification and location.
b. System.
c. Manufacturer, model number and serial number
d. Size.
e. Area.
f. Design velocity.
g. Design air flow.
h. Test velocity.
i. Test air flow.

13. Variable or Constant Volume Terminal Unit Test Sheet:

a. Identification number.
b. Room number/location.
c. Terminal type (FP if fan powered) and / or (SDVV, SDCV, DDVV, DDCV), and (HWRH or ERH if reheat coil is used).
d. Terminal size.
e. Area factor.
f. Design velocity.

g. Design maximum and minimum air flow.
h. Test (final) velocity.
i. Test (final) maximum and minimum air flow.
j. For DDC instrumentation: Measure and record computer readout and calibration factor at the final measurement conditions. Record any additional settings that are not defaulted to assist operations personnel with future troubleshooting.
k. Air dry bulb temperature at the discharge of the terminal unit.

14. Air-cooled Condenser:

a. Identification / number
b. Location
c. Manufacturer
d. Model number
e. Serial number
f. Entering DB air temperature, design and actual
g. Leaving DB air temperature, design and actual
h. Number of fans / motors
i. Fan motor data (volts, phase, amps)

15. Air-cooled Condensing Unit / Heat Pump Unit:

a. Identification and location.
b. Service.
c. Manufacturer
d. Serial number
e. Entering DB air temperature, design and actual
f. Leaving DB air temperature, design and actual
g. Number of compressors
h. Compressor motor data (volts, phase, amps)
i. Condenser Fan motor data (volts, phase, amps)
j. Refrigerant type and charge.

16. Control verification indicating date performed and any abnormalities identified:

a. Point Location/Description.
b. EMS Readout (Setpoint and Actual).
c. Actual Readout.
d. Interlocks.
e. Safeties:

1) VFD Normal Operation.
2) VFD Bypass Operation.

f. Alarms.
g. Sequences of Operation.

17. Duct leak test:

a. Description of ductwork under test
b. Duct design operating pressure
c. Duct design test static pressure
d. Duct capacity, air flow
e. Maximum allowable leakage (duct capacity times leak factor)
f. Test apparatus

1) Blower

2) Orifice, tube size
3) Orifice size
4) Calibration

g. Test static pressure
h. Test orifice differential pressure
i. Measured test leakage

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire, fire/smoke and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Proper strainer baskets are clean and in place or in normal position.
13. Service and balancing valves are open.

C. Report any defects or deficiencies noted during performance of services to Architect/Engineer.

D. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.

E. If, for design reasons, system cannot be properly balanced, report as soon as observed.

F. Beginning of work means acceptance of existing conditions

3.2 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.3 AIR SYSTEM PROCEDURE

A. When systems are installed and ready for operation, the TAB Firm shall perform an air balance for all air systems and record the results.

B. The outside, supply, exhaust and return air volume for each air handling unit, supply fan and exhaust fan and the supply, exhaust or return air volume for each distribution device shall be adjusted to the design values shown on the Drawings, within the specified tolerances.

C. Air handling unit and fan volumes shall be adjusted by changing fan speed as first priority (with dampers open) and adjusting volume dampers associated with the unit as second priority.

D. Air distribution device volume shall be adjusted using the air device branch takeoff damper for flexible duct connected devices and the device opposed blade damper (OBD) for duct connected devices. Air distribution devices shall be balanced with air patterns as specified.

E. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are shown.

F. The general scope of balancing by the TAB Firm shall include, but is not limited to, the following:

1. Filters: Check air filters and filter media and balance only systems with clean filters and filter media. The Contractor shall install new filters and filter media prior to the final air balance.
2. Blower Speed: Measure RPM at each fan or blower. Where a speed adjustment is required, the Contractor shall make any required changes.
3. Ampere Readings: Measure and record full load amperes for motors.
4. Static Pressure: Static pressure gains or losses shall be measured across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter and exhaust fan. These readings shall be measured and recorded for this report at the furthest air device or terminal unit from the air handler supplying that device. Static pressure readings shall also be provided for systems, which do not perform as designed.
5. Equipment Air Flow: Adjust and record exhaust, return, outside and supply air CFM(s) and temperatures, as applicable, at each fan, blower and coil.
6. Coil Temperatures: Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil and reheat coil at each VAV terminal unit. At the time of reading record water flow and entering and leaving water temperatures.
7. Zone Air Flow: Adjust each HVAC VAV terminal unit and VAV air handling unit for design CFM.
8. Outlet Air Flow: Adjust each supply diffuser, register and grille and each exhaust or return inlet to design air CFM., within specified tolerances. Include all terminal points of air supply and all points of exhaust or return.

9. Ensure that all rooms or spaces designed to be negative pressure have an overall air balance of at least 5% negative; and all rooms or spaces designed to be positive pressure have an overall air balance of at least 5% positive.
10. Pitot Tube Traverses: For use in future troubleshooting by Owner, all exhaust ducts, main supply ducts and return ducts shall have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations shall be described on the sheet containing the data.
11. Maximum and minimum air flow on terminal units.
12. TAB shall provide a record of the variable volume system operating conditions at maximum and minimum design airflow including diversity and static pressure setpoints.
13. 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.
14. Prepare schematic diagrams of systems' "as-built" duct layouts.
15. For variable-air-volume systems, develop a plan to simulate diversity.
16. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
17. 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.
18. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
19. Verify that motor starters are equipped with properly sized thermal protection.
20. Check dampers for proper position to achieve desired airflow path.
21. Check for airflow blockages.
22. Check condensate drains for proper connections and functioning.
23. Check for proper sealing of air-handling unit components.
24. Check for proper sealing of air duct system.
25. Perform TAB work to determine the proper relative air pressurization to outside on a per floor basis in order to prevent infiltration. Provide documentation of airflow setpoints and relative pressures.

G. Procedures for Constant-Volume Air Systems

1. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
2. 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.
    e. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    f. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
    g. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
    h. 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.

3. Obtain approval from Engineer 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.
4. 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.
5. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
6. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
7. 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.
8. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
9. Measure terminal outlets and inlets without making adjustments:
10. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
11. 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:

    a. 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 and Specifications.
    b. Adjust patterns of adjustable outlets for proper distribution without drafts.

H. Procedures for Variable Air Volume Systems

1. 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.
2. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

    a. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
    b. 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.
    c. Measure total system airflow. Adjust to within indicated airflow.
    d. 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.
    e. 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.

1) If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

f. 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.
g. 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.
h. Record the final fan performance data.

3. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

a. Balance systems similar to constant-volume air systems.
b. Set terminal units and supply fan at full-airflow condition.
c. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
d. Readjust fan airflow for final maximum readings.
e. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
f. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
g. 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:
h. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
i. Measure 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.

4. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

a. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
b. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
c. Set terminal units at full-airflow condition.
d. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
e. Adjust terminal units for minimum airflow.
f. Measure static pressure at the sensor.
g. Measure 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.

3.4 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the data listed in Part 1 of this specification.

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.

3.5 CONDENSING UNITS

A. Verify proper rotation of fans. Measure data as indicated in Part 1.

3.6 HEAT TRANSFER COILS

A. Measure data as indicated in Part 1.

3.7 BUILDING AUTOMATION SYSTEMS

A. In the process of performing the TAB Work, the Contractor shall:

1. Work with the Building Automation System (BAS) Provider and Owner to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of intended control performance.
2. Verify that all control devices are properly connected.
3. Verify that the intended controllers operate all dampers, valves and other controlled devices.
4. Verify that all dampers and valves are in the position indicated by the controller; open, closed, or modulating.
5. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions. This includes all duct-mounted dampers, dampers in terminal units, and fire/smoke dampers.
6. Observe that all valves are properly installed in the piping system in relation to direction of flow and location. Observe that all balancing valves are properly installed in accordance with manufacturer's published installation instructions.
7. Observe the calibration and operation of all controllers.
8. Verify the proper application of all normally opened and normally closed valves.
9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.
10. Observe the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. BAS Provider will relocate sensors as deemed necessary by the TAB Firm or Contractor.
11. Verify that the sequence of operation for any control mode is in accordance with approved Shop Drawings and Specifications. Verify that no demand for simultaneous heating and cooling occurs at the terminal units.
12. Verify that all controller setpoints meet the Contract Documents.
13. Check all dampers for free travel.
14. Verify the operation of all interlock systems.
15. Perform variable volume system verification to assure the system and system components track with changes from full flow to minimum flow.

3.8 TOLERANCES

A. Set HVAC system airflow rates within the following tolerances:

1. Air Outlets and Inlets: Plus or minus 10 percent.
2. Air Handling Equipment and Fans: Minus 5 to plus 10 percent.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping and Equipment - Cellular Foam.
2. Piping – Jackets.
3. Ductwork – Glass Fiber, Flexible.
4. Ductwork – Glass Fiber, Rigid.
5. Acoustic Duct and Pipe Lagging.

B. Related Sections:

1. Division 07 – Firestopping: Product requirements for firestopping for placement by this section.
2. Division 09 – Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.
3. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
4. Section 23 05 53 – Identification for HVAC Piping and Equipment: Product requirements for HVAC piping and equipment identification.
5. Section 23 31 00 – HVAC Ducts and Casings.

1.2 REFERENCES

A. ASTM International:

1. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM C165 – Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
3. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
4. ASTM C195 – Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board.
6. ASTM C335 - Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
7. ASTM C411 – Standard Test Method for Hot-Surface Performance of High Temperature Thermal Insulation.
8. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
9. ASTM C533 – Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
10. ASTM C534 – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
11. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.
12. ASTM C552 – Standard Specification for Cellular Glass Thermal Insulation.
13. ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
14. ASTM C585 – Standard Practice for Inner and Outer Dimensions of Therma; Insulation for Nominal Sizes of Pipe and Tubing.
15. ASTM C591 – Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

16. ASTM C610 – Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
17. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation
18. ASTM C795 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
19. ASTM C921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
20. ASTM C1104 – Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
21. ASTM C1126 – Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
22. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
23. ASTM C1290 – Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
24. ASTM C1393 – Standard Specification for Perpendicularly Orientated Mineral Fiber Roll and Sheet Thermal Insulation
25. ASTM D1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.
26. ASTM D2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics.
27. ASTM D5590 -- Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay.
28. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
29. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
30. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
31. ASTM E1222 - Standard Test Method for Laboratory Measurement of the Insertion Loss of Pipe Lagging Systems
32. ASTM E2336 – Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems Acceptance Criteria for Grease Duct Enclosures
33. ASTM F1249 -- Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

B. International Code Council:

1. International Energy Conservation Code.

C. Sheet Metal and Air Conditioning Contractors':

1. SMACNA – HVAC Duct Construction Standard – Metal and Flexible.

D. Green Seal Standard:

1. GS-11 – Paints and Coatings (flat insulation coatings); Edition 3.2, October 2015.
   a. Vapor Barrier Coatings: Maximum VOC content 50 g/L.
   b. Weather Barrier Mastics: Maximum VOC content 50 g/L.
   c. Lagging Adhesive/Coating: Maximum VOC content 50 g/L.

E. Underwriters Laboratories:

1. UL 723 – Test for Surface Burning Characteristics of Building Materials
2. UL 2818 – GREENGUARD Standard for Building Materials, Finishes and Furnishings.
3. UL 2821 – GREENGUARD Test Method for Building Materials, Finishes and Furnishings.

F. South Coast Air Quality Management District:

1. SCAQMD Rule 1168 – Adhesive and Sealant Applications, including all amendments through October 2017
   a. PVC welding: Maximum VOC content 510 g/L.
   b. Adhesive primer for plastic: Maximum VOC content 550 g/L.
   c. Contact adhesive: Maximum VOC content 80 g/L.
   d. Fiberglass adhesive: Maximum VOC content 80 g/L.
   e. Insulation joint sealant: Maximum VOC content 420 g/L.
   f. Other: Maximum VOC content 420 g/L.

1.3 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers published literature for each type of insulation. Data shall include product description, thermal characteristics, moisture absorption rating, flame spread and smoke developed ratings for each product.

C. Submittal shall include a schedule indicating the following for each type of insulation:

1. Pipe or duct system.
2. Location (interior, exterior, mechanical room, etc.)
3. Insulation and jacketing material
4. Fitting insulation and jacketing material
5. Pipe size range.
6. Insulation thickness

D. Manufacturer's Installation Instructions: Submit manufacturer’s published literature indicating proper installation procedures.

1.4 QUALITY ASSURANCE

A. Products shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds or polybrominated diphenyl ether fire retardants.

B. Glass Fiber (Fiberglass) insulations shall have a minimum of 50% recycled glass content certified and UL environment validated.

C. Glass Fiber (Fiberglass) insulations shall have a 100% bio-based, formaldehyde-free binder and shall be UL GREENGUARD Gold certified, AAFA Asthma & Allergy Friendly®, and AAFA Verified Healthier Air, where available.

D. All equipment, duct and piping insulation used within the interior portions of the building on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years of experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density, thermal ratings and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical and damage, by storing in original wrapping.

D. All materials delivered to the site shall be dry, undamaged and maintained in good condition throughout the progress of the project.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature during and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 ADHESIVES, MASTICS AND SEALANTS

A. All adhesives, mastics, sealants and coatings utilized for pipe and duct insulation shall have a maximum VOC content as specified in Part 1 of this Section.

2.2 PIPING AND EQUIPMENT - CELLULAR FOAM

A. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. 'K' Value: ASTM C177 or C518; 0.28 at 75°F.
2. Service Temperature: -40°F. to 220°F.
3. Water Absorption: ASTM D1056; 1.0% by volume.
4. Water Vapor Permeability: ASTM E96; 0.10 perm-inches.
5. Maximum Flame Spread: ASTM E84; 25.
6. Maximum Smoke Developed: ASTM E84; 50.
7. Connection: Waterproof vapor barrier adhesive.
8. GEI Greenguard indoor air quality certified for low chemical and particle emission.

B. Elastomeric Foam Adhesive

1. Air dried, contact adhesive, compatible with insulation.

a. Foster 85-75.
b. Childers CP-82.
c. Armacell 520.

2.3 PIPING - JACKETS

A. PVC Plastic

1. Jacket: Comply with ASTM C1917 Standard Specification for Rigid Polyvinyl Chloride (PVC) Jacketing for Insulation. ASTM C921, one-piece molded type fitting covers and sheet material, off white color.

   a. Service Temperature: -40°F. to 150°F.
   b. Water Vapor Permeance: ASTM E96; 0.05 perm or less.
   c. Thickness: 20 mil
   d. Maximum Flame Spread: 25 per ASTM E84.
   e. Maximum Smoke Developed: 50 per ASTM E84.
   f. Connections: Brush on welding adhesive.

2. Vapor Barrier Coating (Indoors) and Weather Barrier Breather Mastic:

   a. Mold resistant, compatible with below ambient piping insulation with a white color finish. Permeability shall be a maximum of 0.08 perms or less at 37 mils dry tested at 100 degrees F (38 degrees C) and 90 percent RH per ASTM F1249. Coating shall meet ASTM D 5590 with 0 growth rating.

      1) Foster 30-80 AF.

   b. Compatible with above ambient insulation: Weather barrier mastic-fire-resistive mastic for indoor/outdoor use.

      1) Foster 46-50.
      2) Childers CP-10/CP-11

B. Aluminum Jacket: Comply with ASTM C1729 Standard Specification for Aluminum Jacketing for Insulation.

1. Thickness: 0.016 inch.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 mm thick die-shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
6. Metal Jacketing/Flashing Sealant: Sealing of seams to prevent water entry.

   a. Foster 95-44.
   b. Childers CP-76.

2.4 INSULATION SHIELDS AND INSERTS

A. Insulation Shields:

1. Application: All insulated piping, except for below grade direct buried piping.
2. Shields shall be made of galvanized steel or made of black iron painted on both sides with a minimum two coats of aluminum paint. Minimum metal shield sizes shall be as listed within the following table. Provide thicker/longer shields where recommended by insulation manufacturer's published product installation data:

Nominal IPS (inches)	Minimum Metal Thickness (gage)	Minimum Length (inches)
1/2 to 1-1/4	18	12
1-1/2 to 2	16	12
2-1/2 to 8	14	18
10	12	24

3. Provide MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier.
4. Depending on the type of pipe support design, stainless steel bands or aluminum bands may be required to keep shield material next to the jacketing material.

    a. Insulation Bands: 3/4 inch wide; 0.007-inch-thick galvanized steel when exposed to interior environment, 0.010-inch-thick stainless steel or 0.015-inch-thick aluminum when exposed to humid interior environment or outside environment.
    b. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum or 0.010-inch-thick stainless steel to match jacket.

B. Insulation Inserts:

1. Application: All insulated piping larger than 2-inch diameter, except for below grade direct buried piping.
2. Inserts for shields shall be manufactured of corrosion resistant insulating material; cellular glass, phenolic or polyisocyanurate, of minimum 5.0 lb./cu. ft. density, suitable for the planned temperature range.
3. Inserts shall be the same thickness and contour as the adjacent insulation and shall be at least as long as the metal shield.
4. Factory fabricated inserts with integral galvanized pipe shields will be acceptable.

2.5 DUCTWORK – GLASS FIBER, FLEXIBLE

A. Glass Fiber (Fiberglass) Blanket Insulation: Fiberglass bonded with a bio-based thermosetting resin. Comply with ASTM C553, Type I, II, and III; ASTM C1136 Type II; and ASTM C1290, Type III. UL/ULC Classified per UL 723 for FSK; NFPA 90A and 90B. Provide insulation with factory-applied Foil-Skrim-Kraft (FSK) facing.

B. Acceptable manufacturers:

1. Knauf Insulation “Performance+” Duct Wrap with ECOSE.
2. Manson Insulation “Alley Wrap B” Duct Wrap with ECOSE.
3. CertainTeed Corp. “Soft Touch” Duct Wrap.
4. Johns Manville “Microlite” Duct Wrap.
5. Owens Corning “SOFTR” All Service Duct Wrap.

C. Insulation shall meet the following properties:

1. Thermal Conductivity 'K' value: ASTM C335, 0.27 or less at 75°F.
2. Maximum service temperature: 250°F.
3. Maximum Water Vapor Sorption: less than 5% by weight, per ASTM C1104.
4. Density: 1.0 lb./cu ft.
5. Maximum Flame Spread: 25 per ASTM E84.
6. Maximum Smoke Developed: 50 per ASTM E84.
7. UL Environment GREENGUARD Gold certified and validated formaldehyde-free.

D. Vapor Barrier Coating:

1. Mold resistant, water-based vapor barrier coating that is compatible with the insulation materials, jackets and substrates. White color finish. Permeability shall be a maximum of 0.08 perms or less at 37 mils dry tested at 100 degrees F and 90 percent RH per ASTM F1249. Coating shall meet ASTM D5590 with 0 growth rating. Provide with backing reinforcement membrane comprised of synthetic fiber.

a. Sealant: Foster 30-80 AF or equal.
b. Backing membrane: Foster Mast-a-fab or equal.

2.6 ACOUSTIC DUCT AND PIPE LAGGING

A. Barrier Material:

1. Constructed of a 0.12 inch thick mass loaded, limp vinyl sheet bonded to a thin layer of reinforced aluminum foil on one side.
2. Nominal density: 1.0 lb./cu.ft.
3. STC rating: Minimum of 28.
4. Minimum flammability ratings: 0.0-seconds for flame-out and after-glow, and 0.2 inch for char length when tested in accordance with Federal Test Std. No. 191-5903.
5. Minimum thermal conductivity (K) value of 0.29.
6. Rated service temperature range of -40°F to 220°F.
7. Surface Burning Characteristics: Per ASTM E84, Flame Spread Index of no more than 10 and a Smoke Development Index of no more than 40.

B. Decoupling layer: Shall be a combination of 1.0-inch fiber glass batting, non-woven porous scrim-coated glass cloth, quilted together in a matrix of 4.0-inch diamond stitch pattern which encapsulates the glass fibers.

C. Barrier overlap tab: The composite material shall be fabricated to include a nominal 6 inches wide barrier overlap tab extending beyond the quilted fiber glass to facilitate a leak-tight seal around field joints. Nominal barrier width 54 inches, nominal fiber glass batt de-coupler width 48”.

D. Performance: Lagging shall meet the following minimum criteria.

1. Insertion Loss when tested as a duct wrap over 2-inch fiber glass board per ASTM E1222-90:

Frequency, Hz	125	250	500	1000	2000	4000	STC
	2	10	16	27	35	34	33

2. Insertion Loss when tested as a duct wrap directly over duct per ASTM E1222-90:

Frequency, Hz	125	250	500	1000	2000	4000	STC
	3	6	7	18	24	27	28

3. Sound Transmission Loss when tested as a free-hanging barrier per ASTM E90-90:

Frequency, Hz	125	250	500	1000	2000	4000	STC
	13	16	24	33	43	49	28

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify piping, equipment and ductwork have been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 COMMON INSULATION REQUIREMENTS

A. Insulation shall not be installed until all testing and inspection of pipe, duct, vessel, etc. has been completed and approved by Engineer/Owner's representative.

B. Replace insulation damaged by either moisture or other means. Insulation which has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also replace any materials damaged by the condensation.

C. 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.

D. 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.

E. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

F. Install insulation with longitudinal seams at top and bottom of horizontal runs.

G. Install multiple layers of insulation with longitudinal and end seams staggered.

H. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

I. Keep insulation materials dry during application and finishing.

J. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

K. Install insulation with the least number of joints practical.

L. Install insulation continuously through hangers and sleeves and around anchor attachments.

M. Where penetrating fire and/or smoke rated walls, partitions, barriers, or floors, provide UL-approved pipe and duct penetration assemblies that maintain the rating of the penetrated wall, partition, barrier, or floor.

N. Insulation on all pipes or ducts is required to have a continuous vapor barrier. On all insulation with a vapor barrier, seal the joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with a vapor-barrier coating/mastic as specified in the individual insulation sections.

1. 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 coating/mastic.

2. Install insert materials and install insulation to tightly join the insert. Seal insulation to inserts with adhesive or sealing compound recommended by insulation material manufacturer.

3. Cover inserts with jacket material matching adjacent pipe insulation.

4. Install sheet metal shields over jacket at each hanger, arranged to protect jacket from tear or puncture by hanger, support, and shield.

O. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

3.3 PAINTING OF INSULATION

A. Where indicated on the construction documents, paint duct or piping insulation in exposed areas, not including mechanical and equipment rooms. Do not paint insulation located in return air plenums.

B. Prior to painting, wipe insulation jacket clean with a mild cleaning solution that will not leave a residue and allow to dry completely. Paint jacket with water based (latex) paint in accordance with manufacturer’s recommendations and as required in the specification Division 09- Painting and Coating.

3.4 INSTALLATION – PIPE INSULATION

A. Install materials in accordance with manufacturer’s installation instructions and practices detailed by the North American Commercial and Industrial Insulation Standards manual (latest edition).

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

D. Insulated pipes conveying fluids below ambient temperature:

1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips sealed with vapor retarder mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier coating or PVC covers.

E. Insulated pipes conveying fluids above ambient temperature:

1. Furnish factory-applied or field-applied standard jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips sealed with vapor retarder mastic.
2. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and weather barrier breather mastic or PVC covers.

F. For hot piping conveying fluids over 180 degrees F, insulate flanges and unions at equipment. If 180 degrees F or under, then bevel and seal ends of insulation with breather mastic.

G. Provide neck extensions or extended stems for valves installed in insulated lines. Refer to Section 23 21 13.

H. Insulation Shields and Inserts:

1. Application: Provide shields for all insulated piping, except for below grade direct buried piping. Provide insulation inserts for all piping or equipment larger than 2-inch diameter.
2. Shields: Install between pipe hangers, pipe supports or pipe hanger rolls and inserts.
3. Insert location: Install between support shield and piping and under finish jacket.

I. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

J. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover all exterior pipe insulation with aluminum jacketing.

K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size the insulation large enough to enclose pipe and heat tracing. Refer to Section 23 21 13 for heat tracing requirements.

L. PVC or aluminum jacket: Install with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom of piping or equipment.

3.5 INSTALLATION – EQUIPMENT INSULATION

A. Install materials in accordance with manufacturer's installation instructions and practices detailed by the North American Commercial and Industrial Insulation Standards manual (latest edition).

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in the least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires or bands.

E. Fill joints, cracks, seams and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement. Coat with lagging cloth and lagging adhesive

F. For all insulated equipment, insulate flanges and unions with removable sections and jackets.

G. Finish insulation at supports, protrusions and interruptions.

H. Nameplates and ASME Stamps conveying fluid above ambient temperature:

1. Bevel and seal insulation around; do not insulate over.

I. Nameplates and ASME Stamps conveying fluid below ambient temperature:

1. Photograph ASME stamp, print, laminate and attach to vessel; insulate over.

J. Equipment Requiring Access for Maintenance, Repair or Cleaning: Install insulation for easy removal and replacement without damage.

K. Provide insulation over heating water reheat coils on terminal units.

L. For internally lined ductwork or isolated equipment containing exposed u-bend coils; insulate over coil u-bends and around upper and lower equipment sides abutting coil, finish with 16 ga. brake metal to cover insulation. Sheet metal to match adjacent, exposed ductwork (paint grip or galvanized).

3.6 INSTALLATION – DUCT INSULATION

A. Install materials in accordance with manufacturer's installation instructions and practices detailed by the North American Commercial and Industrial Insulation Standards manual (latest edition).

B. External Duct Insulation Application:

1. Seal all duct insulation joints and seams with tape and vapor retarder jacket, and finish with two coats of vapor barrier coating reinforced with backing reinforcement membrane.
2. Install insulation without any sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
5. Insulation at flanges shall wrap entirely over flanges and trapeze supports (including bottom of hangers) and shall be the same thickness throughout. Crushing, cutting, or diminishing the thickness or performance of insulation at flanges in any way is not acceptable.
6. Where trapeze hangers are used, install the hanger first and insulate around the entire strut trapeze, including the fastening point to the all-thread rod, the fastening nuts and the end of the all-thread rod below the fastening point. Refer to details on Drawings for additional information where applicable.
7. Insulate the top of all supply ceiling diffusers and uninsulated plenums on slot diffusers and linear bar grilles. Provide two coats of vapor barrier coating at the duct connection to air device insulation.
8. Seal any vapor retarder jacket penetrations with vapor barrier coating reinforced with backing membrane.
9. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping. For any service access, bevel and seal ends of the insulation.
10. Insulate over filter frames and terminal unit reheat coils while maintaining full operation of access doors/panels without damaging insulation.
11. For insulated ductwork conveying air below ambient temperature, vapor barrier coating is not required.

C. Acoustic Pipe and Duct Lagging: The correct installation of the sound control lagging material is critical in order to achieve the desired noise reduction. Sound control lagging material shall be cut to length, wrapped around the outside of the pipe or duct, and fastened with mechanical fasteners or bands. Tape and adhesive can be used in conjunction with mechanical fasteners or bands. All sound control lagging materials must be installed per the manufacturer's installation guidelines.

3.7 PIPING – CELLULAR FOAM INSULATION SCHEDULE

PIPING SYSTEMS		PIPE SIZE INCH	MIN INSTALLED THICKNESS INCH
A.	Condensate Drains	All	1/2"
B.	Cooling-only Commercial Split Systems: Refrigerant Suction Piping	1-1/4" & smaller 1-1/2" & larger	1/2" 1"
C.	Heat Pumps & Mini-splits: All refrigerant piping VRF: All refrigerant	1-1/4" & smaller 1-1/2" & larger	1/2" 1"

piping

D. Field Applied Jackets:

1. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
2. Pipe located outdoors: Finish with aluminum jacket and fitting covers.

3.8 INDOOR DUCTWORK – GLASS FIBER FLEXIBLE INSULATION SCHEDULE

SYSTEM		MIN THICKNESS	MIN INSTALLED R-VALUE
A.	Supply, Return and Relief	2”	6
B.	Outside Air	3”	8
C.	Exhaust (connected to energy recovery equipment)	2”	6

3.9 ACOUSTIC PIPE AND DUCT LAGGING

A. Refer to drawings for extent of lagging indicated there.

END OF SECTION

SECTION 23 31 00 - HVAC DUCT AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Duct materials.
2. Ductwork fabrication
3. Insulated flexible ducts.
4. Single wall spiral round and flat oval ducts.
5. Duct cleaning.
6. Duct liner.

B. Related Sections:
1. Division 03 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Division 09 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
3. Division 11 - Foodservice Equipment: Product requirements for kitchen range hoods for placement by this section.
4. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
5. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
6. Section 23 38 13 – Commercial Kitchen Exhaust Hood Systems.

1.2 REFERENCES

A. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):
1. ASHRAE Handbook of Fundamentals; Duct Design.
2. ASHRAE Handbook of HVAC Systems and Equipment; Duct Construction.
3. ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

B. ASTM International:
1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A90 - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A568 - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
5. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
7. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. ASTM A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
9. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
10. ASTM C177 – Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

11. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
12. ASTM C665 – Standard Specification for Mineral Fiber Blanket Thermal Insulation.
13. ASTM C1071 – Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
14. ASTM C1104 – Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
15. ASTM C1114 – Standard Test Method for Steady State Thermal Transmission Properties by Means of the Thin-Heater Apparatus.
16. ASTM C1338 – Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
17. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
18. ASTM E795 – Standard Properties for Mounting Test Specimens During Sound Absorption Tests.
19. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
20. ASTM G22 – Standard Practice for Determining Resistance of Plastics to Bacteria.

C. International Association of Plumbing and Mechanical Officials
   1. Uniform Mechanical Code.

D. International Code Council:
   1. International Energy Conservation Code.
   2. International Mechanical Code

E. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
   3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

F. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Air Duct Leakage Test Manual, most recent edition.
   2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible, most recent edition.

G. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168 – Adhesive and Sealant Applications, amended January 7, 2005.
      a. Metal to metal: Maximum VOC content 30 g/L.

H. Underwriters Laboratories, Inc.:
   1. UL 94 – Standard for Safety of Flammability of Plastic Materials.
   2. UL 181 - Factory-Made Air Ducts and Connectors.
   3. UL 723 – Test for Surface Burning Characteristics of Building Materials.
   4. UL 2818 – GREENGUARD Standard for Building Materials, Finishes and Furnishings.
   5. UL 2821 – GREENGUARD Test Method for Building Materials, Finishes and Furnishings.

I. U.S. Environmental Protection Agency (EPA)
   1. EPA-registered antimicrobial agent for HVAC duct lining

1.3 DEFINITIONS

A. Duct sizes: Inside clear dimensions. For lined ducts, maintain clear dimensions inside the lining.

B. Ductwork shall be constructed according to the following pressure classifications, as defined by the International Energy Conservation Code:
   1. Low-pressure duct systems: Supply and return ducts operating at a static pressure less than or equal to 2" W.G.
   2. Medium-pressure duct systems: Supply and return ducts and plenums designed to operate at a static pressure greater than 2" W.G. but less than 3" W.G.
   3. High-pressure duct systems: Supply and return ducts and plenums designed to operate at a static pressure equal to or greater than 3" W.G.

1.4 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
   1. Fabrication, assembly and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
   3. Show all fittings, dampers, turning vanes, access doors, fire dampers and all other ductwork accessories to be provided.
   4. Reinforcing details and spacing.
   5. Seam and joint construction details.
   6. Penetrations through fire rated and other walls.
   7. Terminal unit, coil and humidifier installations.
   8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

C. Product Data: Submit data for duct materials, sealants, duct liner and duct connectors.

D. Duct Pressure Test Form.

E. Kitchen Exhaust Leakage Test Form.

1.6 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

C. Duct Pressure Test Report: Indicate pressure tests performed. Include date, section tested, duct design static pressure, test apparatus information (model, fan HP, orifice calibration certificate) test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual, most recent edition.

D. Kitchen Exhaust Leakage Test Report: Indicate the date of the test performed, person testing, wattage of the light used to test, and test results.

1.7 SUSTAINABLE DESIGN SUBMITTALS

A. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
   1. Materials Resources Certificates:
      a. Certify recycled material content for recycled content products.
      b. Certify source for local and regional materials and distance from project site.
   2. Indoor Air Quality Certificates:
      a. Certify volatile organic compound content for each interior adhesive and sealant, related primer and waterproof coating.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A standards and in accordance with applicable mechanical code.

C. Construct kitchen grease exhaust ductwork to NFPA 96 standards and in accordance with applicable mechanical code.

D. Products shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds or polybrominated diphenyl ether fire retardants.

E. Glass Fiber (Fiberglass) insulations shall have a minimum of 50% recycled glass content certified and UL environment validated.

F. Glass Fiber (Fiberglass) insulations shall have a 100% bio-based, formaldehyde-free binder and shall be certified UL GREENGUARD Gold, AAFA Asthma & Allergy Friendly®, and AAFA Verified Healthier Air, where available.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of three years of experience.

B. Installer: Company specializing in performing Work of this section with a minimum of three years of experience.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the Project Site and store and protect products under provisions of Division 01 and Section 23 00 00.

B. Protect materials from rust both before and after installation.

C. Cover all open ends of ductwork both before installation and once installed.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.12 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.

B. Steel Ducts: ASTM A1008, ASTM A1011 or ASTM A568.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

D. Stainless Steel Ducts: ASTM A240 or ASTM A666, Type 316.

E. Fasteners: Rivets, bolts or sheet metal screws.

F. Hanger Rod: ASTM A36; carbon steel or galvanized; threaded both ends, threaded one end, or continuously threaded.

G. Duct Sealants: Fire-resistive, water-based, indoor/outdoor, U.V.-resistant, non-fibrous sealant for use on low-, medium- and high-velocity duct seams. Foster 32-19; Childers CP-146; Duro Dyne SAS UL.

H. Adhesive: Water based. Used to adhere duct liner and/or duct Wrap (up to 3lb./cu. ft.) to metal. Foster 85-60, Childers CP-127, Duro Dyne SSG

2.2 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. All reinforcement shall be external to ductwork wherever possible. Internal reinforcement shall only be considered where no other option exists to reinforce ductwork per SMACNA standards.

C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where standard radius elbows are not possible short radius elbows (minimum radius 1 times duct width) will be acceptable.

D. Where radius elbows are not possible, provide rectangular elbows with double-wall turning vanes. Where acoustic lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation. Provide access door upstream of all turning vanes for inspection and cleaning. Turning vanes are NOT allowed on return, exhaust, or unfiltered outside air systems; see elbow detail in the Drawings.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Branch duct takeoffs shall be one of the following types:
   1. Standard 45-degree lateral wye takeoffs.
   2. Rectangular with 45 degree entry.
   3. Round 90-degree conical tee connections.
   4. Refer to Section 23 33 00 for additional branch duct takeoff data.

G. Seal joints between duct sections and duct seams with gasket and/or mastic adhesives, regardless of duct pressure classification.
   1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
   2. Do not provide sealing products not bearing UL approval markings.

H. Offsets shall be radius ogee type where possible. Where space does not allow radius ogee offsets, shop-fabricated mitered offsets with a maximum 30 degree offset angle shall be used.

2.3 ACOUSTIC INSULATED FLEXIBLE DUCTS

A. Manufacturers & Product:
   1. Flexmaster – Type 1M
   2. Thermaflex – model M-KE

B. Product Description: UL 181, Class 1, acoustically transparent core, polyethylene liner locked to a helical wound spring steel wire; fiberglass insulation; reinforced, aluminized vapor barrier film.
   1. Pressure Rating:
      a. 10 inches w.g. positive and 1.0 inch w.g. negative through 12-inch diameter.
      b. 6 inches w.g. positive and 0.5 inch w.g. negative for 14- through 16-inch diameter.
      c. 4 inches w.g. positive and 0.5 inch w.g. negative for 18- and 20-inch diameter.
   2. Maximum Velocity: 5000 fpm.
   3. Temperature Range: -20 degrees F to 250 degrees F.
   4. Thermal Resistance: 6 square feet-hour-degree F per BTU.

2.4 SINGLE WALL SPIRAL ROUND OR FLAT OVAL DUCTS

A. Product Description: UL 181, Class 1, round or flat oval spiral lockseam duct with light reinforcing corrugations. Longitudinal seam snap-lock is not acceptable.

B. Construct round or oval duct in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, most recent edition and as indicated on Drawings. Provide duct material, gauges, reinforcing and sealing for operating pressures indicated.

C. Fabricate continuously welded round duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

D. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

E. All elbows 45-degree and 90-degree shall be die-stamped for less than or equal to 10 inches diameter. Elbows greater than 10 inches diameter shall be of the gored type and according to the following: 30-degree shall be 2-gore, 45-degree shall be 3-gore and 90-degree shall be 5-gore.

F. Seal joints between duct sections and duct seams with mastic adhesive regardless of duct pressure classification.
   1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.

2. Do not provide sealing products not bearing UL approval markings.

G. Exposed ductwork shall have one of the following finishes.
1. Unless noted otherwise in the Drawings: duct shall be degreased and cleaned and have all exterior markings and lettering removed. Duct shall not be provided with a paint-grip finish.
2. Where exposed double-wall duct is noted in the Drawings to be painted: duct shall have a matte, paint-grip finish and labels shall be removable.

2.5 ACOUSTIC DUCT LINER (FIBERGLASS FREE)

A. Manufacturers:
1. Armacell LLC – AP Coilflex
2. K-Flex – Duct Liner Gray

B. Acoustical Performance:
1. Based on ASTM C423 and ASTM E795, Type A mounting, nominal 1 inch thickness, the liner shall meet the following minimum sound absorption coefficients at each octave band.

125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	NRC
.06	.17	1.00	.32	.67	.50	.55

C. Duct Liners:
1. One-inch thick flexible elastomeric closed cell foam:
   a. ‘K” (‘ksi’) Value: ASTM C 518, 0.25 at 75ºF mean temperature.
   b. Maximum service temperature: 180 degrees F.
   c. Maximum moisture absorption: 0.20 percent by volume.
   d. Density: 3.0 – 6.0 lb./cu. ft.
   e. Antimicrobial Protection: lining shall contain EPA-registered antimicrobial agent “built-in” to liner, not a protective coating. Product must pass tests per ASTM G21 and ASTM C1338.
   f. UL Greenguard Gold Certified for low VOC emissions.
   g. Recognized under Underwriters Laboratories UL 94 Plastic Component Classification.
   h. Maximum Flame Spread: ASTM E84, 25.
   i. Maximum Smoke Developed: ASTM E84; 50.

2.6 THERMAL DUCT LINER (FIBERGLASS FREE)

A. Flexible closed cell elastomeric foam duct insulation liner, free of CFCs, HFCs, HCFCs, PBDEs or formaldehyde.
1. ‘K” (‘ksi’) Value: ASTM C 518, 0.25 at 75ºF mean temperature.
2. Maximum service temperature: 220°F.
3. Maximum moisture absorption: 0.20 percent by volume.
4. Density: 3.0 – 6.0 lb./cu. ft.
5. Water vapor permeability 0.05 perm-in.
6. Antimicrobial Protection: lining shall contain EPA-registered antimicrobial agent “built-in” to liner, not a protective coating.
7. UL Greenguard Gold Certificate for low VOC emissions.
8. Recognized under Underwriters Laboratories UL 94 Plastic Component Classification.
9. Maximum Flame Spread: ASTM E84, 25.
10. Maximum Smoke Developed: ASTM E84; 50.

B. For duct liner installed within interior ductwork, minimum liner thickness shall be one inch.

C. For duct liner installed within exterior ductwork, minimum liner thickness shall be two inches or as required to obtain a minimum insulation value of R-8.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Seal all ductwork to seal class A.

B. During construction, install temporary closures of metal or taped polyethylene on all open ductwork, installed or in storage, to prevent construction dust from entering ductwork system.

C. Duct inlet and outlet areas shall be clean and free of dirt, oil and other bond inhibiting contaminants.

D. Install duct hangers and supports in accordance with SMACNA Duct Construction Standards.

E. Use double nuts and lock washers on threaded rod supports.

F. Connect flexible ducts to metal ducts with nylon draw bands on inner jacket and outer vapor barrier. Finish with mastic adhesive.

G. Install in accordance with manufacturer's instructions.

H. Duct sizes are inside clear dimensions.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. For outdoor ductwork, protect ductwork, ductwork supports, linings and coverings from weather.

K. Connect terminal units to supply ducts with two inlet size diameters length of straight rigid duct. If run out to box exceeds three feet in length, increase duct size to box inlet as indicated on detail in Drawings.

L. All ductwork that is exposed shall be joined with gasketed couplings. For metal to metal joining that cannot be gasketed shall be sealed from the inside. Sealant should not be visible to the end user.

M. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.

3.3 DUCT LINER INSTALLATION

A. Duct liner shall be installed in accordance with manufacturer’s instructions, the latest edition of North American Insulation Manufacturers Association Fibrous Glass Duct Liner Standard (NAIMA FGDLS) or Sheet Metal and Air Conditioning Contractors National Association HVAC Duct

Construction Standard, Metal & Flexible (SMACNA HVAC DCS). In cases of conflict between manufacturer's instructions and other instructions, manufacturer's instructions supersede others.

B. Fabricate and install all duct liner in accordance with SMACNA Installation Standards for Rectangular Ducts using flexible liner with the following exceptions:
   1. For liners which are coated, apply liner with coated side at the air stream side.
   2. All pins or mechanical fasteners shall have beveled or cupped contact edges.
   3. Installed pin length, measured from metal duct surface to underside of pin contact washer, shall equal the thickness of the liner, within a tolerance range of plus or minus 1/16 inch.
   4. Apply liner manufacturer's contact adhesive to all fabrication cuts and seams.
   5. Apply liner manufacturer's coating to repair any tears or damage to the airstream surface prior to final installation.

C. Clean sheet metal with denatured alcohol to remove bond-breaking substances. Adhere the liner to the sheet metal with 100 percent coverage of adhesive. Coat all exposed edges and joints with manufacturer's contact adhesive.

D. Duct liner adhesive shall be applied to the sheet metal with a minimum coverage of 90%. Adhesive shall meet the requirements of ASTM C916.
   1. The liner shall be additionally secured with mechanical fasteners which shall hold it securely in place and prevent sagging.
   2. Fasteners shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from the longitudinal joints and shall be spaced at a maximum of 6 inches on center around the perimeter of the duct, except that there may be a maximum of 6 inches from a corner break. Elsewhere, they shall be a maximum of 16 inches on center, except that they shall be placed not more than 6 inches from a longitudinal joint of the liner nor 12 inches from a corner break.

E. For all equipment installations:
   1. Install 24 gauge channel nosing on the leading and trailing edge of all raw insulation.
   2. Welded pins affixed at 6-inch intervals parallel to the nosing.

F. Cut the liner accurately to assure overlapped and compressed longitudinal corner joints and tightly butted transverse joints.

G. Fabricate all duct liner with precision machinery. Make only minor, onsite manual adjustments to liner.

H. Provide insulated "build-out" sections to maintain the continuity of the liner when specialties, such as dampers and turning vanes, are secured to the sides of the duct. Build-outs shall be secured to the duct with sheet metal fasteners or welds.
   1. Use of a hat section for "build-out" is optional, and its use shall be evaluated for each specialty. Liner shall be adequately protected from damage or erosion, and friction loss through the section shall be minimized.

I. Increase duct size over those shown on the drawings where it is scheduled to receive liner. Sizes on drawings are inside clear dimension.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp unless indicated otherwise.

C. Connect air outlets and inlets to supply ducts with five foot maximum length of flexible duct. If flexible duct is used to change direction, the cross sectional profile of the flexible duct should be maintained.

D. Where exposed ductwork penetrates a ceiling or wall in finished spaces, install sectional plates or escutcheons to cover the annular opening between pipe and sleeve. Solid plates with set screws shall be used where the sectional plates will not stay in place or are not available in the required size, or where other individual specification section(s) require one piece or greater quality escutcheons or plates. Refer to Section 23 00 01 for additional requirements.

3.5 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

C. Clean duct systems with high power vacuum machines. Protect equipment with potential to be harmed by excessive dirt with filters, or bypass during cleaning. Install access openings into ductwork for cleaning purposes.

D. Clean lined ductwork in accordance with North America Insulation Manufacturers Association Publication #AH112, Cleaning Fibrous Glass or Lined Sheet Metal Duct; and AH#122, Cleaning Fibrous Glass Insulated Duct (Ductboard) Systems – Recommended Practices.

3.6 TESTING

A. For ductwork designed for 3 inches w.c. or above ambient per pressure class schedule below, pressure test the first installed systems (minimum 25 percent of ductwork) after duct cleaning, but before duct insulation is applied or ductwork is concealed. If the first systems show a failure during testing, correct these systems as needed and contact Engineer for further duct pressure testing as deemed necessary by the Engineer and Owner. Submit pressure all pressure test reports to Engineer.
   1. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
   2. Maximum Allowable Leakage: In accordance with applicable, local code.

3.7 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Interior Supply	Galvanized Steel
Interior Return and Relief	Galvanized Steel
Interior Supply and Return (within 20 ft. of AHU / RTU)	Galvanized Steel with Internal Acoustic Duct Liner (Duct shall also be externally insulated as per Section 23 07 00)
Interior Outside Air Intake	Galvanized Steel
Transfer	Galvanized Steel with Acoustic Duct Liner
General Exhaust	Galvanized Steel, Stainless Steel or Aluminum

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply (low pressure)	2 inch w.g.
Supply (high pressure)	4 inch w.g.
Return and Relief (low pressure)	2 inch w.g.
Return, Exhaust and Relief (high pressure)	4 inch w.g.
Return and Exhaust (where connected to air systems with high pressure supply ductwork)	4 inch w.g.
Outside Air Intake	2 inch w.g.
General Exhaust (low pressure)	2 inch w.g.

Notes:

All supply or return ducts upstream of terminal units shall be classified as high pressure (4” wg)
All supply or return ducts downstream of terminal units shall be classified as low pressure (2” wg)

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Branch duct take-off fittings.
2. Back-draft dampers.
3. Combination fire-and-smoke dampers.
4. Dynamic fire dampers – curtain blade type.
5. Dynamic fire dampers – multi-blade type.
6. Dynamic fire dampers – true round type
7. Ceiling radiation fire dampers.
8. Smoke dampers.
9. Manual volume balancing dampers.
10. Flexible duct connectors.
11. Duct access doors.
12. Duct test holes.

B. Related Sections:

1. Section 23 09 23 – Building Automation System for HVAC: Execution and Product requirements for connection and control of Smoke Dampers and Control Dampers for placement by this section.
2. Section 23 31 00 – HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
3. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 – Test Methods for Louvers, Dampers, and Shutters.

B. National Fire Protection Association:

1. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA – HVAC Duct Construction Standard - Metal and Flexible.
2. SMACNA – Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.

D. Underwriters Laboratories Inc.:

1. UL 555 – Standard for Safety for Fire Dampers.
2. UL 555C – Standard for Safety for Ceiling Dampers.
3. UL 555S – Standard for Safety for Smoke Dampers.

1.3 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

C. Product Data: Submit data for shop fabricated assemblies and hardware used.

D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.

1. Air device take-offs.
2. Fire dampers including locations and ratings.
3. Smoke dampers including locations and ratings.
4. Combination fire and smoke dampers including locations and ratings.
5. Ceiling radiation fire dampers including locations and ratings.
6. Backdraft dampers.
7. Flexible duct connectors.
8. Volume control dampers.
9. Duct access doors.

E. Product Data: For fire dampers, smoke dampers, combination fire and smoke dampers, and ceiling radiation fire dampers submit the following:

1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
2. Indicate materials, construction, dimensions, and installation details.
3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
4. Manufacturer's Installation Instructions: Submit for each damper type.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 – Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of access doors and test holes.

C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 – Product Requirements: Product storage and handling requirements.

B. Protect dampers from damage to operating linkages and blades.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage. Products on site, but not yet installed shall be stored in boxes. The open airside ends of installed equipment shall be plastic wrapped during construction.

E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Coordinate Work where appropriate with building control Work.

1.10 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two fire damper fusible links of each size and type.

PART 2 - PRODUCTS

2.1 BRANCH DUCT TAKE-OFF FITTINGS

A. Provide all branch duct take-off fittings with construction that is suitable for the duct pressure class as scheduled in section 23 31 00, HVAC Ducts and Casings. Fittings shall be minimum 24-gauge galvanized sheet metal. If trunk ductwork is fabricated from aluminum or stainless steel, takeoffs shall be manufactured from same material.

B. All branch duct take-off fittings serving air devices shall be provided with a manual volume damper equal to Flexmaster model BO3 with 3/8” aluminum square shaft secured to damper blade with U-bolts, nylon bushings, locking quadrant and 2-inch build out for insulation. (The 2-inch build out is not required on uninsulated ductwork.)

C. All branch duct take-off fittings serving terminal units shall be provided without a volume damper.

D. Branch duct take-offs from rectangular ductwork: Fittings shall be constructed for up to 4” w.g pressure rating, with all seams sealed. Connection to trunk duct shall be rectangular in shape with a 45° entry and shall have 1-inch flanges with double-sided adhesive gasket. Transition from rectangular to round branch shall be in an eccentric and tapered configuration. Take-off fittings shall be equal to Flexmaster model STO.

E. Optional branch duct take-offs from rectangular ductwork: Fittings shall be constructed for up to 4” w.g pressure rating, with all seams sealed. Connection to trunk duct shall be round in shape

with a conical entry and shall have 1-inch flanges with double-sided adhesive gasket. Take-off fittings shall be equal to Flexmaster model CB-SOG.

F. Branch duct take-offs from round ductwork: Provide saddle tap take-off fitting for spiral duct sizes up to 24" diameter. Fitting shall have rectangular to round outlet and constructed for up to 4" w.g. pressure rating. Fitting shall transition from rectangular to round in an eccentric and tapered configuration. Fitting shall be equal to Flexmaster model STO-ST 90° or model STO-ST 45°.

G. Branch duct take-offs from round ductwork with duct pressure class exceeding 4" w.g.: Fitting shall be designed to be low loss and have contoured saddle tap for connection to either a flat oval or round duct as indicated on the drawings. The fitting outlet shall transition to round duct. Fitting shall be a United McGill Model "SADDLE LO-LOSS TEE TAP" or equal.

2.2 BACK-DRAFT DAMPERS

A. Extruded aluminum multi-blade, back-draft dampers: Parallel-action, gravity-balanced, with adjustable counterbalance weights to permit setting for varying differential static pressure.

B. Ratings:

1. Leakage: Dampers shall have a maximum leakage of 15 CFM at 1 in. W.G., tested in accordance with AMCA standard 500-D.
2. Differential Pressure: Dampers shall have a maximum differential pressure rating of 2.5 in. W.G.
3. Velocity: Dampers shall have a maximum velocity rating of 2000 FPM.

C. Construction:

1. Frame: 0.063 in. extruded aluminum.
2. Blades: .050 in. extruded aluminum.
3. Seals: Blade edge seals shall be vinyl, mechanically fastened to each blade.
4. Linkage: On blade, plated steel material.
5. Axles: Aluminum.
6. Bearings: Axle bearings shall be synthetic polycarbonate sleeve.
7. Finish: Mill finish.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

B. Fire Resistance: 1-1/2 hour or 3 hour as required. Refer to the Architectural Life Safety drawing for wall, partition and floor ratings.

C. Leakage Rating: Class I, maximum of 8 CFM at 4 in. W.G. differential pressure, and 11 CFM at 8 in. W.G. differential pressure.

D. Damper Temperature Rating: 250 degrees F.

E. Damper Velocity and Pressure Rating:

1. Single skin blades: 2000 fpm at 6 in. WG.
2. Double skin airfoil blades: 3000 fpm at 4 in. WG.

F. Frame: 16 gauge, galvanized steel.

G. Blades:

1. Style: Single skin with 3 longitudinal grooves or airfoil-shaped, single piece, double skin.
2. Orientation: Horizontal.
3. Material: Galvanized steel, minimum 16 gauge for single skin blades or 14 gauge equivalent thickness for double skin blades.
4. Width: Maximum 6 inches.

H. Bearings: Stainless steel pressed into frame.

I. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

J. Linkage: Concealed in frame.

K. Actuator:

1. Type: Electric 120 volt, 60 hertz, two-position, fail close.
2. Mounting: External.
3. Actuator shall be installed by the damper manufacturer at time of fabrication.

L. Release Device: Electric heat responsive device that causes actuator's spring return mechanism to close damper when temperature setting is reached. Device shall be manually resettable. Release temperature shall be 165 degrees F (or approximately 50 degrees F. above normal temperature within duct system).

M. Damper Mounting: Vertical or horizontal as indicated on Drawings.

N. Finish: Mill galvanized.

O. Factory-installed sleeve: Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

P. Provide factory-assembled multiple section dampers where required sizes exceed maximum single section damper size.

2.4 DYNAMIC FIRE DAMPERS – CURTAIN BLADE TYPE

A. Fabricate in accordance with NFPA 90A and UL 555.

B. Fire Resistance: 1-1/2 hour or 3 hour as required. Refer to the Architectural Life Safety drawing for wall, partition and floor ratings.

C. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

D. Construction:

1. Integral Sleeve Frame: Roll formed galvanized steel, in gauge required by UL listing.
2. Blades:

a. Style: Curtain type
b. Action: Spring or gravity closure upon fusible link release.
c. Material: Roll formed, galvanized steel, in gauge required by UL listing.

3. Closure Springs: Stainless steel, constant force type.

E. Fusible Link Release Temperature: 165 degrees F.

F. Mounting: Vertical or horizontal as indicated on Drawings.

G. Duct Transition Connection, for Curtain Damper Style:

1. B style - rectangular connection, blades out of air stream, high free area.
2. CR style - round connection, blades out of air stream, sealed.
3. CO style - oval connection, blades out of air stream, sealed.
4. Style A Grille Mount - Out of wall damper for use at sidewall grilles, blades in air stream; 1-1/2 hour UL555 rated.

H. Finish: Mill galvanized.

I. Provide factory-assembled multiple section dampers where required sizes exceed maximum single section damper size.

2.5 DYNAMIC FIRE DAMPERS – MULTI-BLADE TYPE

A. Fabricate in accordance with NFPA 90A and UL 555.

B. Fire Resistance: 1-1/2 hour or 3 hour as required. Refer to the Architectural Life Safety drawing for wall, partition and floor ratings.

C. Damper Temperature Rating: 250 degrees F.

D. Damper Velocity Rating: 4000 fpm for sizes up to 32 in. x 50 in.; 2000 fpm for larger sizes.

E. Damper Pressure Rating: 8 in. WG.

F. Frame: 16 gauge, galvanized steel.

G. Blades:

1. Style: Single skin with 3 longitudinal grooves or airfoil-shaped, single piece, double skin.
2. Orientation: Horizontal.
3. Material: Galvanized steel, minimum 16 gauge for single skin blades or 14 gauge equivalent thickness for double skin blades.
4. Width: Maximum 6 inches.

H. Bearings: Stainless steel pressed into frame.

I. Seals: stainless steel jamb seals.

J. Linkage: Concealed in frame.

K. Fusible Link Release Temperature: 165 degrees F.

L. Damper Mounting: Vertical or horizontal as indicated on Drawings.

M. Finish: Mill galvanized.

N. Factory-installed sleeve: Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

O. Provide factory-assembled multiple section dampers where required sizes exceed maximum single section damper size.

2.6 DYNAMIC FIRE DAMPERS – TRUE ROUND TYPE

A. Fabricate in accordance with NFPA 90A and UL 555.

B. Fire Resistance: 1-1/2 hour. Refer to the Architectural Life Safety drawing for wall, partition and floor ratings.

C. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

D. Leakage: Dampers shall have a UL555S leakage rating of Class I at differential pressure rating of 4 inches wg.

E. Construction:

1. Frame and Sleeve: The damper frame and sleeve shall be of one piece design, made with 20 ga. galvanized steel and a groove for added strength.
2. Blades: Double skin, minimum 14 ga. equivalent thickness, galvanized steel.
3. Axles: Minimum ½ inch dia. plated steel.
4. Bearings: Minimum ½ inch dia. plated steel.
5. Fire Closure Device: Dampers shall be supplied with fusible link.
6. Mounting: Vertical or horizontal, as detailed on drawings
7. Retaining Plates: Single or two, as detailed on drawings.
8. Finish: Galvanized steel

2.7 CEILING RADIATION FIRE DAMPERS

A. Fire Rating: UL 555C classified and labeled as a 1-1/2 hour ceiling damper.

B. Air Flow Rating: UL approved for dual directional air flow.

C. Frame: Minimum 3 inches by minimum 20 gauge galvanized steel with roll formed ridge for blade stop.

D. Blades:

1. Style: Two-piece, single-thickness with blade insulation, hinged in center, and held open with fusible link.
2. Action: Butterfly.
3. Orientation: Horizontal.
4. Material: Minimum 20 gauge galvanized steel.

E. Hinge: Spring stainless steel, mechanically attached to blades.

F. Mounting: Horizontal.

G. Temperature Release Device: Fusible link, 165 degrees F.

H. Finish: Mill galvanized.

I. Performance Data:

1. Pressure Drop: Maximum 0.1 inches W.G. at 500 FPM across 18 x 18 inch damper.

J. Fusible Volume Adjust: UL classified.

K. Extended Frame:

1. Rectangular Dampers: 8 inches.
2. Round Dampers: 8-1/2 inches.

L. Thermal Blanket: Provide ceramic fiber type.

2.8 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S.

B. Leakage Rating: Class I, maximum of 8 CFM at 4 in. WG differential pressure, and 11 CFM at 8 in. W.G. differential pressure.

C. Damper Temperature Rating: 250 degrees F.

D. Frame: 16 gauge, galvanized steel.

E. Damper Velocity and Pressure Rating:

1. Single skin blades: 2000 fpm at 6 in. W.G.
2. Double skin airfoil blades: 3000 fpm at 4 in. W.G.

F. Blades:

1. Style: Single skin with 3 longitudinal grooves or airfoil-shaped, single piece, double skin.
2. Orientation: Horizontal.
3. Material: Galvanized steel, minimum 16 gauge for single skin blades or 14 gauge equivalent thickness for double skin blades.
4. Width: Maximum 6 inches.

G. Bearings: Stainless steel pressed into frame.

H. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

I. Linkage: Concealed in frame.

J. Actuator:

1. Type: Electric 120 volt, 60 hertz, two-position, fail close.
2. Mounting: External.
3. Actuator shall be installed by the damper manufacturer at time of fabrication.

K. Damper Mounting: Vertical or horizontal as indicated on Drawings.

L. Finish: Mill galvanized.

M. Provide factory-assembled multiple section dampers where required sizes exceed maximum single section damper size.

2.9 MANUAL VOLUME BALANCING DAMPERS

A. Fabricate in accordance with current SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Rectangular Dampers:

1. Single Blade Dampers: Duct sizes up to 36 inches in width. Blade dimension perpendicular to the axle rod shall be a maximum of 12 inches, for dimensions greater than 12 inches use a multi-blade damper. Furnish with 20 gauge galvanized steel blade, continuous axle rod and end bearings.
2. Multi-Blade Damper: Fabricate of opposed blade pattern with a maximum blade size of 8 x 48 inches. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware. Blades shall be minimum 18 gauge galvanized steel and frame shall be minimum 16 gauge galvanized steel.
3. End Bearings: Furnish for single and multiple blade dampers. On multiple blade dampers, furnish synthetic or bronze bearings.
4. Quadrants:

    a. Furnish locking, indicating quadrant regulators on dampers.
    b. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
    c. Where rod lengths exceed 30 inches furnish regulator at both ends.

C. Round Dampers: Sleeve and blade shall be G90 galvanized steel construction, manufactured from 24 gauge or heavier material as required to meet SMACNA for commercial construction. Provide a continuous 3/8” square shaft secured to damper blade with u-bolt(s). Provide with nylon bearings, locking quadrant and 2-inch build out for insulation. Damper shall be Flexmaster Model SL with BO3 build out or equal.

D. Concealed quadrant regulators:

1. Manufacturers:

    a. Young Regulator Co.
    b. Metropolitan Air Technology.
    c. Vent Fabrics.
    d. Or equal.

2. Locations: Provide on round and rectangular dampers in the following locations:

    a. Where damper regulator is located above an inaccessible ceiling (i.e. gypsum board) and a ceiling access door is not provided.
    b. Where the quadrant regulator is remote and is not accessible via a ceiling access door or by removal of a lay-in ceiling panel.
    c. As indicated on the drawing.

3. Flexible Cable Type Regulator:

    a. Regulator shall consist of a remote cable control system with 1/4” rotary motion flexible steel shaft for control of round and rectangular dampers.
    b. Provide with mounting controls, ceiling cup and hardware as required for installation of control mechanism in gypsum board ceiling, unless indicated on the drawings for the control mechanism(s) to terminate at a central control station.

2.10 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with current SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Connector: Fabric crimped into metal edging strip.

1. Fabric:

a. Indoor Applications: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
b. Outdoor Applications: UL listed fire-retardant hypalon coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.; product shall be intended for outdoor, exposed-to-weather applications.

2. Net Fabric Width: Approximately 3 inches wide.
3. Metal: 3 inch wide, 24 gauge galvanized steel.
4. Pressure Rating: min. 10” W.G.

2.11 DUCT ACCESS DOORS

A. Access doors for rectangular, round and oval ductwork shall be Ductmate model Sandwich Access Doors or equal.

B. Fabrication: Sandwich-style insulated access door.

1. Panels: The insulated sandwich access door shall consist of three layers of precision stamped steel. The inside panel shall consist of two layers of metal which are spot welded together along the rim encapsulating high density fiberglass insulation with Ecose Technology UL classified FHC25/50.
2. Gasket: Closed-cell neoprene gasket UL94HF1 listed with a service temperature range of (ASTM D746) -20 degrees F to 200 degrees F. The gasket shall be bonded to the inside of the door.
3. Springs: Zinc-plated conical springs shall be installed, between the inner and outer door, to facilitate opening.
4. Knobs: Polypropylene molded knobs shall have threaded metal inserts to eliminate thread stripping. Knobs shall be easily turned by hand. Knobs shall be UL94HB listed.
5. Bolts: Zinc plated carriage bolts are secured to inner door.
6. Template: Self-adhesive template shall be provided for the exact size of duct opening required.
7. Available Door sizes:

a. 8” x 4”
b. 10” x 6” (rectangular and oval duct only)
c. 12” x 8”
d. 16” x 12”
e. 18” x 14”
f. 24” x 18”

8. Access Door Sizes: Provide the largest door, from the sizes herein specified, that the duct size as indicated on the drawing can accommodate.

2.12 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air-tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

B. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify fire and smoke rated walls are ready for damper installation.

C. Verify ducts and equipment installation is ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A and follow current SMACNA HVAC Duct Construction Standards – Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Install back-draft dampers on exhaust ducts nearest to the outside and where indicated on Drawings.

C. Adjust back-draft damper counterbalance weights to open damper with minimal differential pressure.

D. Access Doors: Install access doors at the following locations and as indicated on Drawings:

1. Spaced every 20 feet of horizontal return air duct as required by NFPA 90A.
2. Upstream of each duct mounted filter.
3. Upstream of each duct mounted coil.
4. Upstream of each duct mounted air flow measuring station.
5. At each automatic control damper, on same side as damper actuator.
6. At each backdraft damper.

    a. Access door shall allow for access to adjust counterbalance weights.

7. At each fire damper, smoke damper, combination fire smoke damper.

    a. Access door shall allow for access to all components, provide additional doors as necessary.
    b. Access doors for smoke dampers shall be located on same side as damper actuator
    c. Access doors shall be labeled, with minimum ½” high letters, to identify location and type of fire protection device within, in accordance with NFPA and the locally adopted mechanical code.

E. Access Door Sizes: Provide the largest door, from the sizes herein specified, that the duct size as indicated on the drawing can accommodate.

F. Install temporary duct test holes where indicated on Drawings and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

G. Install permanent duct test holes where indicated on Drawings and required for testing and balancing purposes.

H. Install all dampers at locations as indicated on Drawings.

I. Install dampers square and free from racking with blades running horizontally.

J. Do not compress or stretch damper frame into duct or opening.

K. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.

L. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

M. Provide identification at each access door.

N. Install fire dampers, smoke dampers and combination fire smoke dampers in accordance with manufacturer's UL approved instructions, applicable building and mechanical codes, NFPA 90A and SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems. Install with required perimeter retaining angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

O. All Fire and Smoke Dampers shall be reasonably accessible without disassembling ceiling grid or other systems that are meant to be permanent.

P. Provide flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment.

Q. Provide balancing dampers where indicated on the drawings and as required for air balancing where branch ducts are taken from larger ducts at points on: constant volume supply air systems; supply air system downstream of air terminal units; return air systems and exhaust air systems.

R. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

3.3 FIRE AND SMOKE DAMPER TESTING

A. All fire and smoke dampers shall be tested by the fire alarm and HVAC contractor prior to substantial completion. The contractors shall visually inspect that every damper opens fully and closes fully when associated life safety devices are tripped.

B. The contractor shall provide as-built drawings, in PDF format, showing the exact location of all new fire and smoke dampers as well as duct access doors. In addition, the ceiling grid shall be tagged with the smoke damper name to expedite finding access to the duct access door.

C. The contractor shall provide documentation of damper make, model location, size and temperature of element (where applicable).

D. The contractor shall also re-test all fire and smoke dampers before the end of the one year warranty period.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof-mounted downblast centrifugal exhaust fans
2. Centrifugal inline fans
3. Ceiling exhaust fans

B. Related Sections:

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
2. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment: Roof curbs.
3. Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment: Product requirements for resilient mountings and snubbers for fans for placement by this section.
4. Section 23 09 23 – Building Automation System for HVAC: Controls remote from unit.
5. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
6. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
7. Section 26 05 03 - Equipment Wiring Connections: Execution and product requirements for connecting equipment specified by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:

1. AMCA 99 - Standards Handbook.
2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. American National Standards Institute:

1. ANSI S1.4 – Specifications for Sound Level Meters

D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. Underwriters Laboratories Inc.:

1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified design and maximum and minimum operating points plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity (measured in accordance with ANSI S1.4), electrical characteristics and connection requirements.

1. Fan efficiency, where scheduled in the Drawings, shall be included in product data such as static efficiency, fan efficiency grade (FEG), and fan energy index (FEI).

D. Manufacturer's Installation Instructions: Submit fan manufacturer’s instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years of documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect motors, shafts and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer's warranty for fans.

1.10 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.

1.11 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two sets of belts for each belt-driven fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Greenheck

B. Cook

C. Substitutions: Division 01 - Product Requirements

2.2 ROOF-MOUNTED DOWNBLAST CENTRIFUGAL EXHAUST FANS

A. General Description:

1. Downblast centrifugal fan shall be for roof mounted applications.
2. Motor drive type (i.e. belt-driven and direct-driven) – as scheduled in the Drawings.
3. Maximum continuous operating temperature shall be 180°F.
4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B. Wheel:

1. Constructed of aluminum.
2. Non-overloading, backward inclined centrifugal.
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05.
4. The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency.

C. Motors:

1. Motor shall meet all specified requirements in section 23 05 13.
2. Motors shall be accessible for maintenance.

D. Housing:

1. Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum.
2. Shroud shall have an integral rolled bead for extra strength.
3. Shroud shall be drawn from a disc and direct air downward.

4. Lower windband shall have a formed edge for added strength.
5. Motor cover shall be drawn from a disc.
6. All housing components shall have final thicknesses equal to or greater then preformed thickness.
7. Curb cap shall have pre-punched mounting holes to ensure correct attachment.
8. Rigid internal support structure.
9. Leak proof.

E. Shafts and Bearings (For Belt-Driven Fans):

1. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating.
2. Permanently sealed bearings or pillow block ball bearings.
3. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
4. Bearings shall be 100 percent factory tested.
5. Fan shaft first critical speed is at least 25 percent over maximum operating speed.

F. Housing Supports and Drive Frame (For Belt-Driven Fans):

1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.

G. Drive Assembly (For Belt-Driven Fans):

1. Belts, pulleys and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. The motor pulley shall be adjustable for final system balancing.
5. Readily accessible for maintenance.

H. Vibration Isolation:

1. Double studded or pedestal mount true isolators
2. No metal to metal contact.
3. Sized to match the weight of each fan.

I. Disconnect Switches:

1. NEMA rated: 3R.
2. Positive electrical shut-off.
3. Wired from fan motor to junction box installed within motor compartment.

J. Accessories:

1. Bird screen:

    a. Material Type: Aluminum.
    b. Protects fan discharge.

2. Roof Curbs: See Section 23 05 29.
3. Curb Seal:

    a. Rubber seal between the fan and the roof curb.

4. Dampers:

a. Type: Gravity.
b. Prevents outside air from entering back into the building when fan is off.
c. Balanced for minimal resistance to flow.
d. Galvanized frames with pre-punched mounting holes.
e. Provide with opening for conduit up through base.
f. Configured to work with fan orientation as indicated in the Drawings.

5. Finishes: None.
6. Auto Belt Tensioner (For Belt-Driven Fans):

a. Automatic tensioning device that adjusts for the correct belt tension, only for single drives.

2.3 CENTRIFUGAL INLINE FANS

A. General Description:

1. Centrifugal inline fan type for duct mounted applications.
2. Motor drive type (i.e. belt-driven and direct-driven) – as scheduled in the Drawings.
3. Base fan performance at standard conditions (density 0.075 Lb/ft3)
4. Normal operating temperature up to 180°F
5. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:

1. Non-overloading, backward inclined centrifugal wheel
2. Constructed of aluminum
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency
5. Single thickness blades shall be securely riveted or welded to a heavy gauge back plate and wheel cone.

C. Motors:

1. Motor shall meet all specified requirements in section 23 05 13.
2. Motor shall be accessible for maintenance.

D. Shafts and Bearings (For Belt-Driven Fans):

1. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating
2. Permanently sealed bearings or pillow block ball bearings
3. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
4. Fan Shaft first critical speed shall be at least 25 percent over maximum operating speed

E. Housing/Cabinet Construction

1. Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars
2. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

F. Housing Supports and Drive Frame (For Belt-Driven Fans):

1. Housing supports are constructed of structural steel with formed flanges
2. Drive frame is welded steel which supports the shaft and bearings and reinforcement for the housing
3. Pivoting motor plate with adjusting screws to make belt tensioning operations

G. Disconnect Switches:

1. NEMA rated: 1
2. Positive electrical shut-off
3. Wired from fan motor to junction box installed within motor compartment

H. Drive Assembly (For Belt-Driven Fans):

1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
2. Belts: Static free and oil resistant
3. Pulleys: Cast type, keyed, and securely attached to wheel and motor shafts
4. Motor pulleys are adjustable for final system balancing
5. Readily accessible for maintenance

I. Duct Collars:

1. Square design to provide a large discharge area
2. Inlet and discharge collars provide easy duct connection

J. Access Panel:

1. Two sided access panels, permit easy access to all internal components
2. Located perpendicular to the motor mounting panel

K. Accessories:

1. Belt Guards (For Belt-Driven Fans):

    a. Three-sided fabricated steel belt guard covers drive and motor

2. Belt Type (For Belt-Driven Fans):

    a. Type: Grip Notch

3. Dampers:

    a. Types: Gravity
    b. Galvanized frames with prepunched mounting holes
    c. Balanced for minimal resistance to flow
    d. Configured to work with fan orientation as indicated in the Drawings

4. Extended Lube Lines:

    a. Grease zerks on housing exterior allows for lubrication of bearings without disassembling the fan

5. Finishes:

    a. Coating type: Polyester

b. Constructed of expanded metal mounted in a steel frame to provide protection for non-ducted installations

6. Isolation:

a. Type: Housed Spring
b. Sized to match the weight of each fan

7. Motor Cover:

a. Constructed of galvanized steel
b. Covers motor and drives for safety
c. Standard on unit specified with UL

8. Wiring Pigtail:

a. Direct hook-up to the power supply
b. Nine foot wiring extension

2.4 CEILING EXHAUST FAN

A. General Description:

1. Ceiling mounted applications.
2. Motor drive type (i.e. belt-driven and direct-driven) – as scheduled in the Drawings.

B. Wheel:

1. Forward curved centrifugal wheel.
2. Constructed of calcium carbonate filled polypropylene.
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05.

C. Motors:

1. Motor shall meet all specified requirements in section 23 05 13.
2. Motors shall be accessible for maintenance.
3. Compatible for use with speed controls as indicated in the Drawings.

D. Housing: Constructed of heavy gauge galvanized steel with mounting brackets.

E. Outlet:

1. Steel duct collar shall be six or four inches in diameter to accept a six or four inch round duct work (ref Drawings).
2. Shall include a backdraft damper configured to work with fan orientation as indicated in the Drawings.

F. Grille: Constructed of high impact polystyrene plastic.

G. Disconnect Switch: NEMA 1

2.5 WALL MOUNTED PROPELLER FANS

A. General Description:

1. Fan arrangement shall be for supply or exhaust, as scheduled on drawings.
2. Motor drive type (i.e. belt-driven and direct-driven) – as scheduled in the Drawings.
3. Maximum continuous operating temperature 130ºF.
4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B. Wheel:

1. Propeller shall be aluminum blade riveted to steel hub.
2. A standard square key and set screw or tapered bushing shall lock the propeller to the motor shaft.
3. Statically and dynamically balanced in accordance with AMCA Standard 204-05.
4. The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

C. Motors:

1. Motor shall meet all specified requirements in section 23 05 13.
2. Motor shall be accessible for maintenance.

D. Drive Frame:

1. Drive frame assemblies and fan panels shall be galvanized steel.
2. Drive frame shall have welded wire or formed channels and fan panels shall have prepunched mounting holes, formed flanges and a deep formed inlet venturi.

E. Drive Assembly (For Belt-Driven Fans):

1. Belts, pulleys and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Pulleys: Cast type, keyed, and securely attached to wheel and motor shafts.
4. Motor pulleys shall be adjustable for final system balancing.
5. Readily accessible for maintenance.

F. Disconnect Switches:

1. NEMA rated: 3R, if exterior to building. NEMA 1, if interior.
2. Positive electrical shut-off.
3. Wired from fan motor to junction box.

G. Accessories:

1. Dampers:

   a. Type: Gravity
   b. Balanced for minimal resistance to flow.
   c. Galvanized frames with prepunched mounting holes.
   d. Configured to work with fan orientation as indicated in the Drawings

2. Finishes:

   a. Types: Polyester.

3. Wall Collar:

a. Constructed of galvanized steel with heavy gauge mounting flanges and prepunched mounting holes.

4. Motor Side Guard:

a. Guard type: OSHA Guard
b. Protective guard completely enclose the motor and drive side of the fan
c. Coated with Polyester, a thermal setting polyester urethane.

5. Weatherhood:

a. Shall shield wall opening and dampers from rain and snow
b. Material type: Galvanized
c. Turndown Angle: 45 degrees
d. Screen: Birdscreen
e. Finishes: Polyester

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as instructed by manufacturer.

C. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Furnish roof curbs per Section 23 05 29 for installation.

B. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance.

C. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck.

3.3 INSTALLATION

A. Install fans in accordance with manufacturer's Installation, Operation and Maintenance Manual (IOM) and contract drawings.

B. Secure roof fans with stainless steel lag screws to roof curb or structure.

C. Suspended Inline Fans: Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one-inch flex between ductwork and fan while running.

D. Install backdraft dampers on inlet to roof exhaust fans.

E. Install safety screen where inlet or outlet is exposed.

F. Pipe scroll drains to nearest floor drain for indoor utility vent set fans.

G. Install backdraft dampers on discharge of exhaust fans and as indicated on Drawings. Refer to Section 23 33 00. Configure to work with fan orientation as indicated in the Drawings.

H. For belt-driven fans, provide sheaves required for final air balance.

3.4 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer’s field services.

B. Furnish services of factory trained representative for minimum of one day to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.5 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction.

C. Vacuum clean inside of fan cabinet.

3.6 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate fan operation and maintenance procedures.

3.7 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect installed product and finished surfaces from damage during construction.

C. Do not operate fans until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

D. Protect installed exhaust fans to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single duct terminal units.

B. Related Sections:

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for fan powered terminal units for placement by this section.
2. Section 23 09 23 – Building Automation System for HVAC: Controls remote from unit.
3. Section 23 31 00 – HVAC Ducts and Casings.
4. Section 23 33 00 – Air Duct Accessories.
5. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electrical connections to air terminal units specified by this section.

1.2 REFERENCES

A. Air Conditioning, Heating and Refrigeration Institute:

1. AHRI 410 – Air Cooling and Air Heating Coils.
2. AHRI 880 – Performance Rating of Air Terminals.
3. AHRI 885 -Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. American Society of Heating Refrigeration and Air-Conditioning Engineers:

1. ASHRAE 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
2. ASHRAE 130 – Method of Testing for Rating Ducted Air Terminal Units.

C. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. National Fire Protection Association:

1. NFPA 70 – National Electric Code.
2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

E. International Association of Plumbing and Mechanical Officials:

1. Uniform Plumbing Code.
2. Uniform Mechanical Code.

F. International Code Council:

1. International Energy Conservation Code.

G. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.
2. UL 864 – Control Units and Accessories for Fire Alarm Systems.
3. UL 916 – Energy Management Equipment.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings indicating airflow, static pressure, total pressure, heating coil capacity and NC designation. Include electrical characteristics and connection requirements. Include schedules listing discharge and radiated sound power level (end reflection corrected per AHRI 885-2008 or later) for each of second through sixth octave bands at inlet static pressures of 1 inch to 4 inches wg.

C. Manufacturer's Installation Instructions: Submit support and hanging details, and service clearances required.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.5 QUALITY ASSURANCE

A. Test and rate air terminal units’ performance for air pressure drop, flow performance, and acoustical performance in accordance with AHRI 880 and AHRI 885. Attach AHRI seal to each terminal unit.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with Controls Specification.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Price Industries

B. Titus

C. Environmental Technologies, Inc.

D. Krueger

E. The Trane Co.

F. Metalaire

G. Nailor

H. Substitutions: Division 01 - Product Requirements.

2.2 SINGLE DUCT TERMINAL UNITS

A. Manufactured Units:

1. Variable Air Volume (VAV) or Constant Volume (CV) supply air control terminals for connection to single duct, central air systems, with DDC controls.
2. The controls contractor shall furnish the terminal control unit controller, electric damper motor, and flow transducer for installation on each terminal unit by the unit manufacturer under Division 23. These devices shall be delivered to the terminal unit manufacturer's factory in sufficient time for the terminal unit manufacturer to meet their schedule obligations. The cost of factory mounting, wiring, enclosure to meet local code and any factory testing and programming of the terminal control unit shall be included by the terminal unit manufacturer.
3. The controls contractor shall be responsible for installation of space sensors and communications transmission bus.
4. The terminal unit manufacturer shall provide a flow cross or two (2) pipe sensor suitable for interfacing with a Microbridge flow transducer.
5. The sheet metal contractor shall provide a minimum of two (2) inlet duct diameters of straight duct upstream from the terminal unit inlet.
6. The sheet metal contractor shall insure all terminal unit controllers are located a minimum of three (3) feet from all obstructions (walls, pipes, etc.) so as to remain accessible
7. The sheet metal contractor shall provide for dry storage of terminal units and mounted terminal box controllers upon receipt at jobsite.
8. The air flow balancing contractor shall check all terminal units and make any changes in the air flow parameters to ensure that the terminal box controls perform in accordance with the approved specifications and schedules.
9. Terminal Equipment Control Units (TEC's) shall be provided for direct digital control of terminals VAV boxes as specified. Units shall be UL Listed (UL916 PAZX, 864 UDTZ) and CSA approved.
10. Identify each unit with clearly marked identification label and airflow indicator. Label shall include unit nominal air flow, maximum factory set air flow, minimum factory set air flow, and coil type.

B. Lining material: Provide lining materials in conformance with NFPA 90A and UL 181.

1. Inside surfaces shall have lining material suitable to provide required acoustic performance, thermal insulation, and prevent sweating. In addition, internal lining shall be protected with scrim reinforced aluminum for cleaning, or lining shall be fiber-free foam.
2. Lining thickness shall be not less than 1 inch.
3. Lining shall be secured to supporting surfaces in such a manner that it will not delaminate, sag or settle.

C. Casing:

1. Provide casing constructed of zinc-coated steel not lighter than No. 24 M.S. gauge or aluminum not lighter than 0.04 inch thick, and hemmed, cross broken and reinforced to form a rigid unit.
2. Casing shall have removable hinged access door large enough to provide access to all moving parts, for inspection, adjustment, and maintenance without disconnecting ducts.
3. Panels shall be flush, gasketed airtight, and held in place by screwdriver operated latches or sheet metal screws.
4. Total leakage from casings shall not exceed 1 percent of the specified capacity when subjected to a pressure of 1/2 inch WG in low pressure section and a pressure of 5 inches WG in high pressure section with all outlets and inlets sealed off.

D. Dampers: Provide dampers and other internal devices constructed of materials that cannot corrode and do not require lubrication or other periodic servicing. Leakage rate of closed dampers shall not exceed 5 percent of specified capacity when close-off pressure differential is 4 inches WG.

E. Controls:

1. Terminal unit actuators shall be factory mounted and be DDC. The unit controller shall be provided by the DDC manufacturer, shipped to the air terminal manufacturer, and be factory mounted. The unit reheat coil control valve shall be provided by the Controls Contractor. Single duct Terminal Units shall be provided with a Class II step-down control transformer of voltage indicated on plans.
2. The terminal unit manufacturer shall include in his price the cost of mounting DDC sensors, controllers and actuators furnished by the temperature controls contractor. These controls shall be shipped to the unit manufacturer by the temperature controls contractor and mounted at the factory. The unit manufacturer shall also provide and install a control transformer. The unit actuator shall be electric.

F. Heating coils:

1. Electric Heating Coil:

a. Electric: UL listed, integral control box with auto reset primary cutout, manual reset secondary cut out, magnetic contactor for each stage, air flow safety switch, fan relay or air flow switch, single point wiring, integral code disconnect, and a control transformer.
b. Capacity: As Scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify ductwork is ready for air terminal installation.

3.2 INSTALLATION

A. Install terminal units in accordance with manufacturer's instructions.

B. Connect to ductwork in accordance with Section 23 31 00.

C. Locate units above easily removable ceiling components or install ceiling access doors.

D. Support units individually from structure. Do not support from adjacent ductwork.

E. Support air terminal units connected by flexible duct independently of flexible duct.

F. Install transition piece to match flexible duct size to inlet of terminal unit.

G. Provide a minimum of two (2) inlet ducts diameters of straight sheet metal duct upstream from the terminal unit inlet from elbows, transitions and duct takeoffs.

H. The sheet metal contractor shall insure all terminal unit controllers are located a minimum of three (3) feet from all obstructions (walls, pipes, etc.) so as to remain accessible.

I. Verify that electric power is available and of the correct characteristics.

J. The sheet metal contractor shall provide for dry storage of terminal units and mounted terminal box controllers upon receipt at jobsite. Once terminal units are received at jobsite and until final duct connections are made, cover outlet and inlet of units to prevent dust from settling inside of unit.

K. The airflow balancing contractor shall check all terminal units and make any changes in the airflow parameters to ensure that the terminal unit controls perform in accordance with the approved specifications and schedules.

3.3 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Ensure the damper operator attached to assembly allows flow range modulation of flow range from 100 percent of design flow to scheduled minimum flow rates and to zero, where applicable.

3.4 UNIT TESTING

A. Provide testing of all terminal units under provisions of Division 01.

B. Test run volume dampers and controls. Check sequence of operation and air flow limits at factory prior to shipment.

C. Base performance on tests conducted in accordance with AHRI 880.

D. Automatic flow controller shall be capable of maintaining air flow to within 5 percent of set point with inlet static pressure variations up to 2 inches.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indoor air devices.
2. Roof hoods.

B. Related Sections:

1. Division 09 – Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.
2. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment: Roof curbs.
3. Section 23 31 00 – HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
4. Section 23 33 00 – Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 – Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 – Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA – HVAC Duct Construction Standard – Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Test Reports: Rating of air outlet and inlet performance.

D. Submit manufacturer’s installation instructions under provisions of Division 01 – Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 – Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 WARRANTY

A. Division 01 – Execution and Closeout Requirements: Product warranties and product bonds.

1.8 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Price Industries

B. Titus.

C. Krueger.

D. Nailor Industries, Inc.

E. Greenheck.

F. Metalaire.

G. Substitutions: Division 01 – Product Requirements.

2.2 INDOOR AIR DEVICES

A. As Scheduled.

2.3 ROOF HOODS

A. As Scheduled.

B. Roof Curb: Provide curb to match dimensions of hood throat. Refer to Section 23 05 29 for curb requirements.

C. Roof hoods shall be Miami-Dade certified to withstand wind loads up to 150 mph without additional tie down methods.

2.4 SCHEDULES – See Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 – Administrative Requirements: Coordination and project conditions.

B. Verify inlet and outlet locations.

C. Verify ceiling and wall systems are ready for installation.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00.

C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Section 09 90 00.

D. Install items in accordance with manufacturer's instructions.

E. Insulate tops of all supply ceiling diffusers with min R-6 flexible duct insulation with vapor barrier.

F. Install return and exhaust register with blades to minimize sight through outlets or inlets.

G. Transfer Grilles: Provide two grilles, one on each side of wall with connecting sheet metal collar.

H. Transfer Ducts: Provide two grilles, one on each end of duct where ducted into space.

I. Locations of air distribution devices on Drawings are approximate and shall be coordinated with other trades to make symmetrical pattern and shall be influenced by the established general pattern of the lighting fixtures or architectural reflected ceiling plan, but primarily located to maintain proper air distribution.

J. Provide all specialties and frames for air distribution devices as required for proper installation in ceiling type as indicated on the architectural drawings. Provide all cutting and patching of T-bars, gypsum board, and other ceilings systems as required for installation of air devices.

K. Install curbs per Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

L. Install supply and return devices with a minimum of 24" separation.

M. Integral OBDs shall be installed fully open and only adjusted if tap dampers are inaccessible or it is necessary for balancing.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 81 03 - PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged variable volume rooftop air conditioning units.
2. Condensate drain piping.

B. Related Sections:

1. Division 22 - Facility Natural-Gas Piping: Natural gas piping connections.
2. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment: Requirements for roof curbs provided with equipment.
3. Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment: Vibration isolators.
4. Section 23 09 23 – Building Automation System for HVAC: Controls remote from unit.
5. Section 23 33 00 - Air Duct Accessories: Flexible connections.
6. Section 23 40 00 – HVAC Air Cleaning Devices.
7. Section 26 05 03 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. AHRI 210/240 – Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment (up to 65,000 BTUh).
2. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
3. AHRI 340/360 - Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment (between 65,000 and 135,000 BTUh).
4. AHRI 365 - Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment (over 135,000 BTUh).

B. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 37 – Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment.
2. ASHRAE 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
3. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
4. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International:

1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

E. International Association of Plumbing and Mechanical Officials:

1. Uniform Mechanical Code.

2. Uniform Plumbing Code.

F. International Code Council:

1. International Energy Conservation Code.

G. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.
2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 DEFINITIONS

A. Energy Efficiency Ratio (EER) - Ratio of cooling capacity in Btuh to power input in watts at any set or rating conditions.

B. Seasonal Energy Efficiency Ratio (SEER) – Ratio of cooling capacity in BTUh to total operating power input in watts, designated Standard Rating Conditions, expressed in BTU/W*h.

C. Integrated Energy Efficiency Ratio (IEER) – A weighted calculation of cooling efficiencies at full load and part-load Standard Rating Conditions (in Btu/Wh).

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating:

1. Cooling and heating capacities per AHRI conditions and capacities at site specific conditions, as scheduled on Drawings.
2. Efficiency ratings (EER, SEER or IEER) at AHRI Standard Raring Conditions.
3. Efficiency rating (EER) at site specific conditions
4. Dimensions.
5. Weights.
6. Rough-in connections and connection requirements.
7. Duct connections.
8. Electrical requirements with electrical characteristics and connection requirements.
9. Controls.
10. Accessories.
11. Sound data – provide unweighted sound power levels for each octave band between 63Hz and 4000Hz.
12. BAS points list for integration (where applicable).

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.6 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with AHRI 210/240 and AHRI 340/360.

B. Sound Rating: Measure in accordance with AHRI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Performance Requirements: Conform to minimum EER and SEER prescribed by the International Energy Conservation Code or ASHRAE 90.1 when tested in accordance with AHRI 210/240 and AHRI 340/360.

E. Outside Air Damper Leakage: Test in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept units on site. Inspect for damage.

C. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.9 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer’s warranty for compressors.

C. Furnish ten-year manufacturer’s warranty for heat exchangers.

1.11 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Maintenance service.

1.12 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of spare filters for each unit.

PART 2 - PRODUCTS

2.1 PACKAGED ROOFTOP VARIABLE VOLUME AIR CONDITIONING UNITS

A. Manufacturers:

1. The Trane Company
2. Aaon, Inc.
3. Carrier Corp.
4. Lennox International
5. Daikin Applied
6. Johnson Controls, Inc.
7. Greenheck
8. CaptiveAire
9. Substitutions: Division 01 - Product Requirements.

B. Product Description: Self-contained, packaged, factory assembled and wired, consisting of roof curb, cabinet, variable speed supply fan, refrigerant cooling coil, variable capacity compressor, refrigeration circuit, condenser, heating section as scheduled in the Drawings, air filters, mixed air casing, controls, and accessories.

C. Configuration: Downflow or horizontal air delivery as indicated on Drawings.

D. Roof Mounting Curb: curb to be provided with equipment; refer to Section 25 05 29 for curb requirements.

E. Cabinet:

1. Designed for outdoor installation with weatherproof construction.
2. Doors: Provide insulated, hinged access doors with quarter-turn handles to access all sections of the air handler.
3. Panels: Constructed of galvanized steel with baked enamel finish meeting salt spray test in accordance with ASTM B117. Furnish removable access panels where access doors are not provided.
4. Insulation: Factory applied to exposed vertical and horizontal panels. Provide aluminum foil faced glass fiber with edges protected from erosion or closed cell foam, with a minimum total thermal resistance value of R-4.

F. Supply Fan: Plenum/plug type, resiliently mounted with direct drive high efficiency motor, as scheduled. Motor permanently lubricated with built-in thermal overload protection. Belt-drive motors are not acceptable. Furnish with variable frequency drive (VFD) or electronically commutated motor (ECM) for variable volume operation, as scheduled in the Drawings.

G. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Stainless steel drain pan with piping connection. Factory leak tested under water.

H. Hot-Gas Reheat Coil: Provide hot-gas reheat coil, piping and valves to provide humidity control, where scheduled in the Drawings.

I. Compressor: All compressors shall be hermetically sealed, resiliently mounted with positive lubrication, and internal motor overload protection. Furnish internal vibration isolators and short cycle protection. Provide each unit with capacity modulation per size category below, or as scheduled in the Drawings:

≤ 5 tons	Variable speed or digital scroll compressor
6 – 20 tons	Variable speed/digital scroll lead compressor, or min. 3 stages of cooling
21-25 tons	Variable speed/digital scroll lead compressor, or min. 4 stages of cooling

J. Refrigeration circuit: Furnish the following for each circuit, thermal expansion valve, filter-drier, suction, discharge, and liquid line service valves with gauge ports, high and low pressure safety controls. Dehydrate and factory charge each circuit with oil and refrigerant.

K. Condenser:

1. Coil: Copper tube aluminum coil assembly or aluminum micro-channel assembly and galvanized steel hail guard. Factory leak tested under water.
2. Condenser Fan: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Motor permanently lubricated with built-in thermal overload protection. Furnish high efficiency fan motors.

L. Air Filters: Refer to Section 23 40 00 – HVAC Air Cleaning Devices. Refer to Drawings for filter size and type.

M. Mixed Air Casing:

1. Outside Air Damper Leakage: Maximum 3.0 cfm per square foot at 1.0 inches wg pressure differential.
2. Outside Air Damper: 0-100% motorized modulating damper with spring return and without actuator. Furnish rain hood with screen.

N. Outside Air Flow Monitoring Station:

1. Provide at units where scheduled on the Drawings.
2. Provide airflow measurement system for monitoring and controlling minimum outdoor airflow rate.

    a. Accurate to plus or minus 0.5 percent over operating range of 200 to 1,200 fpm, and within plus or minus 5 percent for operating ranges as low as 100 fpm.
    b. Provide input to building automation system, linear to measured airflow rate.

3. Digital Airflow Signal Processors:

    a. Span: Factory calibrated to match the application.
    b. Accuracy: Plus or minus 0.25 percent of full scale including non-linearity, hysteresis, deadband and non-repeatability.
    c. Temperature Effects: Less than 0.025 percent full scale per deg F.
    d. Over-pressure: 5 psig proof, 10 psig burst.
    e. Response: Less than 0.25 seconds for full scale input.
    f. Enclosure: NEMA 1 rated flame retardant ABS plastic.
    g. Capable of twelve-point linearization and four-point flow correction.
    h. Large backlit LCD for configuration and local indication of measured process.

O. Controls:

1. Units shall be controlled as noted on the control sequences in the Drawings.
2. Furnish control to provide low ambient cooling to 0 degrees F.
3. Provide factory wired float switch in drain pan to de-energize unit when the primary condensate drain is clogged.
4. Furnish terminal strip on unit for connection of operating controls to remote panel.
5. Thermostat: [7 day] programmable electronic space thermostat with [1] [2] stage heating and [1] [2] stage cooling with automatic changeover and heating setback and cooling setup capability. Furnish system selector switch with [off-heat-auto-cool] [fan control switch, auto-on] option.

P. Accessories:

1. Convenience Outlet: Factory installed, 115 volt, 15 amp, GFCI type, internally mounted.
2. Hail Guard: Provide factory installed hail guard for any exposed condenser coils.
3. Roof Curb Adaptor Package: Furnish duct support hardware to adapt unit to existing roof curb.
4. Factory installed ultraviolet C light located downstream of cooling coil.

Q. Capacity: See Schedule on Drawings.

R. Electrical Characteristics and Components: In accordance with Section 26 05 03 and as scheduled.

1. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.
2. Electrical Connection: The unit shall have capability of single point power supply connection from below, up through the roof level.

2.2 CONDENSATE DRAIN PIPING

A. Furnish and install condensate drain piping from each air conditioning unit as shown on the Drawings. Refer to section 23 05 29 for requirements for supports.

B. Condensate drain piping shall be Type ‘L’ hard drawn copper piping with wrought copper fittings.

C. Provide cleanout at each change of direction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as instructed by manufacturer.

3.2 INSTALLATION

A. Roof Curb:

1. Assemble roof curb.
2. Install roof curb level.
3. Coordinate curb installation and flashing with specified roofing system.
4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
5. Install gasket material between unit base and roof curb.

B. Connect units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.

C. Install condensate piping with trap and route from drain pan as shown on Drawings. Refer to Section 23 05 29 for supports.

D. Install components furnished loose for field mounting.

E. Install electrical devices furnished loose for field mounting.

F. Install control wiring between unit and field installed accessories.

G. Any panels permanently removed from units during installation shall be removed from roof and dispose off-site.

3.3 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer’s field services.

B. Furnish initial start-up for all rooftop units. Provide manufacturer’s start-up report for each unit.

3.4 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.5 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

C. Furnish services of manufacturer's technical representative for one (8) hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

END OF SECTION

SECTION 23 81 26 - SPLIT-SYSTEM AIR CONDITIONERS AND HEAT PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mini-split systems.
2. Condensate drain piping.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete: Execution requirements for concrete foundations specified by this section.
2. Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment: Vibration isolators.
3. Section 23 09 23 – Building Automation System for HVAC: Controls remote from unit.
4. Section 23 23 00 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.
5. Section 23 31 00 – HVAC Ducts and Casings.
6. Section 23 33 00 - Air Duct Accessories: Flexible connections.
7. Section 23 40 00 – HVAC Air Cleaning Devices
8. Section 26 05 03 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. AHRI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
3. AHRI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
4. AHRI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASTM International:

1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

D. International Association of Plumbing and Mechanical Officials:

1. Uniform Mechanical Code.
2. Uniform Plumbing Code.

E. International Code Council:

1. International Energy Conservation Code.

F. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.

G. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Product Data: Submit data indicating:

1. Cooling and heating capacities.
2. Dimensions.
3. Weights.
4. Rough-in connections and connection requirements.
5. Duct connections.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Controls.
8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with AHRI 210/240.

B. Sound Rating: Measure in accordance with AHRI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Accept units and components onsite in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

C. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

D. Protect units from weather and construction traffic by storing in dry, roofed location.

1.8 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of condensing units and heat pumps with concrete pad.

C. Coordinate installation of air handling units with building structure.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer’s warranty for compressors.

1.10 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.

1.11 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Furnish two sets of filters for each unit.

PART 2 - PRODUCTS

2.1 MINI-SPLIT SYSTEMS

A. Acceptable Manufacturers:

1. Mitsubishi.
2. Daikin.
3. LG
4. Substitutions: Division 01 - Product Requirements

B. Fan Coil Unit

1. Configuration: Unit shall be wall-mount or ceiling cassette as indicated on the Drawings. All indoor units shall be compatible with associated outdoor units and vice versa.
2. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, DX cooling coil, air filter, wired for single power connection with control transformer.
    a. Electric Refrigeration: Refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.
3. Supply Fan: Line flow fan with multi-speed direct drive motor.
4. Performance:

a. Ratings: Seasonal Energy Efficiency Rating (SEER) of the system shall be not less than as indicated on the Drawings.
b. Refer to Schedules on Drawings.

5. Operating controls: Units shall be controlled by a factory-installed thermistor mounted to the fan-coil unit. A wired remote controller shall control the unit and shall rest in a remote control holder mounted to the fan coil unit.
6. Condensate Pump: Unit shall be provided with condensate pump integral to unit; where integral condensate pump is not offered, a separate condensate pump shall be provided.

a. Performance: Pump shall be rated for min. 3 gph discharge at 10 ft. w.g. of head. unless noted otherwise on the Drawings.
b. Electrical: Power shall be 120V/1ph unless noted otherwise on the Drawings.
c. Accessories: Furnish compatible tubing and self-sealing connector to route to termination as indicated in the Drawings; Contractor shall coordinate to furnish enough tubing length to achieve total length of run as needed. Furnish mounting bracket if pump is required to be mounted separately from indoor unit.

C. Condensing Units / Heat Pump Units

1. Construction and Ratings: In accordance with AHRI 210/240.
2. Compressor: Energy efficient variable speed inverter rotary compressor, resiliently mounted integral with condenser.
3. Air Cooled Condenser: Aluminum fin and copper tube coil, with direct drive axial propeller fan, and fan guard.
4. Provide hail guard accessory for all units. Hail guard shall consist of an anodized aluminum frame around a welded wire mesh screen with UV resistant PVC coating and stainless steel fasteners to all side of unit with exposed coils.
5. Provide wind baffles for all roof-mounted units and other units with limited airflow clearances or where discharge air is directed at an adjacent unit's inake.
6. Refrigerant: Unit shall be pre-charged with refrigerant for minimum of 70 feet of refrigerant piping. Provide additional refrigerant as required for extended lengths of refrigerant lines.
7. Electrical Characteristics: As Scheduled in the Drawings.

2.2 CONDENSATE DRAIN PIPING

A. Furnish and install an insulated condensate drain piping from each air conditioning unit to a plumbing fixture or other approved location as shown on the Drawings.

B. Condensate drain piping shall be Type "L" hard drawn copper piping with wrought copper fittings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify concrete pad for condensing unit or outdoor heat pump unit is ready for unit installation.

C. Verify that proper power supply is available for equipment.

3.2 INSTALLATION – MINI-SPLIT SYSTEM

A. Install in accordance with manufacturer's instructions.

B. Provide additional refrigerant charge if installed length of refrigerant piping is longer than manufacturer's allowance for pre-charged system.

C. Install connection to electrical power wiring in accordance with Section 26 05 03 for all components.

D. Mount loose condensate pump provided with unit on wall bracket per manufacturer's requirements.

3.3 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.4 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate equipment operation and maintenance.

C. Furnish services of manufacturer's technical representative for one (8) hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days' notice to Architect/Engineer of training date.

3.5 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not operate air handling units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 82 19 - TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Unit Heaters.

B. Related Sections:

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
2. Section 23 40 00 – HVAC Air Cleaning Devices.
3. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electrical connections to air terminal units specified by this section.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Product Data: Submit data indicating configuration, general assembly, and materials used in fabrication. Include fan performance curves, fan sound power rating, certified coil performance ratings, motor ratings, electrical characteristics, and motor and fan accessories.

C. Manufacturer's Installation Instructions: Submit support and hanging details, and service clearances required.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing Work of this section with minimum three years of experience.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with Controls Specification.

C. Coordinate size and location of structural steel support members.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Two sets for each low profile fan coil unit.
2. Fan Belts: One set for each low profile fan coil unit fan.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

A. Acceptable Manufacturers:

1. Modine.
2. Qmark.
3. Reznor
4. Trane
5. Substitution: Division 01 – Product Requirements.

B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Casing: 0.0478 inch steel with threaded pipe connections for hanger rods.

D. Finish: Factory applied baked enamel.

E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

F. Air Outlet: Adjustable pattern diffuser on projection models and four-way louvers on horizontal throw models.

G. Motor: Totally enclosed, permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.

H. Control: Line voltage thermostat, adjustable from 45 degrees to 85 degrees F.

I. Capacity: As scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

C. Examine roughing-in of electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Verify ductwork is ready for unit installation.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Connect to ductwork in accordance with Section 23 31 00.

C. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

D. Protection: Provide finished cabinet units with protective covers during balance of construction.

E. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

F. Arrange installation of all units to provide access space around units for service and maintenance and to ensure that all access panels are unobstructed.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 specifications. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect condensate drain pans, to drainage piping. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

D. Duct installation and connection requirements are specified in other Division 23 specifications. Drawings indicate general arrangement of ducts and duct accessories.

E. Electrical: Comply with applicable requirements in Division 26 for power wiring, switches and motor controls.

F. Ground equipment according to Division 26.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Final Checks before Startup: Perform the following:

1. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters and disconnect switches.
2. Perform cleaning and adjusting specified in this Section.
3. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
4. Lubricate bearings, pulleys, belts and other moving parts with factory-recommended lubricants.
5. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

C. Starting procedures for fan coil units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.

D. Refer to Section 23 05 93 – Testing, Adjusting and Balancing for system testing, adjusting and balancing.

3.6 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units.

B. After completing system installation and testing, adjusting, and balancing fan coil and air-distribution systems, clean filter housings and install new filters.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 26 00 01 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Basic Electrical Requirements specifically applicable to all Division 26 Sections, in addition to Division 1 - General Requirements.

1.2 OWNER-FURNISHED PRODUCTS

A. Products furnished to the site and paid for by Owner:

1. Where indicated on the Drawings or other sections of the specifications.

1.3 WORK SEQUENCE

A. Install work in sequence to accommodate Owner's occupancy requirements during the construction period. Coordinate schedule and operations with Architect/Engineer and Owner.

1.4 BASIS OF BID

A. The Bidders shall bid the work on the basis of the design presented on the Drawings and in the specifications. If in the opinion of the Bidder, the design will not be acceptable to the authorities having jurisdiction, he shall notify the Architect/Engineer, in writing, at least ten days prior to bid opening. After receipt of notice, and concurrence by the Architect/Engineer, changes to the design will be issued by addendum to all bidders of record.

1.5 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code, current edition with local amendments, if any.

B. Applicable Building Code.

C. All work installed under this contract shall comply with the requirements of the referenced standards.

D. All materials and labor furnished by the Contractor shall be in strict accordance with the rules and requirements of the National Board of Fire Underwriters, NEC, State and Municipal regulations, telephone company, power company and other authorities who may have lawful jurisdiction over the work being done.

1.6 SUBMITTALS

A. Submit under provisions of Division 01 – Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Submit Shop Drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal.

D. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

1.7 REGULATORY REQUIREMENTS

A. Conform to referenced codes.

B. Obtain permits, and obtain all required inspections from authority having jurisdiction.

C. The Contractor will be responsible for all permits and inspections required by law for the completion of his work. Cost of all permits and inspections shall be paid by the Contractor. The Contractor shall obtain and pay for all certificates of approval which must be delivered to the Architect before final acceptance of the job.

D. All Division 26 work shall be done under the supervision of a currently licensed State of Texas Master Electrician.

1.8 PROJECT/SITE CONDITIONS

A. Contractor shall visit the site prior to bid and carefully familiarize himself with all existing conditions as may be determined by visual inspection without removing permanent finishes. If discrepancies are noted between the Drawings and existing conditions, the contractor shall notify the Architect/Engineer, in writing, no later than ten days prior to bid opening of the discrepancies. Upon receipt of notice of discrepancies, and verification, the Architect/Engineer will issue corrections by addendum to all bidders of record.

B. Prepare Drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.9 QUALITY ASSURANCE

A. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings or engineering parameters from those indicated on the contract documents, the contractor shall be responsible for all costs, including costs of all trades affected, involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.

B. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable and approved by Architect/Engineer, shall apply and such items shall bear those labels.

1.10 CONTINUITY OF EXISTING SERVICES AND SYSTEMS

A. No outages shall be permitted on existing systems except at the time and during the interval specified by the Owner and by the Architect/Engineer Project Representative. The Owner may require written approval. Any outage must be scheduled when the interruption causes the least interference with normal schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

B. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

1.11 INTENT

A. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.

B. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the Architect/Engineer's intent (as determined by the Architect/Engineer Project Manager).

C. The details and Drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. All sizes as given are minimum except as noted.

E. Whenever a particular manufacturer's specific product is named, it is intended to establish a level of quality and performance requirements.

1.12 ENGINEERING DESIGN TEAM OBSERVATIONS

A. Each contractor shall be responsible for coordinating their work with the General Contractor and scheduling progress observations through the General Contractor to allow for the following observations to be performed without impeding the progress of construction. Generally, the Contractor shall plan for observations to occur two (2) weeks prior to the scheduled concealment of work in the area of observation.

B. In general, observations for this project shall include but not be limited to:

1. Rough Wall: All utilities, services and systems in-place including wall studs, cross bracing, supports, etc. (No sheetrock or insulation).
2. Corrected Rough Wall: (Before Sheetrock).
3. Above Ceiling: All utilities, services and systems in place (ceiling grid/channels may be installed but no sheetrock or ceiling tile).
4. Above Ceiling Final: All utilities, services and systems complete including hangers and labeling (ceiling grid and/or channel may be in place but no sheetrock or ceiling tile shall be installed).
5. Substantial Completion: All surfaces complete, fixtures installed and trim-out complete.
6. Final: Cleaned and ready for occupancy.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 SCOPE

A. The accompanying Plans and Specifications as outlined in the various sections of this Division cover the furnishing of all labor, materials, tools, transportation services, etc., necessary for complete and working installation of electrical facilities.

3.2 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections, raceway systems, and cables, including those located above accessible ceiling finishes.

B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not required to be removed.

C. Extend existing equipment connections where indicated on the Drawings. Where existing circuits to remain are interrupted, replace interrupted portions to maintain continuity. Use materials and methods compatible with existing electrical installations and as specified.

3.3 FIRESTOPPING

A. Unless specifically indicated otherwise on the Drawings, all penetrations of fire-rated walls and floors shall be made in accordance with specification Division 07.

3.4 TESTING

A. General: Provide all labor, materials and equipment necessary to make the required tests as required by code or per other Division 26 sections.

3.5 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with provisions of Division 31. Blasting will not be allowed without written permission of the Architect/Engineer and Owner.

3.6 CONCRETE WORK

A. All cast-in-place concrete unless noted otherwise elsewhere will be provided under Division 3. Provide all Layout Drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

3.7 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.8 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, provide the access doors.

3.9 COORDINATION

A. Cooperate with other trades and Architect/Engineer's personnel in locating work. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Project. The Contractor shall check location of electrical outlets with respect to other installations before installing.

B. The Contractor shall verify that all devices are compatible for the surfaces in or on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.

C. Coordinate all work with other trades prior to installation. Any installed work that is not coordinated and that interferes with other trades' work shall be removed without additional cost.

3.10 SLEEVES

A. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.

B. In wet area floor penetrations, provide Schedule 40 sleeves only. Top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert Schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers and similar waterside equipment.

C. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of a core drilled opening without the sleeve, provided that the firestopping requirements of Article 3.02 are met.

3.11 HOUSEKEEPING AND CLEANUP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

SECTION 26 05 03 - EQUIPMENT WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. The work under this section includes electrical connections to equipment specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:

1. HVAC motors, controllers, and panels.
2. Plumbing motors, controllers, and panels.
3. Architectural Equipment (Overhead doors, motorized partitions, backstops, etc.)

B. Related Sections:

1. Section 26 05 19 - Building Wire and Cable.
2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations and construction.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes and configurations of equipment connections.

1.5 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration with outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

2.2 RACEWAYS, BUILDING WIRE AND CABLE, AND ENCLOSED SWITCHES

A. As specified in other Division 26 sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring and to be energized.

3.2 INSTALLATION

A. Make electrical connections. Utilize cord, receptacles and attachment plugs for portable equipment or for any equipment furnished by manufacturer with cord and plug connections. Install receptacle outlet to accommodate connection with attachment plug. Install cord and cap for field-supplied attachment plug. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes. Provide wire basket type strain reliefs, both ends for any suspended cords. Connect all other equipment with raceways and provide suitably rated disconnecting means, capable of being locked in the “off” position.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

E. Install terminal block jumpers to complete equipment wiring requirements.

F. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements. Install in accordance with equipment vendor’s requirements.

G. HVAC and Plumbing Connections:

1. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.
2. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.
3. Provide 120 volts to each temperature control panel. Coordinate requirements with HVAC/DDC contractors.
4. Unless otherwise specified, all control devices such as aquastats, float and pressure switches, fan-powered VAV boxes, switches, electro-pneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired under other divisions of these specifications.
5. Each motor terminal box shall be connected with a minimum 12", maximum 36" piece of flexible PVC-coated metal conduit to a fixed junction box. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
6. Check for proper rotation of each motor.

3.3 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

3.4 EQUIPMENT TO BE CONNECTED

A. Unless specifically noted otherwise, each piece of utilization equipment shown on the Drawings, whether Owner furnished or Contractor furnished, shall be connected by the Contractor.

END OF SECTION

SECTION 26 05 05 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition for remodeling.

B. Electrical/control portion of HVAC work covered by Division 23 pertaining electrical demolition shall follow the requirement set forth by this specification.

1.2 RELATED WORK

A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for minor electrical demolition for remodeling.

1. Section 26 00 00 - Basic Electrical Requirements.

B. In the event of conflict regarding minor electrical demolition requirements between this Section and any other Section, the provisions of this Section shall govern.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: as specified in individual Sections.

B. Provide all materials necessary for work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. All demolitions or modifications to existing systems shall be coordinated through Owner’s Representative. Demolition Drawings are based on casual field observation and existing record documentations. Therefore, the accuracy or exactness of the Drawings is not guaranteed. The Contractor shall verify that field measurements and circuiting arrangements are as shown on Drawings and abandoned wiring and equipment serve only abandoned facilities. The Contractor shall be responsible for reporting discrepancies to Engineer before disturbing existing installation.

B. Beginning of demolition means Contractor accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal. Provide temporary wiring and connections to maintain remaining systems in service during demolition and/or modification. Owner reserve the right up to 24 hours prior to any scheduled event to delay or suspend shutdowns or outages to more convenient times at no additional cost.

B. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. No work shall begin without proper permits and authorizations. Disable system only to make switchovers and connections. Obtain permission from Owner at least (2) weeks

before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

C. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner at least (2) weeks before partially or completely disabling system. Minimize outage duration. Provisions for manual fire watch shall be provided in areas where services are interrupted. Make temporary connections to maintain service in areas adjacent to work area.

D. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Notify Owner at least (2) weeks before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new plan drawings.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes full length from source to device. Cut embedded or concealed conduit flush with walls and floors, and patch surfaces.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

D. Disconnect and remove abandoned panelboards and distribution equipment.

E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers and other accessories.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

I. Extend existing installations using materials and methods compatible with existing electrical installation or as specified.

J. The level of completion shall be demonstrated to Owner’s Representative.

K. Where equipment is indicated to be demolished and returned to Owner, the Contractor shall include the delivery of this equipment to the Owner's site storage area. Remove with care all equipment to be relocated. Repair or replace of newly damaged equipment is the responsibility of the Contractor.

3.4 CLEANING AND REPAIR

A. The Contractor shall follow Owner’s clean work policy and shall include the removal of trash and demolished material from the building or work area at the end of each day and removal from the site once a week.

B. The Contractor shall be responsible for repairing adjacent construction and finishes damaged during demolition and/or modification. The Contractor shall be responsible for the removal of ceiling tiles required in the demolition work. The Contractor shall be responsible for the replacement of damaged tiles and reinstallation of the ceiling prior to final acceptance.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

3.5 DISPOSITION OF MATERIAL AND EQUIPMENT

A. Review with the Owner materials that have been removed and are no longer required, to determine any which the Owner may desire to keep. Deliver those materials that the Owner desires to the Owner's specified location.

B. For those materials not required by the Owner, dispose of them in accordance with applicable regulations.

END OF SECTION

SECTION 26 05 19 - 600-VOLT BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete system of building wire and cable to all electrical loads.

1.2 REFERENCES

A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wire, cables, and connectors.

B. UL Compliance: Comply with UL standards pertaining to wire cable and connectors.

C. UL Labels: Provide electrical wires, cables and connectors which have been UL-listed and labeled.

D. NEMA/ICEA Compliance: Comply with applicable portions of NEMA/Insulated Cable Engineers Association Standards pertaining to materials, construction and testing of wire and cable.

E. ANSI/ASTM: Comply with applicable portions of ANSI/ASTM standards pertaining to construction of wire and cable.

F. IEEE Compliance: Comply with applicable portions of IEEE standards pertaining to wire and cable.

G. NECA Compliance: Comply with NECA's "Standard of Installation."

1.3 SYSTEM DESCRIPTION

A. Conductors intended for power wiring and control wiring operating at above 50 volts to 600 volts nominal. Section includes both individual conductors and cable assemblies.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit for building wire and each cable assembly type.

1.5 QUALIFICATIONS

A. Manufacturers: Company supplying products listed by UL or CSA.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical wiring work similar to that required for this project.

1.6 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 - PRODUCTS

2.1 GENERAL

A. All conductors shall be copper unless specifically noted or otherwise allowed in specifications or on Drawings. Conductor sizing shown on plans and schedules is based on copper unless specifically noted otherwise.

B. All conductors shall be new, delivered to site in unbroken original packaging out of manufacturer's stock.

C. Except as otherwise indicated, provide wire, cable and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, and as required for the installation.

2.2 CONDUCTORS

A. Conductor: 600-volt copper in sizes #14 and larger.

1. Conductors not smaller than #14 AWG for control circuits.
2. Conductors not smaller than #12 AWG for power and lighting circuits.
3. #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet
4. #10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 150 feet.
5. All control wiring and motor connections shall utilize stranded conductors.
6. Use stranded conductors for all feeders and branch circuits #10 AWG and larger.
7. Wire sizes shown are minimum based on code requirements, voltage drop and/or other considerations. Larger sizes may be installed at the Contractor's option to utilize stock size, provided conduit sizes are increased where necessary to conform to the National Electrical Code. Sizes of wires and cables indicated or specified are American Wire Gage.

B. Terminations:

1. Split Bolt Connectors: Not Acceptable.

2. Solderless Pressure Connectors: High copper alloy terminal. May be used only for conductor terminations to equipment pads or terminals. Not approved for splicing.

3. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

4. Compression (Crimp) Connectors: Long barrel; seamless, with internally beveled barrel ends. Connector shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors, and sized to accept conductors of the required ampacity. Connectors shall be marked with wire size, die index, number and location of crimps and shall be suitably color-coded. Using a suitable stripping tool, remove insulation from the required length of the conductor. Crimp the connection per the connector manufacturer's recommendation.

5. Mechanical Connectors: For use on copper conductors only. Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances, unless otherwise noted specifically on plans.

6. When terminating conductors to plated bus, prepare a compression-type connection. Bolts shall be plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to current ASTM standard or SAE grade 5. Nuts shall conform to current ANSI standards. Washers shall be steel, Type A plain, standard wide series conforming to current ANSI standards. Belleville conical spring washers shall be of hardened steel, cadmium plated or silicone bronze. Lubricate and tighten the hardware per manufacturer's recommendations.

7. Conductor Termination: Provide all power and control conductors that terminate on equipment or terminal strips, with solderless lugs or fork and flanged tongue terminals.

8. Underground Connectors: All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

2.3 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Insulation Types and Permitted Uses in Raceway for feeders and branch circuits:

1. Concealed, Dry, Interior Locations: Type THHN/THWN, XHHW.
2. Damp, Wet, Exterior Locations: Type THWN-2, XHHW-2.

C. Conduit sizes are based on THHN wire.

2.4 METAL-CLAD CABLE

A. Product Description: NEC Type 'MC' Metal Clad Cable. A fabricated assembly of insulated conductors in a flexible metallic enclosure. With an insulated green grounding conductor

B. Armor Material per NEC 330.116

C. Home Runs: All home runs shall be in conduit.

D. Uses Permitted:

1. Light fixtures: 6 foot maximum from individual light fixture to accessible junction boxes only.
2. Branch circuits only.
3. Dry interior locations only.
4. Use of cable allowed between devices in wall, to junction boxes in ceilings, and above concealed ceilings from junction boxes to light fixtures and direct runs between fixtures within room. Cables on same circuits may be run between rooms.

E. Uses Restricted:

1. Exposed cable installation.
2. Direct connections between light fixtures.
3. Patient care areas in healthcare facilities.

2.5 WIRE COLOR

A. General

1. Provide color coding in accordance with local code or Owner's established requirements. If not governed by local code requirements, verify with Owner if any special requirements apply. If not, provide colors for branch circuits and feeders as follows:

	Wire Sizes #10 and Smaller: Use Continuous Color Coded Insulation (Note A.2.)				Wire Sizes #6 and Smaller: Use Continuous Color Coded Insulation (Note A.3.)	
System/Phase	**A**	**B**	**C**	**N**	**G**	**IG**
120/208	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240	Black	Orange	Blue	White w/color stripe (Note 03)	Green	Green/Yellow Stripe
277/480	Brown	Orange (Purple if Orange is utilized for hi-leg system)	Yellow	Gray	Green	Green/Yellow Stripe

2. For wire sizes 8 AWG and larger, identify black conductors with colored tape at terminals, splices and boxes; colors as noted above.
3. For wire sizes 4 AWG and larger, identify black conductors with green colored tape at terminals, splices and boxes; colors as noted above.
4. Provide white (no stripe) insulation when 120/208V system is not present at this installation.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number and provide color coding at each junction box containing more than one neutral.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:

1. For 6 AWG and smaller: Green.
2. For 4 AWG and larger: identify with green tape at both ends and visible points including junction boxes.

2.6 MISCELLANEOUS ACCESSORY MATERIALS

A. Conductor Phase Marking Tape:

1. Furnish materials in accordance with referenced standards and authority having jurisdiction.
2. Tape: Colored adhesive tape, equal to 3M Type 35.

B. Wire Markers

1. Furnish materials in accordance with referenced standards and authority having jurisdiction.

2. Description: Split sleeve type wire markers.
3. Legend:

    a. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

C. Cable Pulling Lubricant

1. Products: Ideal ‘Yellow 77+’ or equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

E. Verify field measurements are as indicated on Drawings.

3.2 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required to meet project conditions.

B. Wire and cable routing is approximate unless dimensioned.

3.3 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods compatible with existing electrical installations, and as specified.

3.4 INSTALLATION

A. All wiring shall be installed as individual conductors contained in raceway systems, unless specifically noted otherwise on the Drawings or otherwise specified. Cables are not raceways.

B. Provide separate neutral conductors for all single phase circuits. The use of multi-wire circuits with common neutrals is not allowed.

C. Neatly train and lace wiring inside boxes, equipment and panelboards.

D. Special Techniques – Building Wire in Raceway:

1. Pull conductors into raceway at same time.
2. Install building wire 1/0 AWG and larger with motorized pulling equipment.
3. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary. Compound must not deteriorate conductor insulation.
4. Place all conductors of a given circuit in the same raceway. This includes phase wires, neutral (if any), and ground conductor. If parallel phase and/or neutral wires are used, place an equal number of phase and neutral conductors in same raceway.
5. Maintain equal lengths on all parallel conductors.
6. Wire shall not be installed in raceways until the concrete work and plastering is completed and all conduits in which moisture has collected have been swabbed out. Insulation resistance to ground shall not be less than that approved by NEC. Eliminate splices wherever possible.

E. Special Techniques – Type MC Cable:

1. Protect exposed cable from damage.
2. Support cable, spacing not exceeding (3) feet and at each junction box.
3. Support cables above accessible ceiling, using spring metal clips to support cables from structure. Supporting methods utilizing either ceiling support or dedicated hanger wires are not acceptable. Do not rest cable on ceiling panels.
4. Use insulated throat fittings and connectors.
5. Each cable shall be supplied by only one (1) branch circuit breaker (one, two or three poles).

F. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors.
2. Conductors shall be continuous and no splices shall be made except within accessible junction boxes.
3. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
4. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
5. Tape splices and joints with vinyl plastic tape. Use sufficient tape to secure insulation strength equal to that of the conductors joined.
6. Split bolt connectors are unacceptable for any purpose. Listed compression type connectors installed with compatible tooling may be used. Utilize manufacturer’s preformed insulating devices when available and listed for use with installed connection.
7. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
8. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

G. Do not place stranded conductors directly under wiring device screws.

H. Conductor Phase Marking Tape:

1. Install to identify phasing on all conductors #8 and larger, at each termination and in junction boxes, gutters and pull boxes.

I. Wire Marker Installation:

1. Install wire marker for each conductor at equipment cabinets, pull boxes, outlet and junction boxes.

3.5 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Provide visual and mechanical inspections on all conductors 1/0 AWG and larger as follows:

1. Inspect exposed sections for physical damage.
2. Verify cable is supplied and connected in accordance with single line diagram.
3. If cables are terminated through window-type CTs, make an inspection to verify that neutrals and grounds are properly terminated for normal operation of protective devices.
4. Inspect for visual jacket and insulation condition.
5. There shall be no tests performed on existing cable without specific direction from the Engineer.
6. Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections.
7. Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor and bus terminations to manufacturer's recommendations.

C. Provide electrical tests on conductors as follows:

1. All secondary conductors from the utility transformers to service equipment and all phase conductors 1/0 and larger shall be subjected to insulation tests using a 500 vdc megger.
2. Check for proper grounding resistance at all services and at transformers. Resistance shall be 2 ohms maximum.

D. Test results and report shall be provided to the engineer.

E. Contractor shall correct all deficiencies reported in the test report.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding bushings.
4. Grounding and bonding hubs.
5. Grounding and bonding connectors.
6. Intersystem bonding bridge grounding connector.
7. Grounding and bonding busbars.
8. Grounding (earthing) electrodes.

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control" Article, including the following:

1. Test wells.
2. Rod electrodes.
3. Ring electrodes.
4. Grounding arrangements and connections for separately derived systems.
5. Ground ring.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. In addition to items specified in Division 01 "Execution and Closeout Requirements," include the following:

a. Plans showing locations of grounding features described in "Field Quality Control" Article, including the following:

1) Test wells.
2) Rod electrodes.
3) Ring electrodes.
4) Grounding arrangements and connections for separately derived systems.

5) Ground ring.

b. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.

1) Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
2) Include recommended testing intervals.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. ASTM - Bare Copper Grounding and Bonding Conductor:

1. Referenced Standards: Complying with one or more of the following:

a. Soft or Annealed Copper Wire: ASTM B3
b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.2 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications; see Division 27 "Grounding and Bonding for Communications Systems," for selection and installation guidelines.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL 467.
b. Grounding and Bonding Equipment for Communications: UL 467.

2.3 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL 467.

2.4 GROUNDING AND BONDING HUBS

A. Description: Hubs with certified grounding or bonding locknut.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL 467.

2.5 GROUNDING AND BONDING CONNECTORS

A. Source Limitations: Obtain products from single manufacturer.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL 467.
b. Grounding and Bonding Equipment for Communications: UL 467.

2.6 INTERSYSTEM BONDING BRIDGE GROUNDING CONNECTORS

A. Description: Devices that provide means for connecting communications systems grounding and bonding conductors at service equipment or at disconnecting means for buildings or structures.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.7 GROUNDING AND BONDING BUSBARS

A. Description: Miscellaneous grounding and bonding device that serves as common connection for multiple grounding and bonding conductors.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL 467.

D. UL KDER - Equipment Room Grounding and Bonding Busbar:

1. General Characteristics:

a. Bus: Rectangular bar of annealed copper.
b. Mounting Stand-Off Insulators: Lexan or PVC.

1) Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.

2. Options:

a. Dimensions: Minimum 1/4 by 4 inch in cross section; 24 inch length as indicated on Drawings.
b. Predrilled Hole Pattern: 9/32 inch holes spaced 1-1/8 inch apart.
c. Mounting Hardware: Minimum Stand-off brackets that provide 3 inch clearance to access rear of bus. Brackets and bolts must be stainless steel.

2.8 GROUNDING (EARTHING) ELECTRODES

A. Description: Grounding electrodes include rod electrodes, ring electrodes, metal underground water pipes, metal building frames, concrete-encased electrodes, and pipe and plate electrodes.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL 467.

D. UL KDER - Rod Electrode:

1. General Characteristics: Copper-clad; 3/4 inch by 10 ft.

E. UL KDER - Plate Electrode:

1. General Characteristics: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of electrical service equipment connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF BUSBARS

A. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated on drawings.

1. Install bus horizontally, on insulated spacers 2 inch minimum from wall, 6 inch 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; connect to horizontal bus.

3.3 SELECTION OF GROUNDING AND BONDING CONDUCTORS

A. Conductors: Install solid conductor for 12 AWG and smaller, and stranded conductors for 10 AWG and larger unless otherwise indicated.

B. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, Type THHN.

C. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.

D. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

E. Underground Grounding Conductors: Install bare copper conductor, 2/0 AWG minimum.

1. Bury at least 30 inch below grade unless indicated otherwise on drawings.
2. Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.

3.4 SELECTION OF CONNECTORS

A. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Exothermic Cad-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: Exothermic Cad-Welded connectors.

3.5 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
2. Consult Engineer for resolution of conflicting requirements.

C. Special Techniques:

1. Conductors:

a. 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.

2. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
f. 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 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 disconnect-type connection is required, use bolted clamp.

g. 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 bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where 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 bolted connector.
3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

h. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft apart.

3. Electrodes:

a. Ground Rods: Drive rods until tops are 2 inch 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) Use exothermic welds for below-grade connections.

b. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.

c. Ring Electrode: Install grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around perimeter of building.

1) Install copper conductor not less than 2/0 AWG for ring electrode and for taps to building steel, unless otherwise indicated via lightning protection drawings.
2) Bury ring electrode not less than 24 inch from building's foundation.

d. Concrete-Encased Electrode (Ufer Ground):

1) Fabricate in accordance with NFPA 70; use minimum of 20 ft of bare copper conductor not smaller than 4 AWG.

a) If concrete foundation is less than 20 ft long, coil excess conductor within base of foundation.
b) 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.

4. Grounding at Service:

   a. Equipment grounding conductors and grounding electrode conductors must be connected to ground bus. Install main bonding jumper between neutral and ground buses.

5. Grounding Separately Derived Systems:

   a. Transformer:

      1) Where transformer secondary includes a neutral, the neutral shall be bonded to the equipment enclosure and connected to the system ground conductor.
      2) Size bonding jumper per NEC Table 250.66.
      3) Grounding conductor shall be in raceway and shall be bonded to nearest available point of interior metal water piping system.

6. Grounding Underground Distribution System Components:

   a. Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.
   b. Comply with IEEE C2 grounding requirements.
   c. Grounding Manholes and Handholes: Install driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch will extend above finished floor. If necessary, install ground rod before manhole is placed and provide 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch above to 6 inch below concrete. Seal floor opening with waterproof, nonshrink grout.
   d. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields in accordance with manufacturer's published instructions with splicing and termination kits.

7. Equipment Grounding:

   a. Install insulated equipment grounding conductors with feeders and branch circuits.
   b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

      1) Flexible raceway runs.
      2) Armored and metal-clad cable runs.
      3) Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

   c. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with nonmetallic raceway fitting listed for the purpose. Install fitting where raceway

enters enclosure, and install separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.

d. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

e. Metallic Fences enclosing electrical distribution equipment: Comply with requirements of IEEE C2.

1) Grounding Conductor: Bare copper, not less than 8 AWG.
2) Gates: Must be bonded to grounding conductor with flexible bonding jumper.
3) Barbed Wire: Strands must be bonded to grounding conductor.

3.6 FIELD QUALITY CONTROL

A. Testing Preparation:

1. Inspect and test in accordance with NETA ATS.

B. 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 calibrated torque wrench in accordance with manufacturer's published instructions.
3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by 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 in accordance with IEEE Std 81.
c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

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 record of tests and observations. Include 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.

C. Nonconforming Work:

1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

D. Collect, assemble, and submit test and inspection reports.

1. Report measured ground resistances that exceed the following values:

a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω.
b. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 Ω.

3.7 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Equipment bases and supports.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.

1.2 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data:

1. Hangers and Supports: Submit manufacturer’s catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of hangers and supports.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section.

1.4 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical and mechanical damage, by storing in original packaging.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Furnish materials in accordance with referenced standards and authority having jurisdiction.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads, 1/4” for single conduits 1” and smaller, 3/8” minimum for trapezes and single conduits 1 1/4” and larger.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit Clamps for Trapeze Hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit Clamps - General Purpose: One-hole plated steel for surface-mounted conduits. Provide with malleable iron clamp backs in damp and wet locations. Provide with pre-galvanized finish.

F. Cable Ties: High-strength nylon temperature rated to 185 degrees F; self-locking.

2.2 FORMED STEEL CHANNEL

A. Furnish materials in accordance with referenced standards and authority having jurisdiction.

B. Product Description: Galvanized 12 gauge thick steel, minimum 1 5/8” x 1 5/8” section when used for trapezes, with holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

A. Furnish materials in accordance with referenced standards and authority having jurisdiction.

B. Product Description: Mounting hole and screw closure.

2.4 MECHANICAL AND CONDUIT SLEEVE SEALS

A. Manufacturers:

1. O-Z/Gedney.
2. Thunderline Link-Seal, Inc.
3. Substitutions: Division 01 - Product Requirements.

B. Furnish materials in accordance with referenced standards and authority having jurisdiction.

C. Product Description: Mechanical type, consisting of rubber sealing elements to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts, expansion anchors or preset inserts.
2. Steel Structural Elements: Provide beam clamps or spring steel clips. Do not drill structural elements unless approved by Structural Engineer.
3. Concrete Surfaces: Provide expansion anchors.
4. Hollow Masonry, Plaster and Gypsum Board Partitions: Provide toggle bolts.
5. Solid Masonry Walls: Provide expansion anchors.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Install conduit and raceway support and spacing in accordance with NEC.

C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit. Do not fasten to suspended ceiling grid system.

D. Install multiple conduit runs on common hangers.

E. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.
5. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

F. Install Work in accordance with referenced standards and authority having jurisdiction.

3.3 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 3 inches beyond supported equipment, under all switchboards, motor control centers, floor mounted transformers, and other locations as indicated on the Drawings. Refer to Division 03.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

END OF SECTION

SECTION 26 05 33 - RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Not included in this section: Electrical underground ductbank systems requiring concrete encasement or manholes.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.6 – Intermediate Rigid Conduit
4. ANSI/UL 5 – Surface Metal Raceway
5. ANSI/UL 5 – Surface Non-Metallic Raceway

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, device mounting, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system. Except where other wiring methods are specifically allowed by other sections of the specifications, or specifically indicated on the Drawings, all wiring on this project shall consist of conductors installed in complete raceway systems as specified in this section of the specifications.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit for the following:

1. Flexible metal conduit.
2. Liquid-tight flexible metal conduit.
3. Non-metallic conduit.
4. Non-metallic tubing.
5. Raceway fittings.
6. Conduit bodies.
7. Surface raceway.
8. Wireway.
9. Pull and junction boxes.
10. Handholes.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements.

B. Project Record Documents:

1. Record actual routing of conduits larger than 2 inch (DN50). Include locations of junction and pull boxes.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.7 COORDINATION

A. Division 01 - Administrative Requirement: Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes. Coordinate locations with architectural features, the work of other trades, obstructions and constraints. Where specific location information is shown on the Architectural Drawings, the information on those Drawings shall govern.

PART 2 - PRODUCTS

2.1 SELECTION OF PRODUCTS

A. Unless specifically indicated otherwise at particular locations on the Drawings, products shall be selected according to installation conditions as described in this article.

B. Outdoor Below Grade Locations: Non-metallic conduit, schedule 40 or 80.

C. Outdoor Above Grade Locations and other Wet Locations (as defined by the NEC): Rigid steel or intermediate metal conduit (IMC).

D. Within or Under Concrete Construction Located On or Below Grade: Non-metallic conduit. Comply with Structural Specifications and Drawings regarding limitations on sizes and placement.

E. Within Concrete Construction Located Above Grade: Non-metallic conduit, rigid steel conduit or intermediate metal conduit. Comply with Structural Specifications and Drawings regarding limitations on sizes and placement.

F. Damp Locations as defined by the NEC including exposed work in any protected locations directly communicating with outside ambient air such as crawl spaces, breezeways, covered porches, under canopies, and similar locations: Rigid steel or intermediate metal conduits (IMC) conduits.

G. Interior Dry Locations (as defined by the NEC): Rigid steel, intermediate metal conduits (IMC), or electric metallic tubing.

H. Motor and Equipment Connections: Liquid-tight conduit not to exceed 6-feet in length.

I. Lighting Fixtures: Flexible metal conduit.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): ANSI C80.1.

C. The term “metal conduit” does not include Electric Metallic Tubing (EMT).

D. Fittings: NEMA FB 1; material to match conduit.

E. Conduit Bodies: NEMA FB 1; shall be malleable iron with steel conduit. Aluminum conduit bodies are not acceptable except for use with aluminum conduit.

2.3 PVC-COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil (0.1 mm) thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 NON-METALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 or 80 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.5 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel or aluminum construction. Lightweight extra flexible type is not acceptable.

B. Fittings: NEMA FB 1.

2.6 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket, UL listed for grounding purposes.

B. Fittings: NEMA FB 1.

2.7 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1.

1. Indenter and die-cast set screw types are not acceptable.
2. Concealed Dry Locations: Steel set screw, steel compression, die cast compression type.

2.8 SURFACE METAL RACEWAY

A. Product Description: ANSI/UL 5 sheet metal channel with fitted cover, suitable for use as surface metal raceway.

B. Size: As indicated on the Drawings.

C. Finish: Gray enamel.

D. Fittings, Boxes and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway. Furnish all fittings and accessories required to provide a complete and working system.

2.9 SURFACE NON-METAL RACEWAY

A. Product Description: ANSI/UL 5A plastic channel with fitted cover, suitable for use as surface metal raceway.

B. Size: As indicated on the Drawings.

C. Finish: IVORY.

D. Fittings, Boxes and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway. Furnish all fittings and accessories required to provide a complete and working system.

2.10 WIREWAY

A. Product Description: General purpose or NEMA 3R type wireway suitable for installation conditions.

B. Knockouts: None; provide in field as required.

C. Size: As indicated on Drawings or as required to meet NEC fill requirements.

D. Cover: Screw cover.

E. Fittings: Lay-in type with captive screws.

F. Finish: Galvanized in mechanical rooms and unfinished areas; gray powder coated in finished areas and outdoors.

2.11 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. 4” square by 2 1/4” deep minimum size. Provide plaster rings of required depth at recessed locations. Provide compatible industrial device covers and blank covers at other locations.
2. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
3. Ceiling Boxes imbedded in concrete: Concrete ring type with top cover
4. Outlet boxes in masonry walls or embedded in concrete: Steel masonry type box.

B. Cast Boxes: NEMA FB 1, material as specified in articles above. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

2.12 PULL AND JUNCTION BOXES

A. Above Ground: Sheet Metal Boxes: NEMA OS 1, galvanized steel, NEMA Type 1 or 3R as required by installation location.

B. In Ground: Fiberglass polymer concrete handhole with concrete polymer composite weatherproof cover with nonskid finish

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

B. Extend existing raceway and box installations using materials and methods as specified.

C. Clean and repair existing raceway and boxes to remain or to be re-installed.

D. Remove exposed abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

3.3 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION – RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceways; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29 and provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Route exposed raceway parallel and perpendicular to walls.

H. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

I. Route raceways in and under slab from point-to-point.

J. Maintain clearance between raceway and piping for maintenance purposes.

K. Maintain 12 inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

L. Cut raceways square using saw or pipe cutter; de-burr cut ends.

M. Bring raceways to shoulder of fittings; fasten securely.

N. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe non-metallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

O. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in wet locations.

P. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or provide factory elbows for bends in metal conduit larger than 1” size.

Q. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

R. Install fittings to accommodate expansion and deflection where raceway crosses expansion joints.

S. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

T. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

U. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

V. Close ends and unused openings in wireway.

W. Outdoor Below Grade Locations: Burial depth per NEC requirements.

1. Where crossing under or through exterior grade beams utilize only Schedule 80 conduit within 5’ of either side of beam.
2. Provide rigid steel or intermediate metal conduit (IMC) elbows at all changes of direction exceeding 30 degrees, including transitions to outdoor above grade locations. Wrap metal conduit with one application, half-lapped, of Minnesota Mining and Manufacturing Company “Scotchwrap” No. 51, Plymouth Rubber Co. “Plywrap 20” or Westape, Inc. 20 mil. Extend tape wrap to a minimum of 6” above grade.
3. Where penetrating exterior walls into basements or finished spaces transition to rigid steel or intermediate metal conduit (IMC) before penetrating wall. Provide an OZ Gedney series “FSK,” Link Seal “LS-200” series, or approved equal seal at each penetration location.

X. Within or Under Concrete Construction Located On or Below Grade:

1. For trade sizes 1” and smaller, transitions to concealed areas above slab may be made with non-metallic elbows and riser nipples. Convert to metallic conduit or tubing within maximum of 18” above slab.
2. For trade sizes 1 1/4” and larger, and all transitions to exposed locations, provide rigid steel or intermediate metal conduit (IMC) elbows.

Y. Interior Dry Locations (as defined by the NEC): Do not use EMT for exposed work within 48” above finished floor. Do not use EMT for medium voltage cables.

Z. Lighting Fixtures:

1. Conduit size shall be 1/2” minimum and shall not exceed 6-feet maximum length. Conduit shall be long enough to allow movement of lay-in type fixtures for maintenance purposes.
2. Conduit shall run directly from a junction box to a single fixture. Direct connections between fixtures utilizing flexible metal conduit is not acceptable.

AA. Flexible metal conduit:

1. Use only in dry locations with minimum length of 1-foot and maximum length of 3-feet for final connections to transformers, motors, and vibrating equipment.
2. Do not install aluminum type in locations less than 6’ above finished floor or working surface.

BB. Liquid-tight flexible metal conduit: Use in wet or dry locations with minimum length of 1-foot and maximum length of 3-feet for final connections to transformers, motors, and vibrating equipment.

3.5 INSTALLATION – BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet (3 m) prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 05 27.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) horizontally from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches (150 mm) separation. Install with minimum 24 inches (600 mm) separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit. Provide rigid support to structure for all junction boxes.

N. Mount junction boxes within 18” of finished ceilings to facilitate future access. Locate junction boxes to allow ready access to junction box covers without removing any equipment.

O. Install gang box where more than one device is mounted together. Do not use sectional box.

P. Install gang box with plaster ring for single device outlets.

Q. Outdoor Above Grade Locations and other Wet Locations (as defined by the NEC): Provide malleable cast iron outlet boxes, “FS” or “FD” series where recessed mounting of outlets is not feasible and for junction boxes in trade sizes 1” and smaller. Utilize malleable iron conduit bodies (condulets) at changes of direction and pull points. Galvanized NEMA 3R steel boxes may be used only at locations where specifically called for on the Drawings, or as approved by the Engineer.

R. Damp Locations: Provide malleable cast iron outlet boxes, “FS” or “FD” series where recessed mounting of outlets is not feasible and for junction boxes in trade sizes 1” and smaller. Utilize malleable iron conduit bodies (condulets) at changes of direction and pull points. Galvanized steel boxes may be used only at locations where specifically called for on the Drawings.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Division 07.

B. Locate outlet boxes to allow luminaires to be positioned as indicated on the Drawings.

C. Align adjacent wall mounted outlet boxes for switches, thermostats and similar devices.

3.7 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.8 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes underground cast-in-place concrete ductbanks for electrical power and signal distribution.

1.2 SUBMITTALS

A. Indicate material specifications, and provide product data on conduit, spacers, terminators, reinforcing steel and related components.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Material: Rigid polyvinyl chloride (PVC) marked at uniform intervals to indicate the kind of material; type Schedule 40 heavy wall, type EB-20 (TC-6), or type EB-35 (TC-8). Type EB PVC conduit is designed for use only in concrete encased installation.

B. Within five (5) feet of each building wall penetration, install heavy wall galvanized steel conduit within the concrete envelope to provide protection against vertical shearing.

2.2 ELBOWS

A. Material to match conduit; minimum bend radius of 36 inches (915 mm).

2.3 SPACERS

A. Plastic, to maintain 3” minimum between conduits.

B. Install spacers as recommended by conduit manufacturer, but not to exceed a maximum of 6 ft-0 in. on center for PVC conduit and 8 ft-0 in. on center for steel conduit. Stagger conduit joints in concrete encasement 6 in. minimum horizontally.

2.4 CONDUIT TERMINATION IN MANHOLES AND BUILDINGS

A. Bell Ends:
   1. Manufactured bell ends of appropriate sizes at each end of conduit.

B. Bushings:
   1. Steel grounding bushings shall be used on all metal conduit entering a building or manhole.

C. Seals:
   1. When entering an existing building, the concrete shall be core drilled for the appropriate size conduit and seal. The seal shall be a mechanical interlocking assembly of modular rubber links properly sized to fit the pipe and tightened in place, in accordance with the manufacturer’s instruction.

2. Seal interior of conduit entry with “Ductseal” compound.

2.5 PLUGS

A. Closure plugs or caps of same material as conduit on empty conduits at building entrances and at terminations in equipment pedestals to prevent the entrance of moisture and gases.

2.6 PULL TAPE

A. Polyester pull tape, 1/2” width, tensile strength of 1,250 lbs. and sequential footage markings along the entire length of the tape as manufactured by Greenlee, Carlon or equivalent. Install pull tape in each empty duct.

2.7 GROUNDING

A. Steel grounding bushings shall be grounded to manhole or junction box ground.

2.8 CONCRETE ENCASEMENT

A. Concrete used throughout shall be ready mixed concrete furnished by an approved mixing plant. The plant shall comply with the requirements of National Ready Mixed Concrete Association certification plan.

B. The concrete mix shall be 3000 psi minimum, 3/8” aggregate, 4 1/2” to 5 1/2” slump.

C. The slump should be just enough to allow the mix to flow to the bottom of the formation and yet not be so wet as to cause the ducts to float.

D. The concrete envelope shall contain red dye at 8 lbs. per cubic yard of concrete.

2.9 REINFORCING STEEL

A. Provide reinforcing steel the entire length of the duct system, four - #4 bars - one in each corner, minimum, or as shown on the drawings.

PART 3 - EXECUTION

3.1 EXCAVATIONS

A. Excavate trenches for ductbank to adequate width, depth, and proper slope as specified.

B. Install forms on sides of ductbank if trench is not of proper firmness to prevent cave-in.

C. Bottom of trench shall be undisturbed earth. If trench bottom is too low for proper grade, fill to proper level with sand and mechanically compact it.

D. Each excavated section from manhole to manhole and from manhole to building shall be completely excavated and graded before any duct is laid in that section.

3.2 PLACEMENT OF CONDUIT

A. Pitch conduit properly for drainage to manhole or pull box and to prevent low pockets or irregular dips between conduit ends. Minimum pitch to be 4 inches per 100 feet. All ducts shall drain to an open end - preferably a manhole.

B. Install not more than one 90 degree bend or equivalent between manholes for primary conduit and three 90 degree bends or equivalent for signal conduit or secondary power conduit.

C. In ductbanks with both primary and signal conduit, primary conduit shall be straight and the signal conduit shall contain bends as necessary to accommodate the primary duct.

3.3 PLACEMENT OF REINFORCING BARS

A. Install the bars - one in each corner minimum, overlap the joints 12” and tie into the connecting walls of manholes, vaults and buildings, etc.

B. At existing building and manhole walls, dowel reinforcement bar into the wall to provide protection against vertical shearing. Use epoxy adhesive to secure the dowels.

3.4 PLACEMENT OF CONCRETE

A. After ducts are in place and before the concrete is poured, the installation shall be inspected by the Engineer’s representative. Notify the Engineer’s representative at least two days before the time of inspection.

B. Complete entire section of conduit from manhole to manhole or from manhole to building before encasement by concrete.

C. Top of concrete envelopes shall be not less than 24 inches below grade.

D. In placing concrete around the conduit, adjust delivery chute so the fall of the concrete into the trench is minimal.

E. Provide minimum of 3” (76 mm) of concrete cover over conduit at the top, bottom and sides of the duct bank. Provide troweled crowned top on the concrete to prevent water accumulation.

F. Place concrete continuously from manhole to manhole to building without interruption.

G. Extend concrete envelope to finish floor grade or interior wall surface in buildings and finish pad grade at equipment. Maintain moisture seal.

3.5 BACKFILL

A. Install detectable underground warning tape 12" below finish grade over all ductbanks. Tape shall be 2” wide minimum, 5 mil thickness, and contain a foil core. Tape color shall be red and labeled with the words "CAUTION-BURIED ELECTRIC LINE BELOW" as manufactured by Presco or similar.

B. Compact backfill around ductbank.

C. After completion of ductbank installation, return all ground and pavement surfaces to original condition or to condition as indicated on the Drawings. This includes all sidewalks, curbs, streets, parking areas, lawns, shrubs, etc.

3.6 ACCESSORY INSTALLATION

A. Pull a mandrel/swab (diameter 1/4 in. smaller than conduit) through each conduit in completed ductbank to ensure adequate opening of duct run.

B. Install pull tape in each empty duct.

C. Install closure plugs or caps on empty conduits at building entrances and at terminations in equipment pedestals to prevent the entrance of moisture and gases.

D. Ground all steel bushings to manhole or junction box ground.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Underground Warning Tape.
6. Lockout Devices.
7. Panelboard Directories

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.
2. Section 26 05 19 – 600-Volt Building Wire and Cable
3. Division 27 – Communications.

1.2 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data:

1. Submit manufacturer’s catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location and function.

1.3 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Furnish materials in accordance with referenced standards and authority having jurisdiction.

B. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color. Use red lettering on nameplates for emergency system components.

C. Letter Size:

1. Panelboards, Switchboards and Motor Control Centers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.
2. Equipment Enclosures: 1 inch (25 mm); identify equipment designation.
3. Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch (13 mm); identify circuit and load served, including location.
4. Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: 1/2 inch (13 mm); identify source and load served.
5. Transformers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify primary and secondary voltages, primary source, and secondary load and location.

D. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

A. Furnish materials in accordance with referenced standards and authority having jurisdiction.

B. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: back side of device plates and junction boxes smaller than 8” X 8” may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.

C. Embossed tape will not be permitted for any application.

2.3 WIRE MARKERS

A. Furnish materials in accordance with referenced standards.

B. Description: Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, machine generated and be wrapped around the cable or sheath. Flag type labels are not acceptable. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

C. Legend:

1. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

D. Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.

2.4 CONDUIT AND RACEWAY MARKERS

A. Furnish materials in accordance with referenced standards.

B. Description: Nameplate fastened with adhesive, labels fastened with adhesive and stencils.

C. Color:

1. 480 Volt System: Black lettering on white background.
2. 208 Volt System: Black lettering on white background.

D. Legend:

1. 480 Volt System: 480 VOLTS.
2. 208 Volt System: 208 VOLTS.

2.5 UNDERGROUND WARNING TAPE

A. Provide detectable underground warning tape, yellow background, black letters, 6” width, equal to Ideal #42-251, with suitable warning legend describing buried electrical lines.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

2.7 PANELBOARD DIRECTORIES

A. Typed directories for panels must be covered with clear plastic, have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment.

C. Replace lost nameplates, labels and markers.

D. Re-stencil existing equipment.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
4. Secure nameplate to equipment front using adhesive.
5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
6. Install nameplates for the following:

    a. Switchboards.
    b. Panelboards.
    c. Transformers.
    d. Disconnects.
    e. Motor Control Centers.

7. Nameplates shall include equipment designation, supply voltage, secondary voltage (for transformers) and feeder source designation.

C. Label Installation:

1. Install label parallel to equipment lines.
2. Install label for identification of individual control device stations.
3. Install labels for permanent adhesion and seal with clear lacquer.
4. Install label for identification of health care facilities receptacles and light switches per NEC Article 517.
5. Install label for receptacles and light switches indicating serving panelboard and circuit number.

D. Wire Marker Installation:

1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes.
2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
3. Install labels at data outlets identifying patch panel and port designation.

E. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 05 73 - SHORT CIRCUIT/COORDINATION STUDY AND ARC FLASH HAZARD STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. The contractor shall retain the services of an independent third-party firm to perform a short circuit/coordination study and arc flash hazard study as described herein.

B. The study and assessment shall be performed utilizing SKM's Captor, ETAP, Dapper, and Power Tool software products.

C. Section includes a short circuit, protective device coordination and arc flash hazard study. The study shall be performed in accordance with all applicable current edition IEEE 1584 requirements.

D. Arc hazard analysis will be based on the latest version of NFPA 70E. The results of that analysis will be printed on the arc flash labels printed and furnished by the study preparer and affixed by the installing contractor.

E. The analysis will consider alternative modes of operation in addition to the normal operating configuration, as applicable.

F. Fault current contributions from motors 50HP or larger shall be individually analyzed at their point of connection in the system. Contributions for smaller motors may be grouped and considered to be connected at the system source for analysis.

G. The short circuit portion of the study shall include evaluation of the adequacy of all motor controllers (including VFD's) serving motors 10HP or above.

H. All portions of the system from the source(s) though final overcurrent devices shall be included except those portions specifically excluded below.

I. Circuits and equipment operating at 240V L-L may be excluded if served by a transformer 125 kVA or smaller transformer in its upstream power supply.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

1.3 DESIGN REQUIREMENTS

A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70 and these specifications.

B. Report Preparation:
1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.

2. Perform study with aid of computer software program.
3. Obtain actual data for packaged chillers and motor characteristics for all motors 100 HP and larger for equipment incorporated into Work. Obtain utility fault current data from the utility company.
4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
   a. Utility supply bus.
   b. Medium voltage switchgear.
   c. Secondary unit substations.
   d. Automatic transfer switch.
   e. Manual transfer switch.
   f. Engine generator.
   g. Medium voltage motor controllers.
   h. Low-voltage switchgear.
   i. Switchboards.
   j. Motor control centers.
   k. Distribution panelboards.
   l. Branch circuit panelboards.
   m. Busway.
   n. Each other significant equipment location throughout system.

C. Report Contents:
1. Include the following:
   a. Calculation methods and assumptions.
   b. Base per unit value selected.
   c. One-line diagram.
   d. Source impedance data including power company system available power and characteristics.
   e. Typical calculations.
      1) Fault impedance.
      2) X to R ratios.
      3) Asymmetry factors.
      4) Motor fault contribution.
      5) Short circuit kVA.
      6) Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
      7) Tabulations of calculation quantities and results.
   f. One-line diagram revised by adding actual instantaneous short circuits available.
   g. State conclusions and recommendations.
2. Prepare time-current device coordination curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.
3. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.
4. Prepare detailed description of each protective device identifying its type, function, manufacturer and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous and time delay settings.
5. Plot device characteristic curves at point reflecting maximum symmetrical fault current to which device is exposed. Include on curve sheets the following. Omit items a through d beyond low-voltage service equipment.
   a. Power company relay characteristics.
   b. Power company fuse characteristics.
   c. Medium voltage equipment protective relay characteristics.
   d. Medium voltage equipment protective fuse characteristics.
   e. Low voltage equipment circuit breaker trip device characteristics.
   f. Low voltage equipment fuse characteristics.

g. Cable damage point characteristics.
h. Pertinent transformer characteristics including:
   1) Transformer full load current.
   2) Transformer magnetizing inrush.
   3) ANSI transformer withstand parameters.
   4) Significant symmetrical fault current.
i. Pertinent motor characteristics.
j. Generator characteristics including:
   1) Phase and ground coordination of generator protective devices.
   2) Decrement curve and damage curve.
   3) Operating characteristic of protective devices.
   4) Actual impedance value.
   5) Time constants.
   6) Current boost data.
   7) Do not use typical values for generator.
k. Transfer switch characteristics.
l. Other system load protective device characteristics.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Qualifications Data: Submit the following for review prior to starting study.

1. Submit qualifications and background of firm.
2. Submit qualifications of Professional Engineer performing study.

D. Product Data: Submit the following:

1. Report: Summarize results of study in report format including the following:

   a. Descriptions, purpose, basis and scope of study.
   b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
   c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
   d. Fault current calculations including definition of terms and guide for interpretation of computer printout.
   e. Tabulations of data required for ordering arc flash hazard labels.

E. Submit copies of final report signed and sealed by the professional engineer.

F. Make additions or changes required by review comments.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State of Texas and local municipality standards.

B. Maintain one copy of document on site.

C. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of 5 years documented availability approved by Architect/Engineer.

D. Perform study in accordance with IEEE 242.

1.6 QUALIFICATIONS

A. Study Preparer: Must be a professional engineer licensed in the State of Texas and qualified in performing work of this section with minimum 5 years of documented experience and having completed three projects of similar size and complexity within the past ten years.

B. Demonstrate that the engineer performing study has capability and experience to provide assistance during system startup.

1.7 PRE-WORK MEETINGS

A. Division 01 - Administrative Requirements: Pre-work meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 SEQUENCING

A. Division 01: Requirements for sequencing.

B. Complete study within eight weeks after pre-work meeting.

C. Allow two weeks for review of completed study by Architect/Engineer.

D. Submit short circuit and protective device coordination study to Architect/Engineer prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.

E. When formal completion of study will cause delay in equipment manufacturing, obtain approval from Architect/Engineer for preliminary submittal of study data sufficient in scope to ensure selection of device ratings and characteristics will be satisfactory.

1.9 SCHEDULING

A. Division 01 - Administrative Requirements.

B. Division 01 - Construction Progress Schedule: Requirements for scheduling.

C. The contractor shall provide the required data for preparation of the studies. The engineer performing the system studies shall furnish the contractor with a listing of the required data immediately after award of the contract.

D. The contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.

1.10 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with local power company. Obtain available fault current at point of service from utility.

1.11 FINAL STUDY REPORT

A. Provide studies in conjunction with equipment submittals to verify equipment ratings required.

B. The results of the power system study shall be summarized in a final report. Six (6) bound copies of the final report shall be submitted. Provide two (2) copies in PDF format of the study, so that it can be more easily stored and shared. Also, provide 2 copies (on CD) of the report in MS word, and 2 copies (on CD) of the one-line diagram in CAD format.

C. The report shall include the following sections:

1. Overview
2. Short Circuit Study
    a. SC-1: Purpose
    b. SC-2: Explanation of Data
    c. SC-3: Assumptions
    d. SC-4: Analysis of Results
    e. SC-5: Recommendations
    f. SC-6: DAPPER Fault Analysis Input Report
3. Protective Device Coordination Study
    a. PDC-1: Purpose
    b. PDC-2: Explanation of Data
    c. PDC-3: Assumptions
    d. PDC-4: Analysis of Results
    e. PDC-5: Recommendations (Including NEC 700-27 Requirement)
    f. PDC-6: CAPTOR Results
    g. PDC-7: Example Drawings
4. Arc Flash Study
    a. ARC-1: Purpose
    b. ARC-2: Explanation of Data
    c. ARC-3: Assumptions
    d. ARC-4: Analysis of Results
    e. ARC-5: Recommendations
    f. ARC-6: SKM Arc Flash Evaluation Report
5. Prioritized Recommendations and Conclusions
6. Appendices
    a. APP-1: DAPPER One-line Diagrams
    b. APP-2: AutoCAD One-line Diagrams
    c. APP-3: SKM Protective Device Summaries
    d. APP-4: Reference Data
    e. APP-5: Sample Work Permit Form
    f. APP-6: Copy of Warning Labels, including study date

D. The above sections shall include the following items in detail:

1. Short circuit studies shall evaluate the available fault current at each bus (each change of impedance), including all three-phase motors.

2. Coordination study recommendations for relay settings, breaker settings, and motor protection settings.

3. Recommendations for improving the coordination and/or load distribution, as well as ground fault requirements.

4. Arc flash values for two normal cases to define the highest values (low short circuit and high short circuit).

5. Arc flash values for two maintenance cases, which define the arc flash values available at the equipment that would be available if the instantaneous trip of the upstream circuit breaker is set at the study-recommended setting.

6. IEEE standard one-line diagram with equipment evaluation and circuit breaker setting forms that clearly define the system data and are easy to interpret.

7. Prioritized report summarizing all recommendations from this study. This shall include observed NEC code violations and their corrective action.

8. The contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 24” x 36” (minimum) Styrofoam backboard for mounting in Main Electrical Service Room.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 SHORT CIRCUIT AND COORDINATION STUDY

A. The short circuit, coordination, and arc flash hazard studies shall be performed using SKM Dapper, Captor and PowerTool for Windows software packages. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA and symmetrical and asymmetrical fault currents.

B. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

C. Include on the curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip

device characteristics, pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

D. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400 or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

E. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

F. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.

G. Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

H. Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective devices not property rated for fault conditions.

I. Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.

J. When an emergency generator is provided, include phase and ground coordination of the generator protective devices to meet NEC 700.27 requirements. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

K. Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

L. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current to ensure protective devices will not trip major or group operation.

3.2 ARC FLASH HAZARD STUDY

A. As part of the short circuit and coordination study, arc flash hazard study shall be included. The study shall include the following:

1. Determine and document all possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.
2. Calculations to conform to National Fire Protection Association (NFPA) 70E calculation standards. All incident energy units shall be calculated in calories per square centimeter.
3. Provide recommended boundary zones and personal protective equipment (PPE) based on the calculated incident energy and requirements of NFPA 70E-2003 for each piece of electrical gear.

B. Electrical Contractor shall provide labeling as required by OSHA based upon the results of the arc flash hazard study. At a minimum, the labeling shall contain the following information: PPE level, Flash Hazard Boundaries and Flash Protection Boundary such as Limited Approach Boundary, Restricted Approach Boundary, Prohibited Approach Boundary, and study date.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting and balancing.

B. Provide assistance to electrical distribution system equipment manufacturer during start up of electrical system and equipment.

C. Select each primary protective device for delta-wye connected transformer so device's characteristic or operating band is within transformer characteristics, including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection.

D. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by 16 percent current margin to provide proper coordination and protection in event of secondary line-to-line faults.

E. Separate medium-voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.

F. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device coordination study and arc flash hazard study.

3.4 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Verify field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Verify settings in accordance with approved short circuit and protective device coordination study.

END OF SECTION

SECTION 26 09 23 - LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital Lighting and Plug Load Controls.
2. Relay Panels.
3. Emergency Lighting Control (if applicable).

B. Related Sections:

1. Section 26 05 27 - Wiring Devices: Receptacles, line voltage lighting controls.
2. Section 26 51 16 – Interior Lighting: Fixtures, lamps, and drivers.
3. Section 26 08 00 – Electrical Commissioning.
4. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section

C. References

1. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
2. International Electrotechnical Commission (IEC)
3. International Organization for Standardization (ISO)
4. National Electrical Manufacturers Association (NEMA)
5. WD1 (R2005) - General Color Requirements for Wiring Devices.
6. Underwriters Laboratories, Inc. (UL):

    a. 20 – Plug Load Controls
    b. 508 – Industrial Controls
    c. 916 – Energy Management Equipment
    d. 924 – Emergency Lighting

D. Provide a complete low voltage lighting control system for the building as shown on the plans and specified herein.

E. Lighting control system shall utilize networking technology connecting relay panels, switches and sensors based upon a 2-wire data line providing both power and data to all field devices. The network shall be free topology; therefore, a serial loop is not necessary to achieve maximum network distance. The system shall utilize a web server device complete with a touch screen located in a relay panel so that programming and viewing of status can be accomplished at the panel or by any PC connected to the same LAN or via the internet.

F. All relay panel interiors shall be pre-assembled complete with the necessary relays, transformers and devices. Relay panels that are wall mounted shall have interiors separate from enclosure so as to permit easy mounting, conduit installation and wire pull to enclosures. Enclosures mounted in the ceiling space are not required to have separate interiors.

1.2 QUALIFICATIONS

A. All components are to be supplied by same manufacturer. Manufacturer to be a supplier of this type of equipment for over 10 years.

1.3 SUBMITTALS

A. Submit a one-line diagram of the proposed system configuration for review.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Supply manuals on system components to permit ease of installation, system operation and maintenance including, but not limited to the following:

1. Lighting control system step-by-step operating instructions.
2. Relay panel schedules indicating circuits connected, inputs assigned, area controlled, panel location and panel equipment details.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acuity nLight.

B. Legrand Wattstopper.

2.2 RELAYS

A. Lighting control relays shall be mechanically latching and shall come complete with a manual ON/OFF switch. The mechanical switch shall continuously display the true state of the relay's internal contacts.

B. Single pole relays shall be rated and UL/CSA listed for 120VAC, 277VAC and 347VAC lighting loads at 20 amps (30A General Use) and have a general, tungsten, standard and electronic ballast rating.

C. Double pole relays shall be rated and UL listed for 208VAC, 240VAC and 480VAC and CSA for up to 347VAC lighting loads at 20 amps and have a general, tungsten, standard and electronic ballast rating.

D. The relays shall have a label indicating the short circuit fault current rating as per the NEC. The relays shall have passed UL 508 short circuit tests at 14,000 amperes.

E. Each lighting control relay shall be capable of controlling incandescent, fluorescent, electronic ballast and H.I.D. lighting loads and have an inrush capability of 3000 amperes. Relays shall be complete with a 5-year Manufacturer's Limited Warranty.

F. Lighting control relays shall include captive screw terminals for both the line voltage and the low voltage connections. Switching the relay shall be accomplished with ONE signal wire and a common return. The signal wire shall be able to signal ON and OFF and shall carry status current that indicates if the relay is ON or OFF.

2.3 PRE-ASSEMBLED RELAY PANELS

A. Where indicated on the drawings, provide a factory pre-assembled relay panel. The panel's enclosure shall be for surface or flush installation, with a screw-on cover or a hinged door assembly as required.

B. The panel shall consist of a pre-assembled interior insert; UL/CSA approved with capacities for 6, 12, 24, 48 or 72 relays as required. Panel enclosure must be UL/CSA Approved.

C. Panel interior shall have the following pre-assembled and pre-wired:

1. Suitable divider separating class 1 and class 2 compartments.
2. Control transformer, UL/CSA approved for class 2 circuits.
3. Low voltage relays as required by switched circuits shown on plans or schedules.
4. Control devices as required.

2.4 DEVICE NETWORK CONTROLS - LIGHTING CONTROL UNIT

A. The Lighting Control Unit (LCU) shall be able to operate the local lighting control system on a stand-alone basis. For large installations that require multiple LCUs, all units must be able to operate on a stand-alone basis should they become disconnected from the network.

B. The LCU shall provide the following user interfaces for viewing and editing data:

1. Built-in touch screen with editable IP address field for convenient at panel configuration and providing web accessible configuration.
2. Built-in web server, accessed via TCP/IP connection.
3. LCU shall be accessible via a web browser with no additional software required.

C. Each LCU shall provide the following standard lighting control functions:

1. Program and control up to 252 relays and 252 dimmers.
2. Link Outputs to switches and/or sensors to provide ON/OFF, Preset, or Dim Up/Down commands. In addition, functions such as Flick Warn, Time Out, Natural Daylight, Enable/Disable and Quiet Time can be associated with switches, sensors and relays and have these features scheduled by time-of-day or date.
3. Be able to group Outputs and Inputs to facilitate various control schemes.
4. Be able to program peripheral devices (switches, sensors, etc.) to function differently based on specific situations such as time-of-day, demand response status, user intervention, etc.
5. Photo Sensor to provide Dusk-to-Dawn (switching) and/or Natural Daylight (dimming) with multiple set points to different groups.
6. Astronomic Controls for Dusk-to-Dawn applications not requiring Photo Sensor.
7. Provide Log Reports for diagnostic and run-time tracking purposes.
8. Time Schedule types include: 7-day weekly scheduling, 365-day date specific, Holiday, and event scheduling.

D. The system shall have pre-defined logical applications for lighting controls.

1. Astronomical Time Clock
2. Natural Daylight (CLC) – Open Loop & Close Loop
3. Exterior Threshold Photo Control
4. Time Out (Unoccupied Mode)
5. Quiet Mode
6. Permanent Block
7. Flick Warn

E. The system must shall the ability to operate multiple items and modes with a single action and sequence them with time offsets.

F. Behaviors: The system shall have the ability to program multiple actuations and modes with a single activation. Each item must be able to be programmed with a time offset. When the deactivation occurs a separate and unique list of actuations can be programmed.

G. Triggers: The system shall be able to utilize the status or the one or many relay/group statuses to send an actuation to the system. The statuses must be able to be programmed in an AND or OR logic.

H. Each LCU shall provide the following system functions:

1. Demand response: connection via contact input.
2. Accept configuration updates via USB port or Ethernet connection.
3. Backup data via Ethernet or USB port.

2.5 ROOM CONTROLLER

A. Where indicated on the drawings provide a pre-configured, digitally addressable, plenum-rated room controller.

B. The Room Controller shall be capable of:

1. Autonomously controlling a space.
2. Networking to a central control system.
3. Networking to a central BACnet based management system.

C. The Room Controller shall consist of:

1. A universal voltage type (120Vac/277Vac/347Vac) power supply.
2. Four 20A rated relays complete with manual override. Circuit Load rating dependent on usage. One circuit dedicated for 20A receptacle control.
3. Four 0-10V control channels, capable of 100mA current sinking
4. A port to connect downstream switches, occupancy sensors and daylight sensors. All downstream devices shall connected via two #18AWG, non-polarized, non-shielded, non-twisted conductors. See Section 3.4 for wiring specifications.
5. A port to connect to an upstream Lighting Control Unit.
6. A port to connect upstream to BACnet IP building management system. The Controller shall communicate using native BACnet command objects appropriate for the application.
7. An indicating LED to aid in locating the controller in a darkened ceiling space.
8. Circuit testing buttons
9. Capable of connecting with WUL-3924
10. Output 24Vac 120mA
11. Relay Ratings
12. 20A Suitable for General Purpose Loads @ 120/277/247VAC
13. 20A Suitable for Standard Ballasts and Tungsten Loads @ 120/277VAC
14. 15A Suitable for Standard Ballasts Only @ 347VAC
15. 16A Suitable for Electronic Ballasts @ 120/277VAC
16. 0.5HP @120/277Vac
17. US & Canada Plenum Rated

D. The Room Controller relays shall be connected such that 120Vac plug load(s) and 277Vac/347Vac lighting loads can be switched by a single Controller with no additional add-ons or remote modules

E. The Room Controller shall mount to electrical junction box via threaded ½” chase nipple. No other mounting hardware shall be required.

2.6 ROOM CONTROLLER UL924 RELAY EXPANSION PACK

A. Where indicated on the drawings provide a 2-relay expansion pack consisting of two independently controllable, 20A relays capable of emergency lighting circuit control.

B. Expansion pack relays shall force EM lights on when the Room Controller loses power.

C. The expansion pack shall connect to the Room Controller. No wires or tools shall be required to add an expansion pack to a Room Controller. The Room Controller will include a means for remote mounting if required.

D. Circuit testing buttons

2.7 RELAY CONTROLS INSTALLED IN RELAY PANELS - RELAY DRIVERS

A. The low voltage relays shall be connected to the system by a relay driver unit. Each relay driver has 8 outputs and shall provide enough relay driver units so that each relay in the system is connected to an output.

B. Relay drivers shall be able to control relays ON and OFF, determine relay status, provide feedback as to whether a relay is connected and be addressable within the network.

2.8 DIMMING DRIVERS

A. The system shall be able to control industry standard 0-10VDC dimming ballasts or 0-10VDC LED drivers by using the Dimming Ballast Module. Each shall have 4 dimming address outputs, be able to support 35 ballasts per output and support sink current of 100mA per output.

2.9 BACNET IP GATEWAY

A. If required, the system shall have the ability to communicate to a system integrator or other software specialist to program the system. It shall be possible to view/control the system via the BACnet integration software through TCP/IP connection. The system shall provide the following features:

1. Program and control up to 252 relays and dimming points.
2. Control and receive status for Groups
3. Control and receive status for Presets
4. Receive status from Occupancy Sensors

2.10 WALL SWITCH

A. Switches shall connect to the lighting control network via a common 2-wire, non-polarized data line. Switches shall be configured and programmed to control one or more outputs in the lighting control system.

B. Switches shall have the capability to be configured an infrared setting unit that accesses programming fields of the switch without removing the switch from the wall box.

C. Switches are linked to a single output or a group of outputs.

D. Switches, Occupancy Sensors and Photo Sensors can be set to a common output address to permit multiple points of control for a single relay or dimming output.

E. Switches, Occupancy Sensors and Photo Sensors can be set to a common group address to permit multiple points of control for a group of outputs.

F. Each switch can be programmed for ON/OFF control of outputs, UP/DOWN control of 0-10VDC dimming ballasts, 0-10VDC LED drivers and/or preset control to set a specific lighting scene.

G. Switches, with LED indicators to indicate both ON and OFF output/group status, shall be available with 1, 2, 3, 4 or 8 single button switches per gang. Switch to fit standard Decora opening.

H. Switches and switch hardware shall mount to standard wall boxes.

I. Each switch shall provide a location for a label to identify function. The label shall be under a clear plastic cover and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable.

J. Adhere to the factory recommended wiring practices so that physical removal of any single switch shall still permit communication between relay panels in the rest of the lighting control network.

2.11 KEYED SWITCH

A. Keyed switches shall be connected to the lighting control network via a 2-wire, non-polarized data line.

B. Keyed ON/OFF switches shall include LED indicators for ON and OFF status.

C. Keyed switches can be programmed to control individual outputs or groups of output and can also be programmed to enable/disable peripheral devices such as switches or sensors.

D. Each keyed action, clockwise and counter-clockwise, shall allow for independently programmed functions.

E. Keyed switches can be programmed with an infrared setting unit.

2.12 DIMMER SWITCH

A. Dimmer switches shall be connected to the lighting control network via a 2-wire, non-polarized data line. Each switch shall be capable of raising or lowering light levels of individual or groups of lighting fixtures.

B. Switches shall include integral LED indication for light levels as well as a switch for ON/OFF control.

C. Dimmer switch can be programmed with an infrared setting unit.

2.13 CEILING SENSOR

A. Sensors shall be Dual Technology with Passive Infrared (PIR) and ADI-Voice detection.

B. Ceiling sensors shall mount recessed in to the ceiling space.

C. Sensors shall have a 360 degree coverage pattern with an adjustable tilt head to maximize coverage, focus on particular areas, or provide adjustment when mounted on sloped ceilings.

D. Sensors shall provide an adjustable time out period of 30 seconds to 30 minutes.

E. A transformer shall be used if required.

F. If a Photo Sensor is required, it shall be incorporated into the Occupancy Sensor device and operate so that when occupancy is detected, the sensor will only allow the load to be switched ON if the light level is below the daylight level set by the user.

G. A Manual Override Switch is to be provided on the sensor to allow the load to be manually switched ON and OFF for the purpose of testing during installation.

H. Where 2 level switching is required, a 2-pole sensor shall be provided. The sensors must be able to be set to activate alternating poles to provide even lamp wear.

I. Provide as required on the plans, options that are available from the following list:

1. 0-10VDC outputs for dimming ballast option for Natural Daylight with user settable light levels
2. Configurable high and low light level set points so that the sensor can toggle between light levels upon occupancy
3. Auxiliary relay, for signaling other systems, which can be configured so that it synchronizes with the ON/OFF status of the load or the status of occupancy/vacancy
4. Remote Manual Override Switch

2.14 CONTACT INPUT

A. When inputs from other devices (including other manufacturers) are required. Each unit shall provide DC power for each sensor and will accept a momentary or maintained contact signal from each sensor that can be assigned to any relay or group. Check with factory to ensure compatibility.

B. Devices connected to the input unit shall include the following features:

1. Adjustable Timeout (3 min to 30 min).
2. Function selection: ON only, OFF only, toggle (ON/OFF)
3. Multiple sensors may work together using either direct connection to sensors or via multi-sensor function built into WCI-3928 units.

2.15 PHOTO SENSOR & DAYLIGHT CONTROLS - EXTERIOR DAYLIGHT SENSOR

A. Provide where required an Exterior Daylight Sensor capable of sensing from 0 to 65,000 lux (0 to 6500 fc) of direct light. The sensor shall derive both its power and data information from the data line.

B. The ambient light level shall be continuously monitored in lux by the sensor. The sensor shall broadcast to the network the existing light level when requested or when there is a change in detected light level.

C. Set point adjustments can be made via a touch screen or web server interface.

D. Each sensor can be programmed to provide ON/OFF control of relays, raise/lower of 0-10vdc ballasts and LED drivers via a touch screen or web server interface.

E. One sensor shall permit different outputs to switch and/or control light levels as ambient light changes. Light levels shall be controlled by ‘sensor only’ or in combination with a time schedule or with a dimming switch.

F. It shall be possible to set a maximum light level which cannot be exceeded during Natural Daylight operations or for non-daylight controlled areas, a permanent or “tuned” light level to maximize energy savings.

2.16 PHOTO SENSOR & DAYLIGHT CONTROLS - INTERIOR DAYLIGHT SENSOR

A. Provide where required an Interior Daylight Sensor capable of sensing from 0 to 65,000 lux (0 to 6500 fc) of direct light. The sensor shall derive both its power and data information from the data line.

B. The ambient light level shall be continuously monitored in lux by the sensor. The sensor shall broadcast to the network the existing light level when requested or when there is a change in detected light level.

C. Set point adjustments can be made via a touch screen or web server interface

D. Each sensor can be programmed to provide ON/OFF control of relays, raise/lower of 0-10vdc type or ballasts and LED drivers via a touch screen or web server interface.

E. One sensor shall permit different outputs to switch and/or control light levels as ambient light changes. Light levels shall be controlled by ‘sensor only’ or in combination with a time schedule or with a dimming switch.

F. It shall be possible to set a maximum light level which cannot be exceeded during Natural Daylight operations or for non-daylight controlled areas, a permanent or “tuned” light level to maximize energy savings.

2.17 INFRARED SETTING UNIT

A. Provide an Infrared Setting Unit to facilitate the following functions:

B. Set input device and address

C. Configure input device presets, group, and individual control

D. Set local or global functionality

E. Dimmer switches

PART 3 - EXECUTION

3.1 RELAY PANELS AND CONDUIT.

A. Ensure that conduit for line voltage wires enters panel in line voltage areas and conduit for low voltage control wires enters panel on low voltage areas. Check manufacturer’s drawings for location of line and low voltage areas.

3.2 DAYLIGHT SENSORS

A. Install daylight sensors as per manufacturer’s recommendations for closed loop and open loop applications. Ensure there is no artificial light shining directly into the sensor head.

B. Adhere to manufacturer’s recommendations for wiring and programming.

3.3 OCCUPANCY SENSORS

A. Install Occupancy Sensors so objects do not block the coverage area. Keep away from HVAC vents and light directly from light fixtures.

B. Adhere to manufacturer’s recommendations for location, wiring and programming.

3.4 WIRING

A. For low voltage wiring, provide wire type as recommended by the manufacturer.

B. Adhere to manufacturer's recommendations as to maximum wire length and maximum quantity of relays per switch.

C. Data line shall be single pair #18AWG LVT wire type or equivalent.

3.5 LINE VOLTAGE WIRING

A. Use wire gauges from #12AWG to #14AWG as appropriately sized for the branch circuit.

3.6 OPTIONAL PRE-INSTALLATION MEETING

A. A factory authorized manufacturer’s representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

B. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.

C. Review the specifications for low voltage control wiring and termination.

D. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

E. Discuss requirements for integration with other trades.

3.7 CONTRACTOR INSTALLATION AND SERVICES

A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.

B. Contractor to install all room/area devices using manufacturer’s factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufactuerer with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer’s specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

C. Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.

D. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

E. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

G. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

H. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

I. Load Parameters (e.g. blink warning, etc.)

J. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activities.

3.8 OPTIONAL FACTORY SERVICES

A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete, fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.

C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION

SECTION 26 22 13 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes two-winding transformers; shielded transformers; autotransformers; and buck-and-boost transformers.

B. Related Sections:

1. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
2. Section 26 22 03 - Low-Voltage Transformers for Nonlinear Loads.
3. Section 26 22 06 - Low-Voltage Transformer Load Centers.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
2. NEMA ST 20 - Dry Type Transformers for General Applications.
3. DOE 2016 Efficiency Standards

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

D. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years of experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 DRY-TYPE TRANSFORMERS

A. Manufacturers:

1. Eaton/Cutler-Hammer.
2. ABB/General Electric.
3. Schneider Electric/Square D.
4. Substitutions: Division 01 - Product Requirements.

B. Product Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings, conforming to DOE 2016 energy efficiency requirements.

C. Primary Voltage: As scheduled.

D. Secondary Voltage: As scheduled.

E. Insulation System:

1. 1-15 kVA: Class 185.
2. 16-500 kVA: Class 220.

F. Average Temperature Rise: As scheduled.

G. Hot Spot Temperature: Do not exceed 35 degrees C rise above average at warmest point at full load.

H. Winding Taps:

1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
2. Transformers 15 kVA and Larger: NEMA ST 20.

I. Sound Levels: NEMA ST 20. Maximum sound levels are as follows:

1. 1-50 kVA: 45 dB.
2. 51-150 kVA: 50 dB.
3. 151-300 kVA: 55 dB.
4. 301-500 kVA: 60 dB.

J. Basic Impulse Level: 10 kV

K. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap sized to meet UL and NEMA standards.

L. Mounting: As scheduled.

M. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

N. Enclosure: NEMA ST 20, as indicated on Drawings. Furnish lifting eyes or brackets.

O. Isolate core and coil from enclosure using vibration-absorbing mounts.

P. Nameplate: Include transformer connection data.

2.2 SOURCE QUALITY CONTROL

A. Production test each unit according to NEMA ST20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 EXISTING WORK

A. Disconnect and remove abandoned transformers.

B. Maintain access and adequate ventilation to existing transformers and other installations remaining active and requiring access and ventilation. Modify installation or provide access panel or ventilation grilles.

C. Clean and repair existing transformers to remain or to be reinstalled.

3.3 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, in accordance with Section 26 05 33, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure below core.

C. Support transformers in accordance with Section 26 05 29.

D. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.

E. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.

F. Mount suspended transformers on framing strut channels supported from building structure with threaded loads.

G. Install grounding and bonding in accordance with Section 26 05 26.

H. Provide sufficient space around transformer for cooling as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Check for damage and tighten connections prior to energizing transformer.

3.5 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution and branch circuit panelboards.
2. Electronic grade branch circuit panelboards.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA PB 1 - Panelboards.
2. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc.:

1. UL 50 - Cabinets and Boxes.
2. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
3. UL 1283 - Electromagnetic Interference Filters.
4. UL 1449 - Surge Protective Devices.
5. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit catalog data showing specified features of standard products.

D. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance products.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years of experience.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Acceptable Manufacturer List: Manufacturers are listed alphabetically:

1. Eaton/Cutler-Hammer.
2. ABB/General Electric.
3. Schneider Electric/Square D.

B. Substitution Limitations:

1. Division 01 - Product Requirements: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA PB 1, panelboard.

D. Operation:

1. Service Conditions:

a. Temperature: <105 degrees F
b. Altitude: <6000 feet above sea level.

2. Minimum integrated short circuit rating: as scheduled.

E. Materials:

1. Panelboard Bus: Aluminum, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
2. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Furnish interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses unless otherwise scheduled.
3. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide electronic trip units when specifically scheduled in lieu of thermal type. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
4. Molded Case Circuit Breakers with Current Limiters: UL 489, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous

magnetic trip in each pole. Provide electronic trip units when specifically scheduled in lieu of thermal type.

5. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral overcurrent and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
6. Circuit Breaker Accessories: Trip units and auxiliary switches as scheduled.
7. Enclosure: NEMA PB 1, Type as scheduled.
8. Cabinet Front: Surface hinged trim type, fastened with screws.
9. Contractor shall determine feed arrangement, top or bottom, to match installation. Where specific feed arrangements are shown on the drawings, the contractor shall adhere to those requirements.
10. Furnish circuit directory inside door.

F. Finishes:

1. Covers, trim and doors: Manufacturer's standard gray enamel. Provide full height side-hinged trim type covers. Door-in-door type construction is not acceptable.
2. Enclosure: Galvanized.

2.2 ELECTRONIC GRADE PANELBOARD

A. Description:

1. Integral Surge Suppresser: Component recognized in accordance with UL 1449 and UL 1283.
2. Panelboard: UL 67 listed and SPD device UL 1449 Component Recognized. SPD device meets UL 1449. Furnish panelboard markings with clamp voltage at SPD terminals and clamp voltage at panelboard line terminals.

B. Performance:

1. Integral Surge Suppressers:

a. Meet or exceed the following criteria:
b. Maximum single impulse current rating 80 kA, 120 kA, 160 kA, or 200 kA as scheduled for each phase.
c. Pulse Lift Test: Capable of protecting against and surviving 5000 IEEE C62.41 Category C transients without failure or degradation.
d. Clamping voltage not exceeding the following:

Voltage	L-N	N-G	L-G
208Y/120	500 V	500 V	500 V
480Y/277	1000 V	1000 V	1000 V

C. Fabrication:

1. Integral Surge Suppresser:

a. Furnish copper bus bars for surge current path.
b. Construct using surge current modules (MOV based). Each module fused with user replaceable 200,000 AIR rated fuses. Status of each module monitored on front cover of panelboard enclosure and on module.

c. Furnish with audible alarm activated when one of surge current modules has failed. Furnish alarm on/off to silence alarm and alarm push-to-test switch to test alarm. Locate switches and alarm on front cover of panelboard enclosure.
d. Furnish response time no greater than five nanoseconds for individual protection modes.
e. Designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
f. Furnish visible indication of proper suppressor connection and operation. Lights indicate operable phase and module.
g. Furnish minimum EFI/RFI filtering of 34 dB at 100 kHz with insertion loss ratio of 50: 1 using Mil Std. 220A methodology.

2. Panelboards:

a. Furnish one circuit breaker, rating as recommended by manufacturer with appropriate number of poles, as dedicated disconnect for TVSS.
b. Furnish 200 percent rated neutral assembly with aluminum neutral bus.
c. Furnish with insulated ground bus and non-insulated equipment grounding bus.
d. Remainder of specification requirements shall be per Article 2.1.

2.3 SOURCE QUALITY CONTROL

A. Division 01 - Quality Requirements: Testing, inspection and analysis requirements.

B. Independently test integral surge suppressors with category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us) per IEEE C62.41.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Disconnect abandoned panelboards and load centers. Install blank cover for abandoned panelboards and load centers where specifically indicated on the Drawings.

B. Maintain access to existing panelboard and load centers remaining active and requiring access. Modify installation or provide access panel.

3.2 INSTALLATION

A. Install panelboards and load centers plumb.

B. Install recessed panelboards flush with wall finishes.

C. Height: Where height of panelboard permits, 6’ above finished floor or working surface. Otherwise, mount higher but to remain in compliance with NEC Article 404.8(A) requirements.

D. Install filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Identify each circuit as to its clear, evident and specific purpose of use.

F. Install engraved plastic nameplates in accordance with Section 26 05 53.

G. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: 3 empty 1 inch (DN27). Identify each as SPARE.

H. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Requirements for inspecting and testing.

3.4 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Measure and record steady state load currents at each panelboard feeder. Submit results to Engineer as part of close-out documents.

3.5 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean existing panelboards [and load centers] to remain or to be reinstalled.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wall switches; wall dimmers; receptacles; multi-outlet assembly; lighting control devices; and device plates and decorative box covers.

1. Wall Switches.
2. Floor boxes.
3. Receptacles.
4. Device Plates, Covers and Colors.
5. Multi Outlet Assembly.
6. Wall-Mounted Line Voltage Occupancy Sensor Switch.
7. Exterior Line Voltage Photocells.
8. Ambient Light Sensor Control Unit.
9. Time Clocks.
10. Timer Switches.

B. Related Sections:

1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
3. UL 498 - Receptacles
4. UL 20 - Switches

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit manufacturer's catalog information showing dimensions, colors and configurations.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section.

1.5 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two of each style, size and finish wall plate.

1.6 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer warranty for components.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:

1. Cooper: CSB Series.
2. Hubbell: CSB Series.
3. Pass and Seymour: CSB Series.
4. Substitutions: Division 01 - Product Requirements.

B. Product Description: NEMA WD 1, Commercial Spec Grade AC only general-use snap switch, side and back wired.

C. Body and Handle: Plastic with toggle handle, unless otherwise noted on plans. Use red for devices connected to emergency systems.

D. Indicator Light: Lighted handle type switch, where shown on plans.

E. Ratings:

1. Voltage: 120-277 volts, AC.
2. Current: 20 amperes.

2.2 FLOOR BOXES

A. On-Grade Floor Box

1. Manufacturers:

a. Wiremold.
b. Hubbell.
c. Substitutions: Division 01 - Product Requirements.

2. Receptacles: NEMA WD 6, type 5-20R, duplex receptacle.
3. Cover: Surface, nickel finish.

B. Poke-Thru

1. Manufacturers:

a. Wiremold.
b. Hubbell.
c. Substitutions: Division 01 - Product Requirements.

2. Receptacles: NEMA WD 6, type 5-20R, duplex receptacle.
3. Cover: Surface, nickel finish.

2.3 RECEPTACLES

A. Duplex Receptacle

1. Product Description: NEMA WD 1, Commercial Spec grade receptacle, 20 amp.
2. Configuration: NEMA WD 6, side and back wired.
3. Device Body: Plastic, unless otherwise noted on Drawings. Use red for devices connected to emergency systems.
4. Manufacturers:

    a. Legrand
    b. Cooper
    c. Hubbell
    d. Substitutions: Division 01 - Product Requirements.

5. Use Hospital Grade devices on all heath care facility projects. Provide hospital-grade tamper-resistant receptacles in business offices, waiting rooms, and corridors.

B. Simplex Receptacle

1. Product Description: NEMA WD 1, Commercial Spec Grade receptacle, 20 amp.
2. Configuration: NEMA WD 6, side and back wired.
3. Device Body: Plastic, unless otherwise noted on Drawings. Use red for devices connected to emergency systems.
4. Manufacturers:

    a. Cooper: 1877 Series
    b. Hubbell, HBL 5261 Series
    c. Leviton: 5891 Series
    d. Pass and Seymour: 5361 Series
    e. Substitutions: Division 01 - Product Requirements.

C. GFCI Receptacle

1. Product Description: NEMA WD 1, Heavy-duty general use receptacle, 20 amp. Provide with weather-resistant rating when located outdoors.
2. Configuration: NEMA WD 6, UL943, side and back wired, feed thru type.
3. Device Body: Plastic, unless otherwise noted on Drawings. Use red for devices connected to emergency systems.
4. Manufacturers:

    a. Cooper: VGF20 Series
    b. Hubbell: GF20L Series
    c. Leviton: 8898 Series
    d. Pass and Seymour: 2095 Series
    e. Substitutions: Division 01 - Product Requirements.

D. Twist Lock Receptacle

1. Product Description: NEMA Lx-xx, UL 94, Twist Lock receptacle.
2. Configuration: NEMA type as indicated on Drawings.
3. Device Body: Black plastic, unless otherwise noted on Drawings. Use red for devices connected to emergency systems.
4. Manufacturers:

    a. Cooper
    b. Hubbell

c. Leviton.
d. Pass and Seymour
e. Substitutions: Division 01 - Product Requirements.

E. Special Purpose Receptacle

1. Product Description: Heavy-duty Special Purpose Receptacle, Straight Blade or Pin and Sleeve Type.
2. Configuration:

a. Range receptacle: NEMA 14-50
b. Dryer receptacle: NEMA 14-30
c. Other types: As indicated on drawings.

3. Device Body: Black plastic, unless otherwise noted on Drawings. Use red for devices connected to emergency systems.
4. Manufacturers:

a. Cooper.
b. Hubbell.
c. Leviton.
d. Pass and Seymour.
e. Substitutions: Division 01 - Product Requirements.

2.4 DEVICE PLATES, COVERS AND COLORS

A. Manufacturers: To match device manufacturer.

B. Device Colors:

1. Wall Devices: White
2. Ceiling Devices: White

C. Decorative Cover Plate: Smooth nylon with mounting screw(s).

D. Jumbo Cover Plate: Smooth nylon with mounting screw(s). For use at masonry walls only.

E. Weather Resistant Cover Plate: Gasketed cast metal plate with hinged and gasketed device cover. Provide weatherproof-while-in-use type covers where indicated on the Drawings.

2.5 MULTI-OUTLET ASSEMBLY

A. Manufacturers: Wiremold.

1. Substitutions: Division 01 - Product Requirements.

B. Receptacles: NEMA WD 6, type 5-15R, duplex receptacle.

C. Receptacle Spacing: As indicated on Drawings.

D. Receptacle Color: White.

E. Channel Finish: White.

F. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.

2.6 WALL-MOUNTED LINE VOLTAGE OCCUPANCY SENSOR SWITCH

A. Manufacturers:

1. Hubbell Model LHIRS1.
2. Sensor Switch Model LWS-P.
3. Watt Stopper Model WS-250.
4. Substitutions: Division 01 - Product Requirements.

B. 800 watt, 120/277 volt line voltage control. Passive infrared and ambient light sensing.

C. Separate sensitivity and time delay adjustments. User adjustable time-delay: 30 seconds to 30 minutes. 0-200 foot candle adjustability for ambient light control.

D. Furnish with manual override.

E. Operation: Silent.

F. Coverage Sensitivity: Capable of detecting motion over nominal 900 square foot area.

2.7 EXTERIOR LINE VOLTAGE PHOTOCELLS

A. Manufacturers:

1. Tork Model 2101 (120 volts) / 2104 (208-277 volt).
2. Substitutions: Division 01 - Product Requirements.

B. General: 1/2” conduit mount, 180 degree sensing photocell with swivel mount, 2800 va load capacity. Galvanized housing. Slide cover sensitivity control.

2.8 AMBIENT LIGHT SENSOR CONTROL UNIT

A. Manufacturers:

1. Hubbell Model LXPSCMLP Series
2. Leviton Mini-Z Series
3. Watt Stopper Model LCO_203 Series.
4. Substitutions: Division 01 - Product Requirements.

B. Product Description: Photodiode control unit with PHOTOCELL ENABLE and MASTER OVERRIDE inputs for remote control, 3 minute time delay, and with selectable ranges 100-1000 footcandle (1,076-10,760 lx).

2.9 TIME CLOCKS

A. Manufacturers:

1. Tork Model DZM200BP, or as otherwise indicated on the Drawings.
2. Substitutions: Division 01 - Product Requirements.

B. Two-channel digital astronomical time clock, LCD display, permanent schedule retention.

2.10 TIMER SWITCHES

A. Manufacturers:

1. Hubbell TD 200.
2. Pass and Seymour RT12.
3. Wattstopper TS 400.
4. Substitutions: Division 01 - Product Requirements.

B. Product Description: 0-12 hour timer switch, ability to interconnect multiple units for 3-way switching.

C. Body and Handle: Plastic with push button control.

D. Ratings:

1. Voltage: 120-277 volts, AC.
2. Load: 0-800 watt ballast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.

B. Modify installation to maintain access to existing wiring devices to remain active.

C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on top.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Connect wiring devices by wrapping solid conductor around screw terminal. When stranded conductors are used in lieu of solid, use back wiring connections. Do not place bare stranded conductors directly under device screws.

I. Use jumbo size plates for outlets installed in masonry walls.

J. Install galvanized steel covers on outlet boxes and junction boxes in unfinished areas and above accessible ceilings.

K. Section 26 05 53 - Identification for Electrical Systems

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified.

3.6 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity and ground.

F. Test each GFCI receptacle device for proper operation.

G. In accordance with NFPA 99 requirements for special grounding and testing in healthcare environments, provide receptacle testing report for all patient care room devices to include:
1. Verification of visual inspection confirming receptacle’s physical integrity.
2. Verification of ground continuity.
3. Verification of correct polarity.
4. Retention force of ground blade not less than 4 oz.

3.7 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust devices and wall plates to be flush and level.

C. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.

D. Test each system component after installation to verify proper operation.

E. Test relays, contactors and switches after installation to confirm proper operation. Provide sensitivity adjustments on motion sensors to avoid nuisance, undesired operation.

F. Confirm correct loads are recorded on directory card in each panel.

3.8 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Clean exposed surfaces to remove splatters and restore finish.

3.9 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate operation of the following system components:

1. Operation of switches.
2. Operation of occupancy sensors. Demonstrate for all zones.
3. Operation of each type of photocell/ambient lighting control zone.

C. Furnish 4 hours to instruct Owner's personnel in operation and maintenance of system. Schedule training with Owner, provide at least 7 days' notice to Architect/Engineer and Owner of training date.

END OF SECTION

SECTION 26 28 13 - 250 & 600-VOLT FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes 250- and 600-volt fuses and spare fuse cabinet.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual sizes, ratings and locations of fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years of experience.

1.6 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two fuse pullers.

1.7 MATERIALS

A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish three spare fuses of each class, size and rating installed.

PART 2 - PRODUCTS

2.1 FUSES

A. Manufacturers:

1. Bussman.
2. Littlefuse.
3. Shawmut.
4. Substitutions: Division 01 - Product Requirements.

B. Dimensions and Performance: NEMA FU 1, class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

D. Interrupting Rating for all Fuses: 200,000 rms amperes minimum.

2.2 CLASS RK1 FUSES

A. Bussman Type LPN-RK__SP (250V), LPS-RK__SP (600V) or equivalent

B. Dimensions and Performance: UL Class RK1, NEMA FU 1, current limiting.

C. Time Delay: 10 seconds minimum at 500% rated current.

D. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.3 CLASS RK5 FUSES

A. Bussman Type FRN-R (250V), FRS-R (600V), or equivalent

B. Dimensions and Performance: UL Class RK1, NEMA FU 1, moderate current limiting.

C. Time Delay: 10 seconds minimum at 500% rated current.

D. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.4 CLASS L (TIME DELAY) FUSES

A. Bussman Type KRP-C__SP or equivalent

B. Construction: silver links with sand filler.

C. Dimensions and Performance: UL Class L, NEMA FU 1.

D. Time Delay: 4 seconds minimum at 500% rated current.

E. Interrupting Rating: 300,000 RMS symmetrical.

2.5 CLASS J (TIME DELAY) FUSES

A. Bussman Type LPJ__SP, or equivalent

B. Time Delay: 10 seconds minimum at 500% rated current.

C. Dimensions and Performance: UL Class J, NEMA FU 1.

D. Interrupting Rating: 200,000 RMS symmetrical minimum.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Remove fuses from abandoned circuits.

B. Maintain access to existing fuses and other installations remaining active and requiring access. Modify installation or provide access panel.

3.2 INSTALLATION

A. Install fuse with label oriented so manufacturer, type and size are easily read.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fusible switches, non-fusible switches, and molded case and insulated case circuit breakers in individual enclosures.

B. Related Sections:

1. Section 26 28 13 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
3. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and circuit breakers with ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

1. Eaton/Cutler Hammer.
2. ABB/General Electric.
3. Schneider Electric/Square D.
4. Substitutions: Division 01 - Product Requirements

B. Product Description: NEMA KS 1, heavy-duty enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R or 4 as noted on plans.

E. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

F. Furnish switches with entirely copper current carrying parts.

2.2 NON-FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

1. Eaton/Cutler Hammer.
2. ABB/General Electric.
3. Schneider Electric/Square D.
4. Substitutions: Division 01 - Product Requirements

B. Product Description: NEMA KS 1, heavy-duty enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R or 4 as noted on plans.

D. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

E. Furnish switches with entirely copper current carrying parts.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

2.4 MOLDED CASE CIRCUIT BREAKER

A. Manufacturers:

1. Eaton/Cutler Hammer.
2. ABB/General Electric.
3. Schneider Electric/Square D.

4. Substitutions: Division 01 - Product Requirements.

B. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.

C. Service Conditions:

1. Temperature: 104 degrees F maximum.
2. Altitude: 6,000 feet maximum.

D. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 200 amperes and larger have mechanism for adjustment as noted on Drawings.

E. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.

F. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings; and delays as noted on Drawings.

G. Current Limiter: Designed for application with molded case circuit breaker.

1. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.
2. Interlocks trip circuit breaker and prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

H. Accessories: As indicated on Drawings. Conform to NEMA AB 1. Typical devices include breaker locks, pad lock provisions, auxiliary switch, shunt-trip operators, and others as indicated.

I. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R or 4 or as noted on Drawings.

J. Service Entrance: Circuit breakers identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned enclosed switches and circuit breakers.

B. Maintain access to existing enclosed switches and circuit breakers and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing enclosed switches to remain or to be reinstalled.

3.2 INSTALLATION

A. Install enclosed switches and circuit breakers plumb. Provide supports in accordance with Section 26 05 29.

B. Height: 5 feet to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

D. Install engraved plastic nameplates in accordance with Section 26 05 53.

E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Division 01 - Execution and Closeout Requirements: Field inspecting, testing and adjusting.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.4 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust trip settings to coordinate circuit breakers with other overcurrent protective devices in circuit.

C. Adjust trip settings to provide adequate protection from overcurrent and fault currents

END OF SECTION

SECTION 26 29 16 - ENCLOSED CONTACTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes enclosed contactors for lighting and general purposes.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
2. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
3. NEMA ICS 6 - Industrial Control and Systems: Enclosures.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: Submit dimensions, size, voltage ratings and current ratings.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for replacing and maintaining coil and contacts.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years of experience.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE CONTACTORS

A. Manufacturers:

1. Cutler-Hammer.
2. G.E.
3. Siemens.
4. Square D.
5. Substitutions: Division 01 - Product Requirements.

B. Product Description: NEMA ICS 2, AC general purpose magnetic contactor.

C. Coil Operating Voltage: 120 volts, 60 hertz, unless otherwise scheduled.

D. Poles: To match circuit configuration and control function.

E. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R or as scheduled.

2.2 LIGHTING CONTACTORS

A. Manufacturers:

1. Cutler-Hammer.
2. G.E.
3. Siemens.
4. Square D.
5. Substitutions: Division 01 - Product Requirements.

B. Product Description: NEMA ICS 2, magnetic lighting contactor.

C. Coil Operating Voltage: 120 volts, 60 hertz, unless otherwise scheduled.

D. Poles: As scheduled.

E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

F. Accessories:

1. Cover-Mounted Pilot Devices: NEMA ICS 5, standard-duty type with Form Z contacts.
2. Pushbutton: ON/OFF function, with unguarded configuration.
3. Selector Switch: ON/OFF/AUTOMATIC function, with rotary action.
4. Indicating Light: GREEN lens, led lamp.
5. Auxiliary Contacts: One normally open and one normally closed in addition to seal-in contact.
6. Relays: NEMA ICS 2.
7. Control Power Transformers: 120 volt secondary. Furnish fused primary, fused secondary and bond unfused leg of secondary to enclosure.

G. Combination Contactors: Combine contactors with thermal magnetic circuit breaker conforming to NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.

H. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect abandoned enclosed contactors and remove abandoned enclosed contactors.

B. Maintain access to existing enclosed contactors and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing enclosed contactors to remain or to be reinstalled.

3.2 INSTALLATION

A. Install enclosed contactors as indicated on Drawings and in accordance with NECA "Standard of Installation."

B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 feet to operating handle.

D. Install fuses for fusible switches. Refer to Section 26 28 13 for product requirements.

E. Install engraved plastic nameplates. Refer to Section 26 05 53 for product requirements and location.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.16.1.

END OF SECTION

SECTION 26 29 23 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes variable frequency controllers.

B. Related Sections:

1. Section 26 28 13 - Fuses.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.
4. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

D. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

E. Test Reports: Indicate field test and inspection procedures and test results.

F. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 7.1. Include procedures for starting and operating controllers, and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience, and with service facilities within 100 miles of project.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for variable frequency controller.

1.9 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Maintenance service.

B. Furnish service and maintenance of variable frequency controller for one year from Date of Substantial Completion.

1.10 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two of each air filter.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY CONTROLLER

A. Manufacturers: Acceptable Manufacturers include, but are not limited to, the following:

1. ABB.
2. Yaskawa.
3. Substitutions permitted per Division 01 – Product Requirements.

B. Product Description: NEMA ICS 7, enclosed variable frequency controller suitable for operating indicated loads. Select unspecified features and options in accordance with NEMA ICS 7.1.

C. Ratings:

1. Input Voltage: 208 or 480 volts, three phase, 60 Hertz.
2. Capable of operating within voltage parameters of +10 to –15 percent of rated line voltage, and to be suitable rated for the full load amps of the maximum HP within its class.
3. Motor Nameplate Voltage: 230 or 460 volts, three phase, 60 hertz.
4. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
5. Operating Ambient: 0 degrees C to 40 degrees C.
6. Minimum Efficiency at Full Load: 92 percent.
7. At 100 percent speed the input power factor of the controller shall not be less than 95 percent and shall be not less than 85 percent at any other speed.

D. Design Features:

1. Employ microprocessor-based inverter logic isolated from power circuits.
2. Solid state with adjustable frequency and voltage, 3-phase output capable of driving standard NEMA Class B induction motors.
3. Utilize diode bridge rectifying circuitry and pulse width modulation DC to AC converters.
4. Silicon controlled rectifiers (SCR) shall not be used in the inverter circuitry.
5. Shall not generate excessive noise at either the motor or controller during its full range of operation. Excessive noise is defined as greater than 61, 53, and 45 db in bands 1, 2 and 3 when measured five feet from any mechanical room wall where motors or controllers are located within the mechanical room with the door to the mechanical room closed.
6. Power for control circuits from integral control transformer.
7. Manually resettable motor overload protection for each phase.
8. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 30 seconds.
9. 4 to 20 ma current follower circuitry for interface with mechanical sensor devices.
10. Automatic frequency adjustment from 20 Hz to 60 Hz.
11. Circuitry to initiate an orderly shut-down and automatic re-start after the motor stops spinning and when conditions are corrected. The controller shall not be damaged by the following electrical disturbances:

    a. Incorrect phase sequence
    b. Single phasing.
    c. Over voltage in excess of 10 percent.
    d. Under voltage in excess of 15 percent.
    e. Running over-current above 110 percent (shall not automatically reset for this condition).
    f. Surge voltage in excess of 1000 volts.
    g. Short duration power outages of 12 cycles or less (i.e. distribution line switching, generator testing, automatic transfer switch operations, etc.)

12. Provide automatic shut-down on receipt of a power transfer warning signal from an automatic transfer switch. Controller shall automatically restart motor after the power transfer.
13. Controller shall not add any current or voltage transients to the input AC power distribution system nor shall the controller be affected by transients from other devices on the AC power distribution system. Controller shall be protected to comply with IEEE C37.90a. Guide for Surge Withstand Capability (SWC) Test (2500 volts for 1 minute) and UL-508 Electrical Industrial Control.

E. Indicators and Manual Controls:

1. Input Signal: 4 - 20 mA DC.
2. Refer to Division 23 Specifications for compatible Digital Control Interface.
3. Display: Furnish integral door mounted digital display to indicate the following:

    a. Output voltage
    b. Output frequency
    c. Output current

4. Status Indicators: Indicators for following:

    a. Overcurrent, overvoltage.
    b. Ground fault
    c. Overtemperature
    d. Input power ON
    e. System protection light indicating that the system has shut down but will restart when conditions return to normal.

5. Volts per Hertz Adjustment: Plus or minus 10 percent.
6. HAND-OFF-AUTOMATIC selector switch and manual speed control.

F. Safeties and Interlocks:

1. Include undervoltage release.
2. Door Interlocks: Mechanical means to prevent opening of equipment with power connected; include means for defeating interlock by qualified persons.
3. Safety Interlocks: Terminals for remote contact to inhibit starting under both manual and automatic mode.
4. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.
5. Manual Bypass: Include three-contactor arrangement, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of motor. Arrangement shall allow maintenance of inverter during bypass operation.
6. Emergency Stop.
7. Disconnecting Means: Integral circuit breaker on line side of each controller.

G. Fabrication:

1. Wiring Terminations: Match conductor materials and sizes as indicated on Drawings.
2. Enclosure: NEMA 250, Type 1, suitable for equipment application in places accessible only to qualified personnel.
3. Finish: Manufacturer's standard enamel.

2.2 SURGE PROTECTIVE DEVICES

A. Shop, inspect and perform standard production test for each controller.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify building environment is maintained within service conditions required by manufacturer.

3.2 EXISTING WORK

A. Disconnect and remove abandoned controllers.

B. Clean and repair existing controllers to remain or to be reinstalled.

3.3 INSTALLATION

A. Install in accordance with NEMA ICS 7.1.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Install fuses in fusible switches.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.

E. Install engraved plastic nameplates in accordance with Section 26 05 53.

F. Neatly type label inside controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

G. Ground and bond controller in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 7.1.

3.5 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Manufacturer’s field services.

B. Prepare and startup variable frequency controller.

3.6 DEMONSTRATION AND TRAINING

A. Furnish four hours of instruction for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION

SECTION 26 41 13 - FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes air terminals, interconnecting conductors, grounding, and bonding for lightning protection.

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 780 - Standard for the Installation of Lightning Protection Systems.

B. Underwriters Laboratories Inc.:

1. UL 96 - Lightning Protection Components.
2. UL 96A - Installation Requirements for Lightning Protection Systems.

C. LPI – Lightning Protection Institute.

1.3 SYSTEM DESCRIPTION

A. Description: Conductor system protecting entire building and having UL Master Label.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

D. Product Data: Submit catalog sheets showing dimensions and materials of each component, and include indication of listing in accordance with UL 96.

E. Manufacturer's Certificate: Certify Products meet or exceed requirements.

F. Certificate of Compliance: Submit certificate from authority having jurisdiction, Underwriter's Laboratories, indicating approval of lightning protection systems.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 780.

B. Perform Work in accordance with UL 96A.

C. It is the intent of this specification to install components of the lightning protection system in compliance with provisions of the latest edition of all applicable codes required to obtain a UL “Master Label” certification. It is the responsibility of the Contractor to obtain the services of a certified LPI “Master Installer” for this work.

D. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum three years experience.

B. Installer: Authorized installer of manufacturer with minimum three years experience.

C. Inspection Agency: Underwriter’s Laboratories, Inc. (UL).

1.8 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with roofing and exterior and interior finish installations.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Product Listing: UL 96.

B. Provide components as required to obtain UL Master Label

C. Coordinate all materials used with metallic roofing materials.

D. Materials:

1. Air Terminals: 1/2-inch by 18-inch solid copper with cast copper/bronze bases and stainless-steel bolt-pressure cable connectors.
2. Conductors: UL listed; Class 11, 115,000 CM, minimum 16 AWG strands, copper wire.
3. Cable Connectors: Cast copper/bronze with bolt-pressure type stainless steel bolts and nuts. Cast or stamped crimp fittings are unacceptable.
4. Fasteners: Non-corrosive, sizes and lengths to suit conditions.
5. Other products, not specifically described, but required for a complete and proper installation of the work in this section shall be selected by the Contractor subject to the approval of the Architect/Engineer and Project Representative.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Remove exposed abandoned air terminals, interconnecting cable, and grounding electrodes, and other lightning protection components. Cut cable flush with walls, floors, and roof; patch surfaces.

B. Maintain access to existing grounding and bonding connections, and other installations remaining active and requiring access. Modify installation or install access panel specified in Division 08.

C. Extend existing lightning protection installations using materials and methods compatible with existing installations and as specified.

D. Clean and repair existing and reinstalled lightning protection components.

3.2 INSTALLATION

A. Install in accordance with NFPA 780 and UL 96A.

B. Equipment/objects to be bonded include, but are not limited to, the following:

1. Rooftop structural steel, access ladders, raised platforms and handrails.
2. Sheet metal and flashing, louvers, grilles, equipment screens.
3. Exhaust fans, other HVAC equipment, rooftop ductwork, piping, plumbing vents.

C. Connect conductors using mechanical connectors. Protect adjacent construction elements and finishes from damage.

D. Primary bonds shall be made with appropriate fittings and full-size secondary conductors. Secondary conductors must pass continuously horizontally, or down from point of bond to point of connection to main conductor. Connections between dissimilar metals shall be made with approved bimetallic connectors.

E. All conductors shall be fastened @ 3’-0” O.C., using appropriate methods.

F. Air terminals shall be mounted in such a way that they project a minimum of 10 inches above the object being protected.

G. Conceal interior conductors within building finishes. Conceal exterior conductors where practical.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Perform inspection and testing in accordance with UL 96A.

END OF SECTION

SECTION 26 43 13 - SURGE PROTECTIVE 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. Section includes surge protective devices for:

1. Service Entrance.
2. Electronic grade panelboards.
3. Auxiliary panelboards.
4. Special systems control and data terminals.

B. Related Sections:

1. 26 24 13 – Switchboards for factory-installed SPDs.
2. 26 24 16 – Panelboards for factory-installed SPDs.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. VPR: Voltage Protection Rating.

C. SPD: Surge Protection Device.

D. Inominal: Nominal Discharge Current.

E. MCOV: Maximum Continuous Operating Voltage.

F. Mode(s), Also Modes of Protection: The pair of electrical connections where the VPR applies.

G. MOV: Metal-Oxide Varistor; An Electronic Component with A Significant Non-Ohmic Current Voltage Characteristic.

H. OCPD: Overcurrent Protective Device.

I. SCCR: Short-Circuit Current Rating.

J. SPD: Surge Protective Device.

K. VPR: Voltage Protection Rating.

1.4 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.

2. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
3. IEEE C62.42, IEEE Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits and test devices.
4. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment connected to Low Voltage AC Power Circuits.

1.5 ACTION SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

D. Product Certificates: For surge protection devices, signed by product manufacturer certifying compliance with the latest editions of the following standards:

1. UL 1283, Electromagnetic Interference Filters.
2. UL 1449, Surge Protective Devices.

E. Qualification Data: For testing agency.

F. Noise rejection test results at 100kHzOperations and Maintenance

1. Include data per Division 1 copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator

G. Field Verification Test Report

1. Include the report for field verification of the injection startup test results and the factory benchmark test results for confirmation of proper suppression filter system function as required from this specification.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports, including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

B. Operation and Maintenance Data: For surge protection devices to include in emergency, operation, and maintenance manuals.

C. Warranties: Special warranties specified in this Section.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing 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. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Construction Manager’s written permission.

B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating RMS voltage for 480Y/277V and not less than 125 percent of nominal RMS voltage for 208Y/120V.
2. Operating Temperature:30 to 120 deg F.
3. Humidity:0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

1.10 COORDINATION

A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.11 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Service Entrance Suppressors: Twenty (20) years from date of Substantial Completion.
2. Warranty Period for Panel Suppressors: Fifteen (15) years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACT Communications, Inc.
2. ABB (with submitted specification compliance)

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

A. Basis of Design: Subject to compliance with requirements. Provide product by the following:

1. ACT Communications 471SEL Series.

B. Other manufacturers wishing to have specific products evaluated for equivalence shall provide detailed compliance or exception statements, along with supporting test documentation, to all provision of this specification, no less than 10 days prior to the bid date.

1. Failure to provide the required documentation no less than 10 days prior to the bid date will disqualify products from consideration for this project.

C. SPDs: Listed as Type 1 SPD per UL1449 4th Edition

D. Description:

1. Externally mounted in accordance with IEEE 1100 recommendations.
2. Connection Means: Permanently wired utilizing manufacturer's High Performance "Low-Z" Cable.
3. Factory installed Integral Disconnect Switch, where indicated on the drawings.
4. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
5. SPD monitoring shall include:
6. Indicator lights which display protection status
7. Audible alarm with silence switch
8. Form C contacts rated at 5 A and 250 V, one normally open and one normally closed for remote monitoring of protection status.
9. Continuous and resettable dual surge event counters
10. Information from monitoring shall be available through the facility network.
11. Via ModBus
12. Via Ethernet

E. Comply with UL 1283 with a maximum attenuation of 54dB based on 50ohm insertion loss test per MIL-STD-220B

F. Performance:

1. Meet or exceed the following criteria:

a. Minimum single impulse current rating 250 kA per mode. The peak surge current rating shall NOT be the arithmetic sum of the ratings of the individual MOVs in a given mode.
b. Capable of protecting against and surviving 3500 IEEE C62.41 Category C transients with less than 5% degradation of clamping voltage.

c. Voltage protection rating (VPR) not exceeding the following:

Voltage	L-N	N-G	L-G	L-L
208Y/120	700 V	700 V	700 V	1000 V
480Y/277	1000 V	1000 V	1000 V	1800 V
240/120	700 V	700 V	700 V	1000 V

G. SCCR: Equal or exceed 200kA

H. Inominal Rating: 20kA and compliance to all UL96A requirements for ac surge protection.

I. Repetitive Surge: SPD shall survive a minimum of 20,000 repetitive category C3 (20kV/10kA) surges with no more than 10% deterioration. Calculated repetitive surge values will not be accepted. SPD manufacture shall provide repetitive surge test report.

J. Temporary Over Voltages: SPD shall be able to prevent common temporary over voltages from damaging the MOVs, increasing longevity and ability of SPD unit to protect the critical load. SPD shall limit the voltage per the following chart:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

K. Temporary Over Voltages: SPD shall be able to withstand a minimum of 100 temporary over voltage events, as defined by: 30A available fault current, 30 cycles of duration, with 10 seconds between events.

2.3 PANELBOARD SURGE PROTECTIVE DEVICES

A. Basis of Design: Subject to compliance with requirements. Provide comparable product by the following:

1. ACT Communications 471 Series

B. Other manufacturers wishing to have specific products evaluated for equivalence shall provide detailed compliance or exception statements, along with supporting test documentation, to all provisions of this specification, no less than 10 days prior to the bid date.

1. Failure to provide the required documentation no less than 10 days prior to the bid date will disqualify products from consideration for this project.

C. SPDs: Listed as Type 2 SPD per UL1449 4th Edition

D. Description:

1. Externally mounted in accordance with IEEE 1100 recommendations.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. SPD Monitoring shall include:

a. Indicator lights which display protection status.
b. Audible alarm with silence switch.
c. Form C contacts rated at 5 A and 250 V, one normally open and one normally closed for remote monitoring of protection status.
d. Continuous surge event counter

4. Comply with UL 1283 with a maximum attenuation of 34dB based on 50ohm insertion loss test per MIL-STD-220B

E. Performance:

1. Meet or exceed the following criteria:

a. Minimum single impulse current withstand rating shall not be less than 150kA. The peak surge current rating shall NOT be the arithmetic sum of the ratings of the individual MOVs in a given mode. SPD manufacturer shall provide independent 3rd party testing validating unit is capable of surviving a single surge at the specified rating.
b. Capable of protecting against and surviving 3500 IEEE C62.41 Category C transients with less than 5% degradation of clamping voltage.
c. Voltage protection rating (VPR) not exceeding the following:

Voltage	L-N	N-G	L-G	L-L
208Y/120	700 V	700 V	700 V	1000 V
480Y/277	1000 V	1000 V	1000 V	1800 V
240/120	700 V	700 V	700 V	1000 V

F. SCCR: Equal or exceed 200kA

G. Inominal Rating: 20kA

2.4 AUXILIARY PANEL SURGE PROTECTIVE DEVICES

A. Basis of Design: Subject to compliance with requirements. Provide comparable product by the following:

1. ACT Communications 455 Series

B. Other manufacturers wishing to have specific products evaluated for equivalence shall provide detailed compliance or exception statements, along with supporting test documentation, to all provisions of this specification, no less than 10 days prior to the bid date.

1. Failure to provide the required documentation no less than 10 days prior to the bid date will disqualify products from consideration for this project.

C. SPDs: Listed as Type 1 or 2 SPD per UL1449 4th Edition

D. Description:

1. Externally Mounted in accordance with IEEE 1100 Recommendations.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. SPD monitoring shall include:

a. Indicator Lights with display protection status

b. Audible alarm with silence switch.
c. Form C contacts rated at 5 A and 250 V, one normally open and one normally closed for remote monitoring of protection status.
d. Continuous surge event counter.

4. Comply with UL 1283 with a maximum attenuation of 34dB based on 50ohm insertion loss test per MIL-STD-220B

E. Performance:

1. Meet or exceed the following criteria:

a. Minimum single impulse current rating 100 kA per mode
b. Capable of protecting against and surviving 3500 IEEE C62.41 Category C transients with less than 5% degradation of clamping voltage.
c. Voltage protection rating (VPR) not exceeding the following:

Voltage	L-N	N-G	L-G	L-L
208Y/120	700 V	700 V	700 V	1000 V
480Y/277	1000 V	1000 V	1000 V	1800 V
240/120	700 V	700 V	700 V	1000 V

F. SCCR: Equal or exceed 200kA

G. Inominal Rating: 20kA

2.5 SPECIAL SYSTEMS CONTROL AND DATA TERMINALS

A. Protectors for fire alarm, copper control, data, antenna, and telephone conductors entering the building from the outside shall be as recommended by the manufacturer for the type of line being protected.

2.6 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1

B. Outdoor Enclosures: NEMA 250, Type 3R

2.7 WIRING

A. Power Wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire. Conductors between SPD and switchgear shall be “High Performance Interconnect” cables with Ultra Low Impedance Characteristics at 10kHz and above.

B. Class 2 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 “low-Voltage Electrical Power Conductors and Cables.”

C. Class 1 Control Cables: Multi-conductor Cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 “Low-Voltage Electrical Power Conductors and Cables.”

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Comply with NECA 1.

B. Provide surge suppression for the incoming service at the switchboard or service entrance equipment.

C. Provide surge suppression at the tele/data demark phone board or cabinet as close as possible to the incoming conduit and conductors. Provide surge suppression for all tele/data conductors that are run underground from one MDF/IDF to another.

D. Provide surge suppression at all fire alarm panels that connect to any fire alarm panel or device with underground conductors.

E. Install devices at service entrance on line side using integral disconnect, with ground lead bonded to service entrance ground. Install using manufacturer’s high-performance Low-Z cable.

F. Install devices for distribution panelboards, branch circuit panelboards, auxiliary panels, or buses with conductors between surge protective device and points of attachment as short and straight as possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

G. Install devices at service entrance on line side with ground lead bonded to service entrance ground. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect.

H. Provide minimum 30-amp multipole circuit breaker as a dedicated disconnect for suppressor at branch circuit and distribution panelboards, unless otherwise indicated.

I. Installer may reasonably rearrange breaker locations to ensure shortest & straightest possible leads to SPDs per NEC 285.12

J. Before energizing, installer shall verify service and separately derived system neutral to ground bonding jumpers per NEC.

K. For surface mounted panelboards, associated surge protective device shall be surface mounted adjacent to the panelboard with user access. For recessed mounted panelboards, associated surge protective devices shall be mounted recessed adjacent to the panelboard with user access. Do not mount above 84 inches unless directed.

L. For surge protective devices added to existing equipment in a separate enclosure, conductor size shall be #4 AWG minimum.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect service entrance equipment or panelboards to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing surge protective devices, test for compliance with requirements.
2. Complete startup checks according to manufacturer's written instructions.
3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19. Certify compliance with test parameters.

4. If the SPD led are not green, replace with new unit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust equipment installation, including connections. Report results in writing. The tests shall include:

1. Off-line Testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. Compare field test results to factory benchmark test parameters supplied with each individual unit.
2. On-line Testing: Verify that suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage by visual inspection.
3. Voltage measurements from Line-to-Ground (L-G), Line-to-Neutral (L-N), Line-to-Line (L-L), and Neutral-to-Ground (N-G), taken at the time of the testing procedure.

C. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

D. Remove and replace malfunctioning units and retest as specified above.

3.4 DOCUMENTATION AND REPORTING

A. Record results of field testing and compare to factory benchmark test parameters supplied with each individual surge protective device. Indicate that the integrity of neutral-to-ground bonds were verified through testing and visual inspection, and that grounding bonds were observed to be in place.

B. Submit to the Owner’s representative and to the Architect/Engineer copies of the startup test results and the factory benchmark testing results for confirmation of proper suppression filter system function, as required by this section. Provide the number of copies as required by Division One and the Electrical General Provisions section; and three copies where not otherwise specified.

END OF SECTION

SECTION 26 51 16 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts and accessories.

1.2 SUBMITTALS

A. Division 01 – Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.

D. Product Data: Submit dimensions, ratings, and performance data.

E. Samples: Submit two color chips 3 by 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES

A. Product Description: Complete interior luminaire assemblies, with features, options and accessories as scheduled on Drawings.

B. Refer to Division 01 – Product Requirements for product options.

2.2 LED LIGHTING

A. Luminaires:

1. The luminaire manufacturer shall be registered as a DOE Quality Advocate.
2. Shall meet DOE’s Energy Star or Design Light Consortium performance criteria.
3. The luminaire manufacturer shall provide the manufacturer’s name of the LED being used in the luminaire.
4. Shall be UL or ETL listed and be furnished complete with LEDs and power supplies.
5. LED light source packages, arrays or modules used in the luminaire shall be tested in accordance with LM-80 lumen depreciation test. Provide test results of each unique package, array or module. The L70 rated life result shall be a minimum of 50,000 hours.
6. Shall be tested in accordance with LM-79-08 electrical and photometric measurements. Provide test results of each unique luminaire.
7. The CCT shall be 4000K unless otherwise approved. The CRI shall be ≥80.
8. Each luminaire shall have a power factor ≥90 percent.

9. In instances where the LED sources are to be mounted directly into the architecture, such as installing a strip LED by using an adhesive tape, the LED manufacturer shall provide a recommended heat sink volume adequate to achieve rated life at L70.
10. Each luminaire shall carry a 3-year minimum product warranty covering failure of ALL electrical components.

B. Power Supplies:

1. LED power supplies shall operate LEDs within the current limit specification of the manufacturer.
2. Shall operate from 60Hz input source and have input power factor >90 percent and a minimum efficiency of 70 percent at full rated load of the driver.
3. Shall have short circuit and overload protection.
4. Shall have a minimum starting temperature of 0 degrees F and a maximum case temperature rating of at least 70 degrees C.
5. Power supply output shall be regulated to +/-5 percent across published load range.
6. Shall have a Class A sound rating.
7. Shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47CFR part 15, non-consumer (Class A) for EMI/RFI.
8. Shall contain no PCBs.
9. Shall carry a 3-year minimum warranty from date of manufacturer against defects in material or workmanship, including a replacement, for operation at or below the maximum case temperature specification. (For LED lamps and internal power regulation components for defects resulting in a fixture lumen depreciation >30 percent.)
10. Dimmable power supplies shall allow the light output to be maintained at the lowest control setting (prior to off) without dropping out.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned luminaires, lamps and accessories.

B. Extend existing interior luminaire installations using materials and methods compatible with existing installations or as specified.

C. Clean and repair existing interior luminaires to remain or to be reinstalled.

3.2 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

B. Support luminaires 2 x 2 foot size and larger independent of ceiling framing.

C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Exposed Grid Ceilings: Support surface-mounted luminaires on grid ceiling directly from building structure.

F. Install recessed luminaires to permit removal from below.

G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Install clips to secure recessed grid-supported luminaires in place.

I. Install wall-mounted luminaires at height as indicated on Drawings or as scheduled.

J. Install accessories furnished with each luminaire.

K. Connect luminaires to branch circuit outlets provided under Section 26 05 33 using 1/2” min. x 6’-0” max. flexible conduit, or type MC cable where allowed under other sections of this specification.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Install specified lamps in each luminaire.

N. Interface with air handling accessories furnished and installed under Section 23 37 00.

O. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements and Division 01 – Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

A. Division 01 – Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Aim and adjust luminaires as indicated on Drawings.

3.5 CLEANING

A. Division 01 – Execution and Closeout Requirements: Final cleaning.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

A. Division 01 – Execution and Closeout Requirements: Protecting finished work.

B. Replace failed luminaires at Substantial Completion.

END OF SECTION

SECTION 26 56 16 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior luminaries, poles and accessories.

1.2 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

C. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.

D. Product Data: Submit dimensions, ratings, and performance data.

E. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

F. Light Layout: Provide a computer-generated factory point to point foot-candle layout of the project for each area involved.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

1.4 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

1.5 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Product Description: Complete exterior luminaire assemblies, with features, options and accessories as scheduled on Drawings.

B. Refer to Division 01 - Product Requirements for product options.

2.2 LED LUMINAIRES

A. LED Pole Luminaires

1. Construction: Single-piece die-cast aluminum housing has integral heat sink fins to optimize thermal management through conductive and convective cooling. The LED drivers are mounted in direct contact with the casting to promote low operating temperature and long life. Housing is completely sealed against moisture and environmental contaminants (IP65). Finish: Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish. Minimum 3 mils thickness.
2. Optics: Precision-molded acrylic lenses are engineered for superior area lighting distribution, uniformity, and pole spacing. Light engine is standard 4000K zero uplight and qualifies as a Nighttime FriendlyTM product.
3. Electrical: High-efficacy LEDs mounted to a metal-core circuit board to maximize heat dissipation and promote long life (L87/100,000 hrs at 40°C). Class 1 electronic drivers have a power factor >90%, THD <20%, and an expected life of 100,000 hours with <1% failure rate.
4. Hardware: Stainless steel bolts fasten the mounting block securely to poles and walls.

B. LED Wall Luminaires

1. Construction: Two-piece die-cast aluminum housing has integral heat sink fins to optimize thermal management through conductive and convective cooling. The LED driver is mounted to the door to thermally isolate it from the light engines for low operating temperature and long life. Housing is completely sealed against moisture and environmental contaminants (IP65). Housing weep holes for wet location listing in the face-up orientation; this permits safe drainage while maintaining the luminaire's IP65 rating.
2. Finish: Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish. Minimum 3 mils thickness.
3. Optics: Precision-molded proprietary acrylic lenses with photometric distributions tailored specifically to building mounted applications. Light engines are 4000K (70 min.CRI), and qualifies as a Nighttime FriendlyTM product when not mounted under a canopy or similar covering.
4. Electrical: High-efficacy LEDs mounted to a metal-core circuit board to maximize heat dissipation and promote long life. Class 1 electronic driver has a power factor >90%, THD <20%, and has an expected life of 100,000 hours with <1% failure rate.
5. Hardware: Universal mounting plate with integral mounting support arms.

2.3 METAL POLES

A. Manufacturers:

1. Millerbernd.
2. Spaulding.
3. Valmont.
4. Substitutions: Division 01 - Product Requirements.

B. Material and Finish: Steel, Bronze Polyester Powder Coat finish, unless noted otherwise on fixture schedule.

C. Shape and Dimensions: Square straight, length per fixture schedule.

D. Base: Non-Breakaway type, provide with bolt covers.

E. Accessories:

1. Anchor Bolts.

2. Handhole.

F. Loading Capacity Ratings:

1. Luminaire Weight: Per Luminaire Supplier
2. Luminaire EPA: Per Luminaire Supplier
3. Wind Load Design: 90 mph steady wind, 1.3 gust factor.

2.4 POLE FOUNDATIONS

A. Construct from reinforced concrete in sizes as shown on Drawings.

B. The exposed surface area of the foundation shall have the forms removed and the concrete rubbed out to a smooth finish.

2.5 FUSES

A. Furnish and install a fuse holder and fuse in each ungrounded leg of the electrical circuit supplying the outdoor luminaire. For pole-mounted fixture located behind handhole cover Bussman HCB series fuse holders with type FNM fuses or equal. Every luminaire shall be separately fused with a waterproof fuse holder. Size the fuse for the amperage of the luminaire. Tap the circuit conductors with a minimum #10 AWG conductor to serve the luminaire. The fuse and holder shall be accessible through the handhole. Provide sufficient wire to bring fuse holder outside of handhole.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and Project conditions.

B. Verify foundations are ready to receive fixtures.

3.2 EXISTING WORK

A. Disconnect and remove abandoned exterior luminaries.

B. Extend existing exterior luminaire installations using materials and methods compatible with existing installations or as specified.

C. Clean and repair existing exterior luminaries to remain or to be reinstalled.

3.3 INSTALLATION

A. Install concrete bases for lighting poles at locations as indicated on Drawings in accordance with Division 03.

B. Install poles plumb. Install double nuts to adjust plumb. Grout around each base.

C. Install lamps in each luminaire.

D. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 26 05 26. Install supplementary grounding electrode at each pole.

E. For wall mounted fixtures on exterior walls with metal wall panels, provide junction box mounted to structural wall with required extension ring brought out flush with face of metal panel. Install fixture mounting plate to face of panel with gasketing to seal around extension ring and wall panel. Coordinate installation with wall panel contractor. Ground fixture to equipment ground conductor for circuit.

3.4 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

C. Measure illumination levels to verify conformance with performance requirements.

D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.5 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Aim and adjust luminaries to provide illumination levels and distribution as indicated on Drawings and Submittals.

3.6 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean lens, finishes and touch up damage.

3.7 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Protecting finished work.

B. Replace failed luminaries at Substantial Completion.

END OF SECTION

SECTION 27 05 00 – COMMON WORK RESULTS

PART 1 – GENERAL

1.01 SUMMARY

A. This document identifies the design and specification requirements for a complete and functional communications cable plant to be performed at the Harris Health System (Project Name) in Houston, Texas. The communications cable plant as specified herein will support the voice, data, AV and security systems as well as other low voltage signaling and control devices.

B. The technology infrastructure will be compliant with the latest versions of the ANSI/TIA- 568-D Series Commercial Building Telecommunications Cabling Standards and the Harris Health Systems adopted Telecommunications Installation Standards. Supported speeds will include up to 10 Gigabit Ethernet in the registered Category 6A horizontal subsystem from the Data Center (DC) and the Intermediate Distribution Frame (IDF) to the telecommunications outlets.

C. The Architectural Plans and Specifications, General Conditions, Supplementary General Conditions and other requirements of Division 1, the Mechanical Plans and Specifications, the Electrical Plans and Specifications, and the Communications Plans may apply to the work specified in the Division 27 Sections, and shall be complied with in every respect. The Contractor shall examine all of these documents, which make up the Contract Documents, and shall coordinate them with all communications work on the Communications plans and in the Division 27 specifications.

D. Contract Documents: Drawings and specifications are to be used in conjunction with one another and to supplement one another. In general, the specifications determine the nature and quality of the materials, and the drawings establish the quantities, details, and give characteristics of performance that shall be adhered to in the installation of the communications system components. If there is an apparent conflict between the drawings and specifications, the items with the greater quantity or quality shall be estimated upon and installed. Clarification with the Owner or their designated representative about these items shall be made prior to bid response.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Division 27 Sections include:

1. 27 05 26 Grounding and Bonding
2. 27 05 28 Pathways for Communications Systems
3. 27 05 53 Identification for Communications Systems
4. 27 11 00 Communications Equipment Room Fittings
5. 27 13 00 Communications Backbone Cabling
6. 27 15 00 Communications Horizontal Cabling
7. 27 16 00 Patch Cords, Station Cords, & Cross-Connect Wire
8. 27 20 00 Data Communications Equipment
9. 27 30 00 Voice Communications Equipment

1.03 REFERENCES

A. Codes and Standards:

1. Telecommunications Industry Association (TIA)

2. American National Standards Institute (ANSI) X3T9.5, Requirements for UTP at 100 Mbps
3. Telecommunications Industry Association/Electronic Industries Association (TIA/EIA) TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning, 2001
4. ANSI/TIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)
5. ANSI/TIA-568-D.1, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements, 2017
6. ANSI/TIA-568-D.1-1, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 1—Minimum 4-Pair UTP and 4-Pair ScTP Patch Cable Bend Radius, 2017
7. ANSI/TIA-568-D.1-2, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 2—Grounding and Bonding Specifications for Screened Balanced Twisted Pair Horizontal Cabling, 2017
8. ANSI/TIA-568-D.1-3, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 3—Supportable Distances and Channel Attenuation for Optical Fiber Applications by Fiber Type, 2017
9. ANSI/TIA-568-D.1-4, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 4—Recognition of Category 6 and 850 nm Laser-Optimized 50/125 µm Multimode Optical Fiber Cabling, 2017
10. ANSI/TIA-568-D.1-5, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 5—Telecommunications Cabling for Telecommunications Enclosures, 2017
11. ANSI/TIA-568-D.2, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components, 2017
12. ANSI/TIA-568-D.2-1, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Components—Addendum 1— Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling, 2017
13. ANSI/TIA-568-D.2-2, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling Components—Addendum 2, 2017
14. ANSI/TIA-568-D.2-3, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 3—Additional Considerations for Insertion Loss and Return Loss Pass/Fail Determination, 2017
15. ANSI/TIA-568-D.2-5, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 5—Corrections to TIA-568-B.2, 2017
16. ANSI/TIA-568-D.2-6, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 6—Category 6 Related Component Test Procedures, 2017
17. ANSI/TIA-568-D.2-10, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 10—Transmission Performance Requirements for 4-pair 100W Augmented Category 6 Cabling, 2017
18. ANSI/TIA-568-D.2-11, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 11—Specifications for Increased Diameter of 4-pair UTP and SCTP cable, 2017
19. ANSI/TIA-568-D.3, Optical Fiber Cabling Components Standard, 2017
20. ANSI/TIA-568-D.3-1, Optical Fiber Cabling Components Standard— Addendum 1—Additional Transmission Performance Specifications for 50/125µm Optical Fiber Cables, 2017
21. ANSI/TIA-569-E, Commercial Building Standards for Telecommunications Pathways and Spaces, 2019
22. ANSI/TIA-598-D, Optical Fiber Cable Color Coding, 2014
23. ANSI/TIA-604.2-A, FOCIS 2—Fiber Optic Connector Intermateablility Standard (FOCIS), 2003
24. ANSI/TIA-606-C, Administration Standard for Commercial Telecommunications

Infrastructures, 2017
25. ANSI J-STD-607-D, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2019
26. ANSI/TIA-758-B, Customer-owned Outside Plant Telecommunications Infrastructure Standard, 2012
27. ANSI/TIA/EIA-854, A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling, 2001
28. ANSI/TIA-862, Building Automation Systems Cabling for Commercial Buildings, 2017
29. ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centers, 2017
30. American National Standards Institute/National Electrical Contractors Association/Building Industry Consulting Services International (ANSI/NECA/BICSI) 568-2006, Standard for Installing Telecommunications Systems, 2006
31. Telecommunications Systems Bulletin TSB-155, Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T, 2007
32. Other Reference Materials
33. Building Industry Consulting Services International (BICSI) Outside Plant Design Reference Manual (OSPDRM), 6th edition.
34. BICSI Information Transport Systems Installation Methods Manual (ITSIMM), 8th edition
35. BICSI Network Design Reference Manual (NDRM), 6th edition
36. BICSI Telecommunications Distribution Methods Manual (TDMM), 14th edition
37. BICSI Wireless Design Reference Manual (WDRM), 2nd edition
38. BICSI Telecommunications Project Management Reference Manual (TPMRM), 2nd edition
39. CENELEC European Normative EN50173-1 for generic/structured cabling system
40. Institute of Electrical and Electronic Engineers (IEEE)
41. International Standards Organization/International Electrotechnical Commission (ISO/IEC) 11801 Information technology – Generic cabling for customer premises
42. National Electrical Manufacturers Association (NEMA)
43. Underwriters Laboratories (UL) Cable Certification and Follow-Up Program
44. SYSTIMAX Solutions SYSTIMAX® Structured Connectivity Solutions, Performance Specifications, (and Addendum) Latest Issue
45. SYSTIMAX Solutions, Components Guide, Latest Issue
46. SYSTIMAX Solutions Generic Specifications: Fiber Optic Outside Plant Cable, Latest Issue
47. SYSTIMAX Solutions Design & Installation Guidelines, Latest Issue
48. VisiPATCH 360 Material ID 860387018: Wall Mounted Panel Instructions
49. VisiPATCH 360 Material ID 860397058: Rack Mounting Instructions
50. National Electrical Code (NEC), based upon year approval by local codes or AHJ
51. Local, county, state and federal regulations and codes in effect as of date of purchase

B. Acronyms and Abbreviations

1.	AC	Alternating Current
2.	ACMA	Australian Communications and Media Authority
3.	AES/EBU	Audio Engineering Society/European Broadcasting Union
4.	AFF	Above Finished Floor
5.	ANSI	American National Standards Institute
6.	ANSI/NECA/BICSI	American National Standards Institute/National Electrical Contractors Association/Building Industry Consulting Services International
7.	AP	Access Point
8.	ATM	Asynchronous Transfer Mode

9.	AWG	American Wire Gauge
10.	BAS	Building Automation System
11.	BD	Building Distributor
12.	BICSI	Building Industry Consulting Services International
13.	CAT3	Category 3
14.	CAT5	Category 5 (See Definition under section 01 42 16)
15.	CAT5e	Category 5e (See Definition under section 01 42 16)
16.	CAT6	Category 6 (See Definition under section 01 42 16)
17.	CAT6A	Category 6A (See Definition under section 01 42 16)
18.	CATV	Cable Television
19.	CD	Campus Distributor
20.	CENELEC	European Committee for Electrotechnical Standardization
21.	CFR	Code of Federal Regulations
22.	CM	Construction Manager
23.	CMP	Communications Multipurpose Plenum: cable rating
24.	CMR	Communications Multipurpose Riser: cable rating
25.	CP	Control Panel
26.	CSA	Canadian Standards Association
27.	CWDD	Coarse Wave Division Multiplexing
28.	DC	Direct Current
29.	DWDM	Dense Wave Division Multiplexing
30.	E2PROM	Electrically Erasable Programmable Read-Only Memory
31.	EF	Entrance Facility
32.	EIA	Electronic Industries Association
33.	ELFEXT	Equal-Level Far-End Crosstalk
34.	EMEA	Europe, Middle East and Africa
35.	EMI	Electromagnetic Interference
36.	EN	European Norm
37.	ER	Telecommunications Equipment Room
38.	FCC	Federal Communications Commission
39.	FD	Floor Distributors
40.	FEP	Fluorinated Ethylene Propylene
41.	FOCIS	Fiber Optic Connector Intermateability Standard
42.	HC	Horizontal Cross-connect
43.	HDPE	High-Density Polyethylene
44.	IC	Intermediate Cross-connect

45.	IDC	International Data Corporation
46.	IEC	International Electrotechnical Commission
47.	IEEE	The Institute of Electrical and Electronics Engineers
48.	IP	Internet Protocol
49.	ISDN	Integrated Services Digital Network
50.	ISO	International Standards Organization
51.	ISO/IEC	International Standards Organization/International Electrotechnical Commission
52.	IT	Information Technology
53.	LC	Type of Fiber Connector
54.	LSZH	Low Smoke Zero Halogen
55.	MC	Main Cross-connect
56.	MAC	Media Access Control
57.	MPOE	Minimum Point of Entry
58.	NEC	National Electric Code
59.	NECA	National Electrical Contractors Association
60.	NEMA	National Electrical Manufacturers Association
61.	NEXT	Near End Cross Talk
62.	NFPA	National Fire Protection Act
63.	NOC	Network Operations Center
64.	OSP	Outside Plant
65.	PBX	Private Branch Exchange: telephone switch
66.	PoE	Power over Ethernet (IEEE 802.3af)
67.	POP	Point of Presence
68.	PSELFEXT	Power Sum Equal Level Far-End Crosstalk
69.	PSNEXT	Power Sum Near-End Crosstalk
70.	PVC	Polyvinyl Chloride
71.	RFI	Radio Frequency Interference
72.	RMU	Rack Mount Unit
73.	SCS	Structured Cabling System
74.	SCTE	Society of Cable TV Engineers
75.	SCTP	Stream Control Transmission Protocol
76.	STI	Specified Technologies, Inc.
77.	TIA	Telecommunications Industry Association
78.	TIA/EIA	Telecommunications Industry Association/Electronic Industries Association
79.	TO	Telecommunications Outlet

80.	TP-PMD	Twisted Pair Physical-layer Medium Dependent
81.	TR	Telecommunications Room
82.	TSB	Telecommunications Systems Bulletin
83.	TV	Television
84.	UL	Underwriters Laboratories
85.	UTP	Unshielded Twisted Pair
86.	WAP	Wireless Access Point

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. The Communications Cabling Contractor, hereafter referred to as “Contractor”, shall provide all materials, components, tools and labor necessary for the complete installation of all communications work required in the contract documents and specified herein.
2. The Electrical Contractor, here after referred to as “Electrical Contractor”, shall provide materials, components, tools and labor to complete a communications cabling pathway, electrical power distribution and communications building grounding system as set forth in the Structured Cabling System specifications and Electrical specifications and Telecommunications and Electrical drawings.
3. Work furnished and installed by the Contractor as specified in Division 27 and as shown in E and T drawings includes:
    a. The Ladder tray within the TRs;
    i Ladder tray should be mounted 4 to 6 inches above standup rack with appropriate mounting hardware including waterfalls into vertical cable management on either side of rack.
    b. Identification for Communications Systems;
    c. Communications Equipment Room Fittings;
    d. Communications Backbone Cabling;
    e. Communications Horizontal Cabling;
    f. Patch Cords, Station Cords, and Cross-Connect Wire;
    g. Bonding conductors from all cable tray, sleeves and conduits;
    h. Coordination with OFOI Data Communications Equipment;
    i. Coordination with OFOI Voice Communications Equipment;
4. Work under this Division not in contract (NIC) that will be Owner Furnished/Owner Installed (OFOI) includes:
    a. Communications services;
    b. Wired Data communications equipment; The contractor is responsible for patching to the owner furnished and installed network switches.
    c. Wireless Data communications equipment; This will be owner furnished Contractor Installed
    d. Voice communications equipment;
    e. Phone cords at the work area;
5. Work furnished and installed by the Electrical Contractor as specified in Division 27 and as shown in E and T drawings includes:
    a. Underground ducts and raceways;
    b. The conduits and back boxes for the work area telecommunications outlets.

c. Cable tray installed outside of the IDFs.
d. Installation of the TBB from the Data Center and IDF's;
e. Installation of the Bonding Conductor for Telecommunications (BCT) that bonds the TMGB to the electrical power ground compliant with ANSI J STD-607B Standards;
f. Electrical circuits in the telecom rooms.

6. Work furnished and installed by others.

a. The new IDF walls will be covered with 8'H x 4'W x ¾" T grade ACX painted plywood, 24" AFF above telecommunication room floor to the building structure or slab above and capable of supporting attached connecting hardware. Plywood will be covered with two coats of white, fire-retardant paint.

1.05 WORK RESULTS – DESCRIPTION OF PROJECT

A. Communications Services

1. Communications Services include data and voice circuits required to connect the IDFs to the MDF. It includes network services for the local area network, wide area network, security network, voice network and community antenna television (CATV) network.

B. Grounding and Bonding

1. The Telecommunications Main Grounding Busbar (TMGB) will be located in the Data Center (DC) room and a Telecommunications Bonding Backbone (TBB) will connect the TMGB in the DC to the Telecommunications Grounding Busbar (TGB) in the Intermediate Distribution Frames (IDFs). A Bonding Conductor for Telecommunications (BCT) will bond the TMGB to the electrical power ground compliant with ANSI J STD-607B Standards.
2. Bonding conductors from the TMGB or TGB will be installed to all communications equipment cabinets, equipment racks, raceway, cable ladder rack, cable tray, sleeves and conduits.
3. Final design and specifications for the Grounding and Bonding system shall be coordinated with the Electrical Engineer of Record.
4. Pathways for Communications Systems
5. In a typical communications outlet, one (1) 1" conduit fed to the nearest accessible ceiling then routed to the nearest overhead cable tray via cable saddles pathway. Once cables are in the cable tray, they shall be routed to the nearest IDF as indicated on the T series floor plans.

a. Final design and specifications for the Pathways for Communications Systems conduit and primary cable pathway outside the IDFs shall be coordinated with other trades to avoid pathway conflicts.

C. Identification for Communications Systems

1. All labeling will be compliant with ANSI/TIA 606-C – Administration Standard for Commercial Telecommunications Infrastructures and comply with Harris Health Systems Labeling standards.
2. Harris Health System will provide detailed description during Data Pre-construction Meeting.

D. Communications Horizontal Cabling

1. All voice and data horizontal cables will consist of plenum rated, Category 6A, 4 pair UTP copper cables terminated on, 8P8C, Category 6A, 360-E-MOD-48-2U patch panels in the Telecommunication Rooms. The maximum horizontal distance shall be 295 feet.
2. All voice and data horizontal cables shall be Category 6A, blue in color terminated on 8P8C inserts at work area outlets. Pin out will be 568B. All information outlets inserts shall be blue in color.

3. All Wireless Access Point (WAP) horizontal cables shall be Category 6A, blue in color terminated on 8P8C inserts at WAP outlet, and 360-E-MOD-2U panels in the Telecommunications Rooms.

E. Patch Cords, Station Cords, and X-Connect Wire

1. 568B Patch cords used shall meet or exceed the performance requirements in ANSI/TIA-568-D.2 and ANSI/TIA-568-D Category 6A specifications.
2. 568B Category 6A 8P8C patch cords will be Contractor Furnished Contractor Installed (CFCI). Contractor will make connections in data rooms to network equipment. All remaining patch cables shall be transmitted to Owner from Contractor. Owner will distribute end user patch cables at outlets.

F. Data Communications Equipment

1. Data communications equipment will be Owner Furnished Owner Installed (OFOI).

G. Voice Communications Equipment

1. Voice communications equipment will be OFOI.

H. Commissioning Administration

1. Contractor shall comply with GENERAL COMMISSIONING REQUIREMENTS of the Information Communication Technology (ICT) System.

I. Meetings

1. Contractor shall attend Division 27 preconstruction meeting with the Owner’s Representative and the General Contractor to discuss the details of the Project.
2. Contractor shall provide representation on Project Team Meetings as specified in Division 1 and by the General Contractor as required.
3. Contractor shall attend a pre-testing meeting to review testing parameters and testing documentation deliverables.
4. Contractor will provide ad-hoc representation on the Commissioning Team as required for implementation of the Commissioning Plan.
5. Within two (2) weeks of the initial meeting, the contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project.

J. Preconstruction Evaluation

1. Examination of buildings and site shall be the responsibility of the Contractor. Examine conditions for compliance with Communications design specifications. Validate Communications section is in accordance with related Contract Documents and the specified Owner's operational needs.

K. Substitutions

1. Equivalent product(s) may be considered as substitution for those products specified; however, any equivalent cabling product(s) must be approved by the cabling system manufacturer and show demonstrated and documented equivalence to the product(s) specified.
2. Documentation shall include, but is not limited to, product samples, data sheets, and actual test date.
3. The request for product substitution, as well as supporting documentation, must be submitted, in writing, prior to submitting the bid.
4. Written approval for product substitution must be submitted with the bid.

L. Construction Documentation

1. Contractor shall coordinate requirements with General Provisions specified in Division 1 – Construction Progress Documentation.

2. Contractor shall provide a weekly report of inspection by project RCDD to confirm Contractor's work is compliant with industry and manufacturer standards.

1.06 SUBMITTALS

A. Following Division 1 and this Section. All submittals shall be reviewed and stamped by the Contractor's project RCDD.

1. Submit a resume and copy of Building Industry Consulting Services International (BICSI) Registered Communication Distribution Designer (RCDD) certificate for Contractor's project RCDD.

B. A list of technical product education (training) completed by the Contractor's project personnel.

1. All members of the installation team must be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Submit copies of certificates of manufacturer training for each installation team member.
2. Submit cable tester manufacturer or third party certification for copper and fiber cable test technicians.
3. Data installation foreman must be a BICSI certified Technician and should not be replaced during the duration of the job. All installation members must have completed BICSI installer Level II or higher training courses. All certifications must be current and presented to Harris Health System IT Services at a pre-installation meeting.

C. The contractor shall review Codes and Standards Section – Latest issue and addendums and state understanding and compliance or exception.

D. Product Data: Submit Product Data sheets for each type of product indicated below. Product data to include, but not limited to, materials, finishes, approvals, load ratings, and dimensional information:

1. Submittals shall include the manufacturers cut sheets for the following:

a. Equipment enclosures and/or racks;
b. Fiber optic and balanced twisted pair cable;
c. Patch cords and cross connect media;
d. Connectors and termination hardware;
e. Protection hardware;
f. Fire stopping materials;
g. Test equipment to be used for fiber and balanced twisted pair channels;
h. Cable tray and cable support hardware.

E. Product Data manufacturer's literature sheets for all materials and equipment, including a copy of the proposed warranty, recommended preventative maintenance and spare part inventory recommendations. Literature containing more than one device shall be highlighted and clearly marked to delineate item(s) included in the work. Clearly indicate color or special finishes.

F. Submittals shall be original catalog sheets or photocopies thereof. Facsimile (fax) sheets will not be accepted.

G. Manufacturer and Contractor statements of RoHS: Restriction of Certain Hazardous Substances Compliance.

H. Design and Installation Certificates: Signed by local cable manufacturer's representative certifying that design is acceptable with cable manufacturers Design Engineer9s) and state that the contractor is authorized by manufacturer to install registered (warranty) cabling system.

I. A minimum of five (5) representative healthcare facilities cabling projects must be submitted as references to include the hospitals name, Architect or Engineer, cost of the cabling project and the contact person at the hospital to include a phone number.

1.07 SUBMITTALS FOR PROJECT RECORD

A. Follow Division 1 and this Section.

1. Drawings: As-built documentation MUST be submitted five (5) business days PRIOR to obtaining approval for cutover to any portion of the new cable plant system. Furnish for review and comments, 4 CDs containing all electronic AutoCad 2004 or newer (DWG) files.
2. Final approved Shop Drawings: Include plan and elevation of TRs, cable pathway details, and cable locations and cable ID#.
3. 4 sets of cable inventory data must be submitted for all copper and fiber, termination hardware prior to installation. Submit data electronically on CDs in “Microsoft Excel” format, listing products furnished, including:
    a. Manufacturer’s name and part numbers;
    b. Cable numbers utilizing the Owner’s cable numbering standard;
    c. Location and riser assignments.
4. Manufacturer Certificates: Within 10 days of completion of the project, Contractor shall deliver letter signed by local Structured Cabling Components representatives and Contractor’s RCDD stating that installed cabling system complies with all requirements specified in manufacturer’s installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact warranty.
5. Test Reports: 4 copies on CD in compliance with related Test Result Documentation.
6. Submitted test results and other submittals that are non-compliant will be reviewed and returned to the contractor with comments.
7. Re-submitted test results and other submittals that are non-compliant will be reviewed and returned to the contractor with comments.
8. Subsequent review of test results and other submittals will be performed jointly by the contractor and the Communication Consultant and Contractor will pay Communications Consultant’s published hourly rate during third review and thereafter.
9. Manufacturer’s warranty to the owner. This shall include, but is not limited to: Owner’s name and project name and address. (Within three weeks of substantial completion).
10. Within 21 days of completion of the project the communications contractor and/or the manufacturer’s local representative will provide the owner with the Structured Cabling Performance Warranty signed by the manufacturer. The warranty shall list Harris Health Systems in Houston, Texas as the holder of the Warranty.

1.08 EQUIPMENT RELOCATION AND SYSTEM STARTUP

A. Upon notice of construction completion, the selected Contractor will be responsible for system startup services for the new telecommunication room. The Contractor shall be responsible for ensuring the new equipment room, cabinets, floors and walls are clean and ready for equipment installation. On behalf of the Owner, the Contractor shall be responsible for coordinating with the GC and other trades to keep the room (s) clean and dust free at all times.

B. After installation is complete, Contractor shall clean all systems; vacuum debris from system components, enclosures, racks, etc. and thoroughly clean the DC/IDFs.

C. It shall be the responsibility of the Contractor to develop and implement a full migration project schedule detailing the responsibilities of assigned personnel, along with contingency plans, and submit it to the Owner, or their designated representative, for approval.

D. During the transition period, Contractor shall have the necessary supervisory, technical, and other personnel available throughout technology relocations and cutover of the telephone, networking, and video systems. This is to ensure that technicians are on site to observe the operation and maintenance of the equipment, and to resolve any cabling related issues during system start-up.

E. Contractor shall accomplish a smooth and successful transition of operations and services to the new telecommunication room. The transition includes the coordination, migration, testing, and problem resolution with the system vendors.

1.09 SEQUENCING AND SCHEDULING

A. An initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within two (2) weeks of the initial meeting, the Contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project taking into account all lead time for delivery of materials.

B. Contractor shall be responsible for the development and implementation of a complete project schedule detailing the responsibilities of assigned personnel and submit it to the GC and Owner for approval.

PART 2 – PRODUCTS

2.01 PRODUCT SCHEDULE

A. See Division 27 sections for approved products and schedules.

B. 27 05 26 Grounding and Bonding

C. 27 05 28 Pathways for Communications Systems

D. 27 05 53 Identification for Communications Systems

E. 27 11 00 Communications Equipment Room Fittings

F. 27 13 00 Communications Backbone Cabling

G. 27 15 00 Communications Horizontal Cabling

H. 27 16 19 Patch Cords, Station Cords, and Cross-Connect Wire

2.02 WARRANTY

A. Within 10 days of completion of the project, Contractor shall deliver letter signed by local SCS Manufacturer’s representative and Contractor's RCDD stating that installed cabling system complies with all requirements specified in installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact the warranty.

B. Within 21 days of completion of a project the communications contractor and/or the manufacturer's local representative will provide the Owner with the 25-year Extended Product

Warranty and Application Assurance signed by the manufacturer. The warranty shall list Harris Health System in Houston, Texas as the holder of the Warranty.

C. The Owner shall not be responsible for any aspect of ensuring the warranty is issued or updated. It shall be the Contractor's responsibility in conjunction with the Manufacturer.

D. During the warranty period, Owner may engage any manufacturer approved communication contractor to perform future moves, additions and changes to the system. Owner approved contractors shall be responsible for updating any required documentation. Owner shall not be responsible for any aspect of updating and maintaining the warranty.

E. The 25-year Labor, Material and Performance Warranty shall cover the testing and replacement of all structured cabling components. The structured cabling system shall be a complete certified system. The system and all components shall be performance matched and guaranteed by the manufacturer.

F. Person / Entity Covered

1. This warranty is for the sole benefit of Owner to the site in which such Registered SCS was originally installed.
2. All communications work and materials not included in the SCS components shall be warranted by the Contractor that performed the work for a minimum of one year from the date of substantial completion.

2.03 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Follow Division 1 Requirements.

B. Packing, Shipping, Handling, and Unloading

1. All material shall be shipped to the Project's designated on-site staging area (to be determined), or a mutually agreed upon location.

C. Acceptance at Site

1. All risk of damage or loss will remain with the Contractor until project completion and acceptance of the installation by the Project Manager. Upon acceptance, risk of loss will pass to the Owner. Prior to that time, the Contractor shall be solely responsible for security of all Contractor provided project materials.

D. Storage and Protection

1. All materials and equipment delivered and placed in storage shall be stored with protection from the weather, humidity, and temperature variation, dirt, and dust, or other contaminants.
2. Material will be properly packaged in original factory-fabricated type containers and protected from damaging fumes, construction debris, and traffic until installation or job completion.
3. Any flammable materials or hazardous materials shall be kept and/or stored in suitable places approved by the General Contractor and outside the buildings at all times.

2.04 PRODUCT QUALITY ASSURANCE

A. All materials and equipment provided shall be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacture of such products. All materials shall be typical commercial designs that comply with the requirements specified. All materials and equipment shall be readily available through manufacturers and/or distributors. All equipment shall be supplied complete with any optional items required for proper installation.

B. In the event of a breach of the representations and warranties contained herein, the Contractor, at their own expense, shall take all measures necessary to correct and make the cabling system work in compliance with the applicable manufacturer written technical recommendations and standards.

PART 3 – EXECUTION

3.01 SITE CONDITIONS

A. Environmental Limitations

1. Due to the critical nature of the environment, the Contractor shall use extra effort to provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation. Contractor shall remove all rubbish from job site daily at his or her own expense.

3.02 EXAMINATION

A. Examination of buildings and site shall be the responsibility of the Contractor. Examine conditions for compliance with requirements of other Sections in which related work is specified and determine if conditions affecting performance of the work of this Section are satisfactory. Do not proceed with work of this Section until unsatisfactory conditions have been corrected in an acceptable manner.

B. Verify liquid-carrying pipes are not installed in or above voice and data system equipment rooms. Verify conduit, raceways, and boxes are properly installed.

C. Verify backboards are properly installed and painted with 2-coats of fire retardant paint on all sides. Notify the Project Manager immediately and prior to installation in the event that the backboards are not installed or painted properly.

D. Prior to starting the installation, the assigned installation supervisor shall participate in a walk-through of the project site with the Project Manager, consultant and Harris Health Systems to review the installation documentation, verify that all construction necessary for the installation has been completed, and verify all installation methods and cable routes.

E. The Contractor shall provide a complete cabling infrastructure according to the written specifications and drawings. If the scope of work to be performed by the Contractor changes, it shall be in writing. Contractor shall respond to these changes with a complete material list, including pricing, labor, and taxes in writing per Division 1 requirements. Contractor shall not proceed with additional scope of work without signed approval by the General Contractor.

3.03 PREPARATION

A. Protection of Surroundings

1. Repair: Patching and repair of facilities, finishes, and equipment. Any damage to building or site caused by Contractor, including grass, paving, curbs etc., shall be restored at Contractor's expense to match condition prior to damage. If necessary and requested by the General Contractor, Contractor shall provide professional services to clean or repair scratched/soiled finishes at their own expense.
2. Contractor shall keep all foods and liquids (water, drinks, etc.) in designated break areas.
3. The Contractor shall obtain the Architect's and Engineer's written permission via the General Contractor before proceeding with any work necessitating cutting into or through any part of building structures such as girders, beams, concrete or tile floors, partition and/or ceilings.

4. If it becomes necessary to cut through any wall, floor, or ceiling to install any work under this Section of the Contract or to repair any defects that may appear up to the expiration of the guarantee period, such cutting shall be done by the Contractor under the supervision of the General Contractor.
5. Patching of all openings cut by the Contractor, or repairing of any damage to the work of other trades caused by cutting or by the failure of any part of the work installed under this Contract, shall be performed by the appropriate trade but shall be paid for by the Contractor.
6. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact-type equipment shall not be used except where specifically approved by the Architect/Engineer.
7. All openings shall be restored to “as-new” condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.
8. Refer to Division 1 for additional information.

3.04 DEMOLITION / REMOVAL

A. Unless indicated otherwise, all items that must be removed due to interference with work of this contract remain the property of the Owner, and are to be salvaged at the Owner's discretion. Any material to be salvaged, other than Contractor's waste material, must be approved in writing by the General Contractor.

3.05 FIRESTOPPING

A. The Contractor is required to properly fire-stop any penetrations through fire barriers utilized for the placement of telecom cabling. Provide fire resistant intumescent materials to restore fire ratings to wall, floor, or ceiling penetrations according to local and national codes.

B. Verify the hourly rating of the barrier.

C. Select the UL Listing to match or exceed the barrier.

D. Adhere to cable loads and fill procedure in the Listing.

E. Seek pre-approval from the Authority Having Jurisdiction (Inspector).

F. When installing the System, be sure not to exceed the listing limitations.

G. All openings shall be restored to “as-new” condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

H. Provide fire resistant materials to restore fire ratings to all wall, floor, or ceiling penetrations used in the distribution and installation for communications cabling system. Coordinate fire stopping procedures and materials with General Contractor.

I. Solutions and shop drawings/submittals for fire stop materials and systems shall be presented to the General Contractor for written approval of materials prior to purchase and installation.

J. Materials shall be installed per manufacturer instructions, be UL listed for intended use, and meet NEC codes for fire stopping measures.

K. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and remain resilient and pliable to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

L. The fire stopping material shall maintain/establish the fire rated integrity of the wall/barrier that has been penetrated.

M. Contractor shall coordinate with electrical contractor and ensure communications pathway firestopping is properly identified and labeled.

N. Firestopping in high density wiring locations is achieved by the use of STI EZ Path enclosures.

3.06 CONSTRUCTION WASTE MANAGEMENT

A. Contractor shall remove all excess material and debris from the site upon completion of work each day and in a manner approved by the General Contractor's Project Manager.

3.07 LABELING

A. Confirm administrative labeling scheme of cabling and its numerical positions on the termination hardware. Ensure compliance with Harris Health Systems Labeling standards and as detailed below:

1. Each cable should be clearly labeled with the cable id using a permanent label on the cable sheath at both ends.
2. The outlet cover should also be labeled with the cable id. The cable id should be written on the outlet or outlet cover in indelible ink under a printed label with the same information. The proper designation icons (data, voice, TV) should be placed on the outlet cover.
3. The patch panels in the wiring closet should have label designation strips that indicate the cable id and either the remote room number or consolidation point number as applicable.
4. Patch panel labeling in closet should consist of cable# on front of patch panel with printed labels to each designated jack. Permanent marker is not acceptable.
5. Exact details for copper and fiber labeling of horizontal and backbone riser runs will be presented by Harris Health Systems at pre-installation meeting.

3.08 CLOSEOUT ACTIVITIES

A. Acceptance shall be subject to substantial completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation as described herein.

1. All Proposal Submittals and Project Record Submittals.
2. Training to Owner's representative on methods to add and remove fire stop barriers
3. Maintenance manuals specified in Div. 1 to GC and Owner regarding structured cabling system, fire stopping and manufacturer's recommended maintenance instructions.
4. Contractor shall complete all punch list items within five (5) days of notification by GC.
5. Contractor shall complete Closeout Checklist listing status of all submittals, maintenance manuals, Owner training, and punch list items and deliver per Division 1.
6. Contractor will provide two (2) technicians for eight (8) hours each (for a total of 16 hours) of support during the physical move to the space.

END OF SECTION 27 05 00

SECTION 27 05 00 – COMMON WORK RESULTS

PART 1 – GENERAL

1.01 SUMMARY

A. This document identifies the design and specification requirements for a complete and functional communications cable plant to be performed at the Harris Health System Sunset Clinic in Houston, Texas. The communications cable plant as specified herein will support the voice, data, AV and security systems as well as other low voltage signaling and control devices.

B. The technology infrastructure will be compliant with the latest versions of the ANSI/TIA- 568-D Series Commercial Building Telecommunications Cabling Standards and the Harris Health Systems adopted Telecommunications Installation Standards. Supported speeds will include up to 10 Gigabit Ethernet in the registered Category 6A horizontal subsystem from the Data Center (DC) and the Intermediate Distribution Room (IDR) to the telecommunications outlets.

C. The Architectural Plans and Specifications, General Conditions, Supplementary General Conditions and other requirements of Division 1, the Mechanical Plans and Specifications, the Electrical Plans and Specifications and the Communications Plans may apply to the work specified in the Division 27 Sections and shall be complied with in every respect. The Contractor shall examine all of these documents, which make up the Contract Documents, and shall coordinate them with all communications work on the Communications plans and in the Division 27 specifications.

D. Contract Documents: Drawings and specifications are to be used in conjunction with one another and to supplement one another. In general, the specifications determine the nature and quality of the materials, and the drawings establish the quantities, details, and give characteristics of performance that shall be adhered to in the installation of the communications system components. If there is an apparent conflict between the drawings and specifications, the items with the greater quantity or quality shall be estimated upon and installed. Clarification with the Owner or their designated representative about these items shall be made prior to bid response.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Division 27 Sections include:

1. 27 05 26 Grounding and Bonding
2. 27 05 28 Pathways for Communications Systems
3. 27 05 53 Identification for Communications Systems
4. 27 11 00 Communications Equipment Room Fittings
5. 27 13 00 Communications Backbone Cabling
6. 27 15 00 Communications Horizontal Cabling
7. 27 16 00 Patch Cords, Station Cords, & Cross-Connect Wire
8. 27 20 00 Data Communications Equipment
9. 27 30 00 Voice Communications Equipment

1.03 REFERENCES

A. Codes and Standards:

1. Telecommunications Industry Association (TIA)

2. American National Standards Institute (ANSI) X3T9.5, Requirements for UTP at 100 Mbps
3. Telecommunications Industry Association/Electronic Industries Association (TIA/EIA) TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning, 2001
4. ANSI/TIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)
5. ANSI/TIA-568-D.1, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements, 2017
6. ANSI/TIA-568-D.1-1, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 1—Minimum 4-Pair UTP and 4-Pair ScTP Patch Cable Bend Radius, 2017
7. ANSI/TIA-568-D.1-2, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 2—Grounding and Bonding Specifications for Screened Balanced Twisted Pair Horizontal Cabling, 2017
8. ANSI/TIA-568-D.1-3, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 3—Supportable Distances and Channel Attenuation for Optical Fiber Applications by Fiber Type, 2017
9. ANSI/TIA-568-D.1-4, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 4—Recognition of Category 6 and 850 nm Laser-Optimized 50/125 µm Multimode Optical Fiber Cabling, 2017
10. ANSI/TIA-568-D.1-5, Commercial Building Telecommunications Cabling Standard—Part 1: General Requirements—Addendum 5—Telecommunications Cabling for Telecommunications Enclosures, 2017
11. ANSI/TIA-568-D.2, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components, 2017
12. ANSI/TIA-568-D.2-1, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Components—Addendum 1— Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling, 2017
13. ANSI/TIA-568-D.2-2, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling Components—Addendum 2, 2017
14. ANSI/TIA-568-D.2-3, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 3—Additional Considerations for Insertion Loss and Return Loss Pass/Fail Determination, 2017
15. ANSI/TIA-568-D.2-5, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 5—Corrections to TIA-568-B.2, 2017
16. ANSI/TIA-568-D.2-6, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 6—Category 6 Related Component Test Procedures, 2017
17. ANSI/TIA-568-D.2-10, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 10—Transmission Performance Requirements for 4-pair 100W Augmented Category 6 Cabling, 2017
18. ANSI/TIA-568-D.2-11, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted-Pair Cabling—Addendum 11—Specifications for Increased Diameter of 4-pair UTP and SCTP cable, 2017
19. ANSI/TIA-568-D.3, Optical Fiber Cabling Components Standard, 2017
20. ANSI/TIA-568-D.3-1, Optical Fiber Cabling Components Standard— Addendum 1—Additional Transmission Performance Specifications for 50/125µm Optical Fiber Cables, 2017
21. ANSI/TIA-569-E, Commercial Building Standards for Telecommunications Pathways and Spaces, 2019
22. ANSI/TIA-598-D, Optical Fiber Cable Color Coding, 2014
23. ANSI/TIA-604.2-A, FOCIS 2—Fiber Optic Connector Intermateablility Standard (FOCIS), 2003
24. ANSI/TIA-606-C, Administration Standard for Commercial Telecommunications

Infrastructures, 2017
25. ANSI J-STD-607-D, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2019
26. ANSI/TIA-758-B, Customer-owned Outside Plant Telecommunications Infrastructure Standard, 2012
27. ANSI/TIA/EIA-854, A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling, 2001
28. ANSI/TIA-862, Building Automation Systems Cabling for Commercial Buildings, 2017
29. ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centers, 2017
30. American National Standards Institute/National Electrical Contractors Association/Building Industry Consulting Services International (ANSI/NECA/BICSI) 568-2006, Standard for Installing Telecommunications Systems, 2006
31. Telecommunications Systems Bulletin TSB-155, Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T, 2007
32. Other Reference Materials
33. Building Industry Consulting Services International (BICSI) Outside Plant Design Reference Manual (OSPDRM), 6th edition.
34. BICSI Information Transport Systems Installation Methods Manual (ITSIMM), 8th edition
35. BICSI Network Design Reference Manual (NDRM), 6th edition
36. BICSI Telecommunications Distribution Methods Manual (TDMM), 14th edition
37. BICSI Wireless Design Reference Manual (WDRM), 2nd edition
38. BICSI Telecommunications Project Management Reference Manual (TPMRM), 2nd edition
39. CENELEC European Normative EN50173-1 for generic/structured cabling system
40. Institute of Electrical and Electronic Engineers (IEEE)
41. International Standards Organization/International Electrotechnical Commission (ISO/IEC) 11801 Information technology – Generic cabling for customer premises
42. National Electrical Manufacturers Association (NEMA)
43. Underwriters Laboratories (UL) Cable Certification and Follow-Up Program
44. SYSTIMAX Solutions SYSTIMAX® Structured Connectivity Solutions, Performance Specifications, (and Addendum) Latest Issue
45. SYSTIMAX Solutions, Components Guide, Latest Issue
46. SYSTIMAX Solutions Generic Specifications: Fiber Optic Outside Plant Cable, Latest Issue
47. SYSTIMAX Solutions Design & Installation Guidelines, Latest Issue
48. VisiPATCH 360 Material ID 860387018: Wall Mounted Panel Instructions
49. VisiPATCH 360 Material ID 860397058: Rack Mounting Instructions
50. National Electrical Code (NEC), based upon year approval by local codes or AHJ
51. Local, county, state and federal regulations and codes in effect as of date of purchase

B. Acronyms and Abbreviations

1.	AC	Alternating Current
2.	ACMA	Australian Communications and Media Authority
3.	AES/EBU	Audio Engineering Society/European Broadcasting Union
4.	AFF	Above Finished Floor
5.	ANSI	American National Standards Institute
6.	ANSI/NECA/BICSI	American National Standards Institute/National Electrical Contractors Association/Building Industry Consulting Services International
7.	AP	Access Point
8.	ATM	Asynchronous Transfer Mode

9.	AWG	American Wire Gauge
10.	BAS	Building Automation System
11.	BD	Building Distributor
12.	BICSI	Building Industry Consulting Services International
13.	CAT3	Category 3
14.	CAT5	Category 5 (See Definition under section 01 42 16)
15.	CAT5e	Category 5e (See Definition under section 01 42 16)
16.	CAT6	Category 6 (See Definition under section 01 42 16)
17.	CAT6A	Category 6A (See Definition under section 01 42 16)
18.	CATV	Cable Television
19.	CD	Campus Distributor
20.	CENELEC	European Committee for Electrotechnical Standardization
21.	CFR	Code of Federal Regulations
22.	CM	Construction Manager
23.	CMP	Communications Multipurpose Plenum: cable rating
24.	CMR	Communications Multipurpose Riser: cable rating
25.	CP	Control Panel
26.	CSA	Canadian Standards Association
27.	CWDD	Coarse Wave Division Multiplexing
28.	DC	Direct Current
29.	DWDM	Dense Wave Division Multiplexing
30.	E2PROM	Electrically Erasable Programmable Read-Only Memory
31.	EF	Entrance Facility
32.	EIA	Electronic Industries Association
33.	ELFEXT	Equal-Level Far-End Crosstalk
34.	EMEA	Europe, Middle East and Africa
35.	EMI	Electromagnetic Interference
36.	EN	European Norm
37.	ER	Telecommunications Equipment Room
38.	FCC	Federal Communications Commission
39.	FD	Floor Distributors
40.	FEP	Fluorinated Ethylene Propylene
41.	FOCIS	Fiber Optic Connector Intermateability Standard
42.	HC	Horizontal Cross-connect
43.	HDPE	High-Density Polyethylene
44.	IC	Intermediate Cross-connect

45.	IDC	International Data Corporation
46.	IEC	International Electrotechnical Commission
47.	IEEE	The Institute of Electrical and Electronics Engineers
48.	IP	Internet Protocol
49.	ISDN	Integrated Services Digital Network
50.	ISO	International Standards Organization
51.	ISO/IEC	International Standards Organization/International Electrotechnical Commission
52.	IT	Information Technology
53.	LC	Type of Fiber Connector
54.	LSZH	Low Smoke Zero Halogen
55.	MC	Main Cross-connect
56.	MAC	Media Access Control
57.	MPOE	Minimum Point of Entry
58.	NEC	National Electric Code
59.	NECA	National Electrical Contractors Association
60.	NEMA	National Electrical Manufacturers Association
61.	NEXT	Near End Cross Talk
62.	NFPA	National Fire Protection Act
63.	NOC	Network Operations Center
64.	OSP	Outside Plant
65.	PBX	Private Branch Exchange: telephone switch
66.	PoE	Power over Ethernet (IEEE 802.3af)
67.	POP	Point of Presence
68.	PSELFEXT	Power Sum Equal Level Far-End Crosstalk
69.	PSNEXT	Power Sum Near-End Crosstalk
70.	PVC	Polyvinyl Chloride
71.	RFI	Radio Frequency Interference
72.	RMU	Rack Mount Unit
73.	SCS	Structured Cabling System
74.	SCTE	Society of Cable TV Engineers
75.	SCTP	Stream Control Transmission Protocol
76.	STI	Specified Technologies, Inc.
77.	TIA	Telecommunications Industry Association
78.	TIA/EIA	Telecommunications Industry Association/Electronic Industries Association
79.	TO	Telecommunications Outlet

80.	TP-PMD	Twisted Pair Physical-layer Medium Dependent
81.	TR	Telecommunications Room
82.	TSB	Telecommunications Systems Bulletin
83.	TV	Television
84.	UL	Underwriters Laboratories
85.	UTP	Unshielded Twisted Pair
86.	WAP	Wireless Access Point

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. The Communications Cabling Contractor, hereafter referred to as “Contractor”, shall provide all materials, components, tools and labor necessary for the complete installation of all communications work required in the contract documents and specified herein. There must be only one Communications Cabling Contractor per project.
2. The Electrical Contractor, here after referred to as “Electrical Contractor”, shall provide materials, components, tools and labor to complete a communications cabling pathway, electrical power distribution and communications building grounding system as set forth in the Structured Cabling System specifications and Electrical specifications and Telecommunications and Electrical drawings.
3. Work furnished and installed by the Contractor as specified in Division 27 and as shown in E and T drawings includes:
    a. The Ladder tray within the IDRs;
    i Ladder tray should be mounted 4 to 6 inches above standup rack with appropriate mounting hardware including waterfalls into vertical cable management on either side of rack.
    b. Identification for Communications Systems;
    c. Communications Equipment Room Fittings;
    d. Communications Backbone Cabling;
    e. Communications Horizontal Cabling;
    f. Patch Cords, Station Cords, and Cross-Connect Wire;
    g. Bonding conductors from all cable tray, sleeves and conduits;
    h. Coordination with OFOI Data Communications Equipment;
    i. Coordination with OFOI Voice Communications Equipment;
4. Work under this Division not in contract (NIC) that will be Owner Furnished/Owner Installed (OFOI) includes:
    a. Communications services;
    b. Wired Data communications equipment; The contractor is responsible for patching to the owner furnished and installed network switches and completing the owner provided Project Cable Details Spread Sheet before the end of each construction phase
    c. Wireless Data communications equipment; This will be owner furnished Contractor Installed
    d. Voice communications equipment;
    e. Phone cords at the work area;
5. Work furnished and installed by the Electrical Contractor as specified in Division 27 and as shown in E and T drawings includes:

a. Underground ducts and raceways;
b. The conduits and back boxes for the work area telecommunications outlets.
c. Cable tray installed outside of the IDRs.
d. Installation of the TBB from the Data Center and IDR's;
e. Installation of the Bonding Conductor for Telecommunications (BCT) that bonds the TMGB to the electrical power ground compliant with ANSI J STD-607B Standards;
f. Electrical circuits in the telecom rooms.

6. Work furnished and installed by others.

a. The new IDR walls will be covered with 8'H x 4'W x ¾" T grade ACX painted plywood, 24" AFF above telecommunication room floor to the building structure or slab above and capable of supporting attached connecting hardware. Plywood will be covered with two coats of white, fire-retardant paint.

1.05 WORK RESULTS – DESCRIPTION OF PROJECT

A. Communications Services

1. Communications Services include data and voice circuits required to connect the IDRs to the Main Distribution Room (MDR). It includes network services for the local area network, wide area network, security network, voice network and community antenna television (CATV) network.

B. Grounding and Bonding

1. The Telecommunications Main Grounding Busbar (TMGB) will be located in the Data Center (DC) room and a Telecommunications Bonding Backbone (TBB) will connect the TMGB in the DC to the Telecommunications Grounding Busbar (TGB) in the Intermediate Distribution Rooms (IDRs). A Bonding Conductor for Telecommunications (BCT) will bond the TMGB to the electrical power ground compliant with ANSI J STD-607B Standards.
2. Bonding conductors from the TMGB or TGB will be installed to all communications equipment cabinets, equipment racks, raceway, cable ladder rack, cable tray, sleeves and conduits.
3. Final design and specifications for the Grounding and Bonding system shall be coordinated with the Electrical Engineer of Record.
4. Pathways for Communications Systems
5. In a typical communications outlet, one (1) 1" conduit fed to the nearest accessible ceiling then routed to the nearest overhead cable tray via cable saddles pathway. Once cables are in the cable tray, they shall be routed to the nearest IDR as indicated on the T series floor plans.

a. Final design and specifications for the Pathways for Communications Systems conduit and primary cable pathway outside the IDRs shall be coordinated with other trades to avoid pathway conflicts.

C. Identification for Communications Systems

1. All labeling will be compliant with ANSI/TIA 606-C – Administration Standard for Commercial Telecommunications Infrastructures and comply with Harris Health Systems Labeling standards.
2. Harris Health System will provide detailed description during Data Pre-construction Meeting.

D. Communications Horizontal Cabling

1. All voice and data horizontal cables will consist of blue plenum rated, Category 6A, 4 pair UTP copper cables terminated on, black in color 8P8C inserts, Category 6A, 360-E-ANG-MOD-2U-48 patch panels in the Telecommunication Rooms. The maximum

horizontal distance shall be 295 feet.
2. All voice and data horizontal cables shall be Category 6A, blue in color terminated on 8P8C inserts at work area outlets. Pin out will be 568B. All information outlets inserts shall be blue in color.
3. All Wireless Access Point (WAP) horizontal cables shall be Category 6A, blue in color terminated on 8P8C inserts at WAP outlet, and 360-E-MOD-2U panels in the Telecommunications Rooms.

E. Patch Cords, Station Cords, and X-Connect Wire

1. 568B Patch cords used shall meet or exceed the performance requirements in ANSI/TIA-568-D.2 and ANSI/TIA-568-D Category 6A specifications.
2. 568B Category 6A 8P8C patch cords will be Contractor Furnished Contractor Installed (CFCI). Contractor will make connections in data rooms to network equipment. All remaining patch cables shall be transmitted to Owner from Contractor. Owner will distribute end user patch cables at outlets.

F. Data Communications Equipment

1. Data communications equipment will be Owner Furnished Owner Installed (OFOI).

G. Voice Communications Equipment

1. Voice communications equipment will be OFOI.

H. Commissioning Administration

1. Contractor shall comply with GENERAL COMMISSIONING REQUIREMENTS of the Information Communication Technology (ICT) System.

I. Meetings

1. Contractor shall attend Division 27 preconstruction meeting with the Owner’s Representative and the General Contractor to discuss the details of the Project.
2. Contractor shall provide representation on Project Team Meetings as specified in Division 1 and by the General Contractor as required.
3. Contractor shall attend a pre-testing meeting to review testing parameters and testing documentation deliverables.
4. Contractor will provide ad-hoc representation on the Commissioning Team as required for implementation of the Commissioning Plan.
5. Within two (2) weeks of the initial meeting, the contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project.

J. Preconstruction Evaluation

1. Examination of buildings and site shall be the responsibility of the Contractor. Examine conditions for compliance with Communications design specifications. Validate Communications section is in accordance with related Contract Documents and the specified Owner's operational needs.

K. Substitutions

1. Equivalent product(s) may be considered as substitution for those products specified; however, any equivalent cabling product(s) must be approved by the cabling system manufacturer and show demonstrated and documented equivalence to the product(s) specified.
2. Documentation shall include, but is not limited to, product samples, data sheets, and actual test date.
3. The request for product substitution, as well as supporting documentation, must be submitted, in writing, prior to submitting the bid.
4. Written approval for product substitution must be submitted with the bid.

L. Construction Documentation

1. Contractor shall coordinate requirements with General Provisions specified in Division 1 – Construction Progress Documentation.
2. Contractor shall provide a weekly report of inspection by project RCDD to confirm Contractor's work is compliant with industry and manufacturer standards.

1.06 SUBMITTALS

A. Following Division 1 and this Section. All submittals shall be reviewed and stamped by the Contractor's project RCDD.

1. The contractor shall not perform any portion of the work requiring submittal review of shop drawings and product data sheets until Harris Health System IT owner representative has approved the respective submittals.

B. A list of technical product education (training) completed by the Contractor's project personnel.

1. All members of the installation team must be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Submit copies of certificates of manufacturer training for each installation team member.
2. Submit cable tester manufacturer or third-party certification for copper and fiber cable test technicians.
3. Data installation foreman must be a BICSI certified Technician and should not be replaced during the duration of the job. All installation members must have completed BICSI installer Level II or higher training courses. All certifications must be current and presented to Harris Health System IT Services at a pre-installation meeting.

C. The contractor shall review Codes and Standards Section – Latest issue and addendums and state understanding and compliance or exception.

D. Product Data: Submit Product Data sheets for each type of product indicated below. Product data to include, but not limited to, materials, finishes, approvals, load ratings, and dimensional information:

1. Submittals shall include the manufacturers cut sheets for the following:

a. Equipment enclosures and/or racks;
b. Fiber optic and balanced twisted pair cable;
c. Patch cords and cross connect media;
d. Connectors and termination hardware;
e. Protection hardware;
f. Fire stopping materials;
g. Test equipment to be used for fiber and balanced twisted pair channels;
h. Cable tray and cable support hardware.

E. Product Data manufacturer's literature sheets for all materials and equipment, including a copy of the proposed warranty, recommended preventative maintenance and spare part inventory recommendations. Literature containing more than one device shall be highlighted and clearly marked to delineate item(s) included in the work. Clearly indicate color or special finishes.

F. Submittals shall be original catalog sheets or photocopies thereof. Facsimile (fax) sheets will not be accepted.

G. Manufacturer and Contractor statements of RoHS: Restriction of Certain Hazardous Substances Compliance.

H. Design and Installation Certificates: Signed by local cable manufacturer's representative certifying that design is acceptable with cable manufacturers Design Engineer9s) and state

that the contractor is authorized by manufacturer to install registered (warranty) cabling system.

l. A minimum of five (5) representative healthcare facilities cabling projects must be submitted as references to include the hospitals name, Architect or Engineer, cost of the cabling project and the contact person at the hospital to include a phone number.

1.07 SUBMITTALS FOR PROJECT RECORD

A. Follow Division 1 and this Section.

1. Drawings: As-built documentation MUST be submitted five (5) business days PRIOR to obtaining approval for cutover to any portion of the new cable plant system. Furnish for review and comments, 4 CDs containing all electronic AutoCAD 2004 or newer (DWG) files.
2. Final approved Shop Drawings: Include plan and elevation of TRs, cable pathway details, and cable locations and cable ID#.
3. 4 sets of cable inventory data must be submitted for all copper and fiber, termination hardware prior to installation. Submit data electronically on CDs in “Microsoft Excel” format, listing products furnished, including:
    a. Manufacturer’s name and part numbers;
    b. Cable numbers utilizing the Owner’s cable numbering standard;
    c. Location and riser assignments.
4. Manufacturer Certificates: Within 10 days of completion of the project, Contractor shall deliver letter signed by local Structured Cabling Components representatives and Contractor’s RCDD stating that installed cabling system complies with all requirements specified in manufacturer’s installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact warranty.
5. Test Reports: 4 copies on CD in compliance with related Test Result Documentation.
6. Submitted test results and other submittals that are non-compliant will be reviewed and returned to the contractor with comments.
7. Re-submitted test results and other submittals that are non-compliant will be reviewed and returned to the contractor with comments.
8. Subsequent review of test results and other submittals will be performed jointly by the contractor and the Communication Consultant and Contractor will pay Communications Consultant’s published hourly rate during third review and thereafter.
9. Manufacturer’s warranty to the owner. This shall include, but is not limited to: Owner’s name and project name and address. (Within three weeks of substantial completion).
10. Within 21 days of completion of the project the communications contractor and/or the manufacturer’s local representative will provide the owner with the Structured Cabling Performance Warranty signed by the manufacturer. The warranty shall list Harris Health Systems in Houston, Texas as the holder of the Warranty.

1.08 EQUIPMENT RELOCATION AND SYSTEM STARTUP

A. Upon notice of construction completion, the selected Contractor will be responsible for system startup services for the new telecommunication room. The Contractor shall be responsible for ensuring the new equipment room, cabinets, floors and walls are clean and ready for equipment installation. On behalf of the Owner, the Contractor shall be responsible for coordinating with the GC and other trades to keep the room (s) clean and dust free at all times.

B. After installation is complete, Contractor shall clean all systems; vacuum debris from system components, enclosures, racks, etc. and thoroughly clean the DC/IDRs.

C. It shall be the responsibility of the Contractor to develop and implement a full migration project schedule detailing the responsibilities of assigned personnel, along with contingency plans, and submit it to the Owner, or their designated representative, for approval.

D. During the transition period, Contractor shall have the necessary supervisory, technical, and other personnel available throughout technology relocations and cutover of the telephone, networking, and video systems. This is to ensure that technicians are on site to observe the operation and maintenance of the equipment, and to resolve any cabling related issues during system start-up.

E. Contractor shall accomplish a smooth and successful transition of operations and services to the new telecommunication room. The transition includes the coordination, migration, testing, and problem resolution with the system vendors.

1.09 SEQUENCING AND SCHEDULING

A. An initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within two (2) weeks of the initial meeting, the Contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project taking into account all lead time for delivery of materials.

B. Contractor shall be responsible for the development and implementation of a complete project schedule detailing the responsibilities of assigned personnel and submit it to the GC and Owner for approval.

PART 2 – PRODUCTS

2.01 PRODUCT SCHEDULE

A. See Division 27 sections for approved products and schedules.

B. 27 05 26 Grounding and Bonding

C. 27 05 28 Pathways for Communications Systems

D. 27 05 53 Identification for Communications Systems

E. 27 11 00 Communications Equipment Room Fittings

F. 27 13 00 Communications Backbone Cabling

G. 27 15 00 Communications Horizontal Cabling

H. 27 16 19 Patch Cords, Station Cords, and Cross-Connect Wire

2.02 WARRANTY

A. Within 10 days of completion of the project, Contractor shall deliver letter signed by local SCS Manufacturer’s representative and Contractor's RCDD stating that installed cabling system complies with all requirements specified in installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact the warranty.

B. Within 21 days of completion of a project the communications contractor and/or the manufacturer's local representative will provide the Owner with the 25-year Extended Product Warranty and Application Assurance signed by the manufacturer. The warranty shall list Harris Health System in Houston, Texas as the holder of the Warranty.

C. The Owner shall not be responsible for any aspect of ensuring the warranty is issued or updated. It shall be the Contractor's responsibility in conjunction with the Manufacturer.

D. During the warranty period, Owner may engage any manufacturer approved communication contractor to perform future moves, additions and changes to the system. Owner approved contractors shall be responsible for updating any required documentation. Owner shall not be responsible for any aspect of updating and maintaining the warranty.

E. The 25-year Labor, Material and Performance Warranty shall cover the testing and replacement of all structured cabling components. The structured cabling system shall be a complete certified system. The system and all components shall be performance matched and guaranteed by the manufacturer.

F. Person / Entity Covered

1. This warranty is for the sole benefit of Owner to the site in which such Registered SCS was originally installed.
2. All communications work and materials not included in the SCS components shall be warranted by the Contractor that performed the work for a minimum of one year from the date of substantial completion.

2.03 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Follow Division 1 Requirements.

B. Packing, Shipping, Handling, and Unloading

1. All material shall be shipped to the Project's designated on-site staging area (to be determined), or a mutually agreed upon location.

C. Acceptance at Site

1. All risk of damage or loss will remain with the Contractor until project completion and acceptance of the installation by the Project Manager. Upon acceptance, risk of loss will pass to the Owner. Prior to that time, the Contractor shall be solely responsible for security of all Contractor provided project materials.

D. Storage and Protection

1. All materials and equipment delivered and placed in storage shall be stored with protection from the weather, humidity, and temperature variation, dirt, and dust, or other contaminants.
2. Material will be properly packaged in original factory-fabricated type containers and protected from damaging fumes, construction debris, and traffic until installation or job completion.
3. Any flammable materials or hazardous materials shall be kept and/or stored in suitable places approved by the General Contractor and outside the buildings at all times.

2.04 PRODUCT QUALITY ASSURANCE

A. All materials and equipment provided shall be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacture of such products. All materials shall be typical commercial designs that comply with the requirements specified. All materials and equipment shall be readily available through manufacturers and/or distributors.

All equipment shall be supplied complete with any optional items required for proper installation.

B. In the event of a breach of the representations and warranties contained herein, the Contractor, at their own expense, shall take all measures necessary to correct and make the cabling system work in compliance with the applicable manufacturer written technical recommendations and standards.

PART 3 – EXECUTION

3.01 SITE CONDITIONS

A. Environmental Limitations

1. Due to the critical nature of the environment, the Contractor shall use extra effort to provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation. Contractor shall remove all rubbish from job site daily at his or her own expense.

3.02 EXAMINATION

A. Examination of buildings and site shall be the responsibility of the Contractor. Examine conditions for compliance with requirements of other Sections in which related work is specified and determine if conditions affecting performance of the work of this Section are satisfactory. Do not proceed with work of this Section until unsatisfactory conditions have been corrected in an acceptable manner.

B. Verify liquid-carrying pipes are not installed in or above voice and data system equipment rooms. Verify conduit, raceways, and boxes are properly installed.

C. Verify backboards are properly installed and painted with 2-coats of fire-retardant paint on all sides. Notify the Project Manager immediately and prior to installation in the event that the backboards are not installed or painted properly.

D. Prior to starting the installation, the assigned installation supervisor shall participate in a walk-through of the project site with the Project Manager, consultant and Harris Health Systems to review the installation documentation, verify that all construction necessary for the installation has been completed, and verify all installation methods and cable routes.

E. The Contractor shall provide a complete cabling infrastructure according to the written specifications and drawings. If the scope of work to be performed by the Contractor changes, it shall be in writing. Contractor shall respond to these changes with a complete material list, including pricing, labor, and taxes in writing per Division 1 requirements. Contractor shall not proceed with additional scope of work without signed approval by the General Contractor.

3.03 PREPARATION

A. Protection of Surroundings

1. Repair: Patching and repair of facilities, finishes, and equipment. Any damage to building or site caused by Contractor, including grass, paving, curbs etc., shall be restored at Contractor's expense to match condition prior to damage. If necessary and requested by the General Contractor, Contractor shall provide professional services to clean or repair scratched/soiled finishes at their own expense.
2. Contractor shall keep all foods and liquids (water, drinks, etc.) in designated break areas.
3. The Contractor shall obtain the Architect's and Engineer's written permission via the

General Contractor before proceeding with any work necessitating cutting into or through any part of building structures such as girders, beams, concrete or tile floors, partition and/or ceilings.

4. If it becomes necessary to cut through any wall, floor, or ceiling to install any work under this Section of the Contract or to repair any defects that may appear up to the expiration of the guarantee period, such cutting shall be done by the Contractor under the supervision of the General Contractor.
5. Patching of all openings cut by the Contractor, or repairing of any damage to the work of other trades caused by cutting or by the failure of any part of the work installed under this Contract, shall be performed by the appropriate trade but shall be paid for by the Contractor.
6. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact-type equipment shall not be used except where specifically approved by the Architect/Engineer.
7. All openings shall be restored to “as-new” condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.
8. Refer to Division 1 for additional information.

3.04 DEMOLITION / REMOVAL

A. Unless indicated otherwise, all items that must be removed due to interference with work of this contract remain the property of the Owner, and are to be salvaged at the Owner's discretion. Any material to be salvaged, other than Contractor's waste material, must be approved in writing by the General Contractor.

3.05 FIRESTOPPING

A. The Contractor is required to properly fire-stop any penetrations through fire barriers utilized for the placement of telecom cabling. Provide fire resistant intumescent materials to restore fire ratings to wall, floor, or ceiling penetrations according to local and national codes.

B. Verify the hourly rating of the barrier.

C. Select the UL Listing to match or exceed the barrier.

D. Adhere to cable loads and fill procedure in the Listing.

E. Seek pre-approval from the Authority Having Jurisdiction (Inspector).

F. When installing the System, be sure not to exceed the listing limitations.

G. All openings shall be restored to “as-new” condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

H. Provide fire resistant materials to restore fire ratings to all wall, floor, or ceiling penetrations used in the distribution and installation for communications cabling system. Coordinate fire stopping procedures and materials with General Contractor.

I. Solutions and shop drawings/submittals for fire stop materials and systems shall be presented to the General Contractor for written approval of materials prior to purchase and installation.

J. Materials shall be installed per manufacturer instructions, be UL listed for intended use, and meet NEC codes for fire stopping measures.

K. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and remain resilient and pliable to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

L. The fire stopping material shall maintain/establish the fire rated integrity of the wall/barrier that has been penetrated.

M. Contractor shall coordinate with electrical contractor and ensure communications pathway firestopping is properly identified and labeled.

N. Firestopping in high density wiring locations is achieved by the use of STI EZ Path enclosures.

3.06 CONSTRUCTION WASTE MANAGEMENT

A. Contractor shall remove all excess material and debris from the site upon completion of work each day and in a manner approved by the General Contractor's Project Manager.

3.07 LABELING

A. Confirm administrative labeling scheme of cabling and its numerical positions on the termination hardware. Ensure compliance with Harris Health Systems Labeling standards and as detailed below:

1. Each cable should be clearly labeled with the cable id using a permanent laminated label on the cable sheath at both ends.
2. The outlet cover should also be labeled with the cable id. The cable id should be written on the outlet or outlet cover in indelible ink under a printed laminated label with the same information. The proper designation icons (data, voice, TV) should be placed on the outlet cover.
3. The patch panels in the wiring closet should have label designation strips that indicate the cable id and either the remote room number or consolidation point number as applicable.
4. Patch panel labeling in closet should consist of cable# on front of patch panel with printed labels to each designated jack. Permanent marker is not acceptable.
5. Exact details for copper and fiber labeling of horizontal and backbone riser runs will be presented by Harris Health Systems at pre-installation meeting.

3.08 CLOSEOUT ACTIVITIES

A. Acceptance shall be subject to substantial completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation as described herein.

1. All Proposal Submittals and Project Record Submittals.
2. Training to Owner's representative on methods to add and remove fire stop barriers
3. Maintenance manuals specified in Div. 1 to GC and Owner regarding structured cabling system, fire stopping and manufacturer's recommended maintenance instructions.
4. Contractor shall complete all punch list items within five (5) days of notification by GC.
5. Contractor shall complete Closeout Checklist listing status of all submittals, maintenance manuals, Owner training, and punch list items and deliver per Division 1.
6. Contractor will provide two (2) technicians for eight (8) hours each (for a total of 16 hours) of support during the physical move to the space.

END OF SECTION 27 05 00

SECTION 27 05 26 – GROUNDING AND BONDING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for the Communications Grounding and Bonding for the Harris Health System.

1.02 RELATED REQUIREMENTS

A. Section 27-05-00 Common Work Results for Communications.

B. Section 27-05-26 Grounding and Bonding for Communications Systems.

C. Section 27-05-28 Pathways for Communications Systems.

D. Section 27-05-53 Identification for Communications Systems.

E. Section 27-11-00 Communications Equipment Room Fittings

F. Section 27-13-00 Backbone Cabling Requirements

1.03 REFERENCES AND STANDARDS

A. ANSI J-STD-607-C, Commercial Building. Grounding/Bounding Requirements- Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2013*.

B. IEEE/ANSI 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems.

C. IEEE 1100, Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

D. UL 467 Electrical Grounding and Bonding Equipment.

E. NEC, NFPA 780, Standards for Installation of Lightning Protection.

1.04 DEFINITIONS AND ABBREVIATIONS

A. TMGB – Telecommunications Main Grounding Busbar: The dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The central attachment point for the TBB's and equipment typically located in the EF, also known as the Entrance Facility.

B. TGB – Telecommunications Grounding Busbar: The grounding connection point for telecommunications systems and equipment in the area typically served by a Telecommunications Room other than the EF.

C. TBB – Telecommunications Bonding Backbone: A bonding conductor that interconnects telecommunications main grounding busbar (TMGB) to the telecommunications grounding busbar (TGB).

D. BCT – Bonding Conductor for Telecommunications that bonds the TMGB to the electrical power ground.

E. GE – Grounding Equalizer: A conductor that interconnects elements of telecommunications grounding infrastructure.

F. Exothermic Weld: A method of permanently bonding two metals together by controlled heat

reaction resulting in a molecular bond.

1.05 SUMMARY

A. Telecommunications Main Grounding Bus Bar Connection to the Electrical Ground must be an exothermic weld. When making exothermic welds, wire brush or file the point of contact to a bare metal surface. Use exothermic welding cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly cleaned the joint area. Notify the Resident Engineer prior to backfilling any ground connections.

B. Provide ground lug for each 19” rack. Racks shall be grounded to wall mounted ground bus bar using #6 AWG stranded, green jacketed, insulated copper conductor. Furnish all required bonding material and hardware, and bond to building grounding electrode subsystem TMGB in EF. If compression connectors are used to bond the #6 AWG wire, follow NEC bonding procedures/specifications.

C. Ground all telecommunication hardware such as cable ladder, conduit, equipment racks, protection units and shielded cabling with #6AWG ground wire.

D. An inert dielectric material shall separate dissimilar metals apt to corrode through electrolysis under the environmental operating conditions specified.

E. Telecommunications Grounding Bus Bars and grounding wires connecting to main building grounding electrode system provided by Electrical Contractor.

F. Refer to grounding and bonding details in drawing set for placement and terminations of bonds.

PART 2 – PRODUCTS

2.01 TELECOMMUNICATIONS BUSBARS – Per Division 26

A. Material: Copper, ¼” thick (aluminum not permitted).

B. Pre-drilled

1. 3/8” Diameter.
2. Hole spacing per ANSI Joint Standard J-STD-607-C.
3. Hole pattern shall accommodate two-hole lugs.

C. Busbars shall be listed by a nationally recognized testing laboratory.

D. Telecommunications Main Grounding Busbar (TMGB)

1. Chatsworth #10622-012 ground busbar with Chatsworth #10622-000 busbar insulators or equivalent, 20”x4” minimum.

E. Telecommunications Grounding Busbar (TGB)

1. Chatsworth #10622-012 ground busbar with Chatsworth #10622-000 busbar insulators or equivalent, 12”x2” minimum.

F. Rack Bonding Accessories – CommScope CGT200 & RA100A.

2.02 GROUNDING JOINTS/SPLICES

A. Grounding conductor joints/splices shall be mechanical type, copper alloy, with a minimum of two bolts and a separate section for each conductor equal to Burndy “QPX”, OZ/Gedney “XTP” or “PMX” or Penn-Union “VX” or copper compression type with two (2) indents equal to Burndy, T&B or Blackburn.

B. Grounding conductor terminations (lugs) shall be single barrel, mechanical screw type, copper alloy with machined contact surfaces equal to OZ type “SL”, T&B, or Burndy or copper compression type with two (2) indents equal to Burndy, T&B or Blackburn.

2.03 BONDING CONDUCTORS

A. Material: Stranded copper (aluminum not permitted).

B. Cable Tray Bonding Conductor: Green #8 AWG insulated bonding jumper (12” max) with appropriate lugs or manufactured braided copper grounding jumper equal to B-Line #CAM-GJ, T&B #BD12, OZ/Gedney type “FB” or Mono-Systems.

C. Equipment Frame Bonding Conductor; Panduit #TRGK672 Telecommunications Rack Grounding Kit.

D. Bonding Conductor (BC): Green insulated copper bonding conductor, size as required by NEC.

E. The BC shall be, as a minimum, the same size as the TBB.

F. Telecommunications Bonding Backbone (TBB): Green insulated copper conductor, minimum size of No. 6 AWG.

G. The TBB shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG. Insulation shall meet fire ratings of its pathway.

Table 1

Sizing of the TBB

TBB length (ft)	TBB Size (AWG)
Less than 13 =	6
14-20 =	4
21-26 =	3
27-33 =	2
34-41 =	1
42-52 =	1/0
53-66 =	2/0
Greater than 66 =	3/0

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Provide the required elements and associated hardware necessary to provide a complete Telecommunications Grounding Infrastructure as specified.

C. Ground all hardware back to the main busbar of two grounding busbars installed by the electrical sub-contractor. Install two busbars per Telecommunications Room. One main busbar near the racks and a second busbar located near the electrical panel serving the Telecommunication Room that is grounded to the electrical panel ground.

D. Grounding system must maintain a suitably low earth resistance of 5 ohms or less. The contractor shall properly test the grounding system upon construction completion to quantify that it meets or exceeds this requirement.

E. TMGB

1. TMGB shall be installed so that the BC for telecommunications is as short and straight

as possible.

2. Conductor shall be installed in continuous 3/4” conduit.

F. TGB

1. TGB shall be installed so that the TBB for telecommunications is as short and straight as possible.

G. TBB

1. Install Green insulated copper grounding conductor (refer to 2.03.D for conductor size) from the TMGB to each TGB.

H. Grounding Conductor Joints/Splices

1. Install mechanical type, copper alloy, with a minimum of two bolts and a separate section for each conductor or copper compression type with two (2) indents.
2. Install manufactured insulating cover or heavy tape insulation over joints/splices.

I. Grounding of Cable Tray

1. Install Green #8 AWG bonding jumper (12” max) with appropriate lugs at each cable tray joint or install manufactured braided copper grounding jumper equal to B-Line #CAM-GJ, T&B #BD12, OZ/Gedney type “FB” or Mono-Systems.
2. Install Green #8 AWG grounding conductor with appropriate lugs from side of cable tray down to TMGB or TGB. Drill and tap side of cable tray (for appropriate size bolt, ¼” x 20 min.), making sure that bolt does not extend into wire management part of tray.

J. Grounding of Equipment Frame

1. Install Panduit or equivalent Telecommunications Rack Grounding Kit from equipment frame to grounded cable tray, TMGB, or TGB.

K. ANSI J-STD-607-B, Commercial Building. Grounding/Bounding Requirements- Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002*.

L. IEEE 1100, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

M. NEC, NFPA 780.

N. SECTION 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

3.02 QUALITY CONTROL

A. Inspect grounding and bonding system connections and conductors for proper installation and tightness.

3.03 DOCUMENTATION

A. Provide documentation of actual locations of grounding electrodes, busbars and backbone grounding conductors.

END OF SECTION 27 05 26

SECTION 27 05 28 – PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for the Pathways for Communications Systems for the Harris Health System.

B. Communication Pathways are defined to include, but are not limited to, innerduct, conduit, pull boxes, cable saddles, cable trays, supports, accessories, associated hardware and fire stopping materials. Final design and specifications for conduits shall be made by the Electrical Engineer of Record.

C. In typical work areas, one (1) 1” conduit with pull strings, not more than 100' long with a maximum of two (2) 90-degree bends, will provide the cabling pathway from a double gang box to the primary horizontal overhead pathway system.

D. Provide a metallic Cable Saddle system for horizontal cabling in the accessible ceiling space from each work area conduit to the nearest cable tray serving as primary horizontal pathway. Assemblies shall be complete with mounting hardware and rated for Cat 6A data cabling.

E. Work furnished and installed by Electrical Contractor as specified in this Section and as shown in E and T drawings includes:

1. The conduits and back boxes for the work area telecommunications, and specialty systems outlets.
2. The overhead cable tray system serving as primary horizontal pathway.
3. Fire stopping of cable tray and conduit cable pathway

F. Work furnished and installed by the Cable Contractor as specified in this section and as shown in E and T drawings includes:

1. The overhead cable runway (ladder rack) within the new Telecommunication Rooms.
2. Bonding and grounding of overhead cable runway (ladder rack), racks and cabinets within the new Telecommunications Rooms.

PART 2 – PRODUCTS

2.01 GENERAL

A. Where conduit, pull boxes, and other raceway sizes are not specifically shown on contract drawings, all communication pathways shall be sized in accordance with the requirements of BICSI and the NEC. No conduit shall be less than 1".

2.02 HANGERS AND SUPPORTS

A. All horizontal voice and data runs will be supported by cable tray down major hallways from the telecommunication rooms transitioning to metal Cable Supports to the conduit connecting to the outlet box. Refer to the T drawings for details

B. Cable bundles shall be self-supported via metal J-hooks attached to the building structure and framework at a maximum of five (5) ft. intervals.

C. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.

D. Cables shall not be attached to or supported by fire sprinkler pipe, heads, or delivery systems or any environmental sensor located in the ceiling air space.

2.03 CONDUITS AND FITTINGS

A. For each wireway system indicated, provide a complete assembly of conduit, tubing or duct with fittings including, but not necessarily limited to, connectors, nipples, couplings, locknuts, bushings, expansion fittings, other components and accessories as needed to form a complete system of the same type indicated.

B. See Division 26 for RACEWAYS, CONDUITS AND BOXES

C. Minimum conduit size for Telecommunications Outlets shall be 1 (one) inch.

D. Electrical contractor shall leave a ¼" dia. 200lb test rating nylon pull cord in all conduits used for cable installation.

E. Conduit fill shall not exceed 40% on sleeves in non-fire rated walls. Sleeves in rated walls shall be STI EZ Paths manufacturer listed and tested WL Rating.

2.04 WALL AND CEILING OUTLET BOXES

A. Galvanized steel interior outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.

B. Outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.

C. See Division 26 for RACEWAYS, CONDUITS AND BOXES.

2.05 PULL AND JUNCTION BOXES

A. See Division 26 for RACEWAYS, CONDUITS AND BOXES

2.06 CABLE TRAY SECTIONS AND COMPONENTS

A. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

B. Tray Sizes shall have 4-inch minimum usable load depth, or as noted on the drawing.

C. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard 12-foot lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.

D. Tray widths shall be 18 inches or as shown on drawings.

E. All fittings must have a minimum radius of 24 inches.

F. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.

G. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum span indicated on drawings. Supports shall be constructed from 12gauge steel formed shape channel members 1-5/8 inch by 1-5/8 inch with necessary hardware such as Trapeze Support Kits (9G-55XX-22SH) as manufactured by Cooper B-Line, Inc. [or engineer approved

equal]. Cable trays installed adjacent to walls shall be supported on wall mounted brackets such as B409 as manufactured by Cooper B-Line, Inc. [or engineer approved equal].

H. Trapeze hangers shall be supported by 1/2-inch (minimum) diameter rods.

I. Barrier Strips: Shall be placed as specified on drawings and be fastened into the tray with self-drilling screws.

J. Accessories – special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.

K. When installing cable tray the National Electric Code (NEC) shall apply. Cable trays are designed to accommodate a maximum calculated fill ratio of 50% to a maximum of 6” inside depth.

PART 3 – EXECUTION

3.01 SUMMARY

A. Final design and specifications for the Communications Systems conduits shall be made by the Electrical Engineer and Architect of Record.

B. Conduits shall be reamed to eliminate sharp edges. Metallic conduit shall be terminated with an insulated bushing. Do not install communication cables in conduits until all bushings and couplers are installed on the ends of the conduits.

C. The inside of the cable tray shall be free of burrs, sharp edges or projections that can damage cable insulation. Abrasive supports (e.g., threaded rod) shall have the portion within the tray protected with a smooth, non-scratching covering so that cable can be pulled without physical damage. When a cable tray passes through a partition or wall, it shall be an unbroken length. Installation of telecommunications cables shall not exceed the fill requirements. Openings in fire-rated walls, floors and ceilings shall be properly fire stopped. Barriers between power and telecommunications cables shall be installed per electrical code. Cable trays and shall not be used as walkways or ladders unless specifically designed and installed for that purpose.

D. Supports should be located where practicable so that connections between sections of the tray fall between the support point and the quarter section of the span. The support centers shall be in accordance with the load and span for the applicable class as specified in the electrical code. A support should be placed within 600 rnm (2 ft) on each side of any connection to a fitting. Cable tray shall be supported on 1500 mrn (5 ft) centers unless designed for greater lengths.

E. A minimum of 300 mm (12 in) access headroom shall be provided and maintained above a cable tray. Care shall be taken to ensure that other building components e.g., air conditioning ducts) do not restrict access to trays.

F. All pathways must be grounded and bonded per ANSI J-STD-607-D standards.

G. Contractor shall ground all incoming communications conduit/tray in the Telecommunication Rooms with a minimum #6 AWG green insulated jacket, braided conductor.

H. When Cable Saddles are used in the ceiling area, conduits from the cable saddles to outlets or zones shall be provided unless otherwise permitted by code and specified.

I. Provide #8 AWG wire and/or all-threaded rod for supporting hangers when hanging from floor deck and deck members. Refer to manufacturer recommendations for proper installation, sizing, and loading of hangers.

J. All threaded rod shall be ½" diameter for supporting slotted channel under cable runway between floor deck and deck members. Refer to communications drawings for details. Threaded rod ends shall be filed to remove sharp edges and capped with plastic caps.

K. Cables shall be neatly dressed along common paths with plenum rated Velcro tie wraps. Maximum number of cables per bundle shall not exceed 24 (Twenty-Four).

L. Layout cable runs in advance to determine quantities of cable to be installed along pathways, and to ensure non-interference from other trade installations.

M. Do not support cables from, or on, ceiling suspension system or use electrical, plumbing, or other pipes for support. Cable supports shall be permanently anchored to building structure or joist. Provide attachment hardware and anchors designed for the structure to which attached, and that are suitably sized to carry the weight of the cables to be supported. Confirm with Architect and/or Construction Manager on installation procedures for cable support system prior to implementation.

N. Chases and slots must maintain a 50% spare capacity.

O. Secure and support exposed horizontal cable at intervals not exceeding 4ft and not more than 16 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

3.02 MINIMUM CLEARANCES

A. Communication Pathway minimum clearances from:

1. Minimum of 1 foot parallel, 3 inches crossover from power cables and conduits.
2. Minimum of 6 inches above ceiling tiles.
3. Minimum of 24 inches Hot Flues, Steam pipes, Hot water pipes and other hot surfaces.
4. Minimum of 3 feet separation from electrical panel boards.
5. Minimum of 12-inches from fluorescent fixtures.
6. Minimum of 6 feet separation from electrical motors and transformers.
7. Minimum of 2-inches from exposed all-thread rods.

3.03 FIRE STOPPING

A. Provide fire resistant materials to restore fire ratings to all wall, floor, or ceiling penetrations used in the distribution and installation for communications cabling system. Coordinate fire stopping procedures and materials with General Contractor and Electrical Contractor.

B. Solutions and shop drawings/submittals for fire stop materials and systems shall be presented to the General Contractor for written approval of materials prior to purchase and installation.

C. Materials shall be installed per manufacturer instructions, be UL listed for intended use, and meet NEC codes for fire stopping measures.

D. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and remain resilient and pliable to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

E. The fire stopping material shall maintain/establish the fire rated integrity of the wall/barrier that has been penetrated. Verify with Harris Health System Engineering department the manufacturer of fire stop per facility.

F. Cable Contractor shall laminate and permanently affix to the TR wall, adjacent to chases, the following information:

1. Name of manufacturer of fire stop system.
2. Part & model numbers of system and all components.
3. Phone numbers of manufacturer's corporate headquarters in U.S. and local distributor's

name and phone number.

G. All pathway penetrations shall be STI EZ-PATH device modules comprising of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. Size all room penetrations on floor plans accordingly to cable bundles being installed in each location.

END OF SECTION 27 05 28

SECTION 27 05 53 – IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

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 specifies the requirements for the Identification for Communications Systems for the Harris Health System.

B. Work covered by this Section shall consist of furnishing labor, equipment and materials necessary for the labeling of the telecommunications infrastructure as described on the Drawings and/or required by these specifications.

1.03 QUALITY ASSURANCE

A. Identification and administration work specified herein shall comply with the applicable requirements of:

1. ANSI/TIA – 606-D Administration Standards.
2. ANSI/TIA – 569-D Telecommunications Pathway and Spaces
3. ANSI/TIA – 568-D.1 Commercial Building Telecommunications Cabling Standard.
4. BICSI Telecommunications Distribution Methods Manual. (Current Edition)
5. UL 969.

1.04 TELECOMMUNICATIONS ADMINISTRATION

A. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, Telecommunications Rooms, and other telecommunications spaces.

B. Harris Health System maintains a campus wide numbering scheme for voice and data outlets and patch panels.

C. Harris Health Systems will provide a detailed description during the Data Pre-Construction Meeting.

D. Telecommunications Infrastructure Records must be maintained in a computer spreadsheet, or in a computer database. Paper records are encouraged, but are optional. A cable record is prepared for each backbone cable. The record will show the cable name, and must describe the origin point and destination point of the cable. The cable record will record what services and/or connections are assigned to each cable pair or strand. An equipment record is prepared for services distributed from a certain piece of equipment, such as a router, or a system such as the telephone system PBX. Harris Health System will communicate the cable numbers which the contactor will patch to the network switch. The contactor will provide the cable number to IDR, switch name, blade and port for each cable on a spreadsheet at substantial completion of each phase of the project.

E. The Contractor is required to keep accurate, up-to-date Installation or Construction Drawings. At a minimum, the Installation Drawings shall show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.

F. The Contractor to provide a complete and accurate set of as-built drawings. The as-built drawings shall record the identifiers for major infrastructure components including; the pathways, spaces, and wiring portions of the infrastructure which may each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. When the project is completed in phases these drawings are due at substantial completion of each phase.

PART 2 – PRODUCTS

2.01 COMMUNICATION CABLING LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Approved Manufacturer:

1. Brady Corporation
2. P-Touch
3. Kroy

2.02 LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

C. Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

D. Where insert type labels are used provide clear plastic cover over label.

E. Install colored labels according to the type of field as per ANSI/TIA communications color code designations.

F. Approved Manufacturer:

1. Brady Corporation
2. P-Touch
3. Kroy

PART 3 – EXECUTION

3.01 IDENTIFICATION AND LABELING

A. Contractor shall follow Harris Health System Labeling Standard. Harris Health System will provide a detailed description of numbering scheme during Data Preconstruction meeting.

B. All labeling must be coordinated with Harris Health System prior to start date.

C. The size, color, and contrast of all labels shall be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.

D. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.

E. All labels shall be printed or generated by a mechanical device.

F. Label Fiber Optic cable runs with 3” wide by 10” long red “Caution – Fiber Optic Cable” tags every 7’ along the entire pathway of the Fiber Optic cable.

G. Use labels for all infrastructure, racks, fiber termination and OSP cable must be label throughout the entire system including within 12” of entering and exiting all penetrations in floors, walls and manholes.

H. Label each horizontal cable on the patch panel and I/O faceplate.

I. Label each cable within 6” of each termination, where it is accessible and readable in a cabinet, junction/splice case, or outlet box and elsewhere as indicated.

J. Communications room grounding will be marked conspicuously with permanent plastic labels at each end and location stating “Caution: Telecommunication Ground – DO NOT REMOVE”. Indicate the room number of the opposite end of the wire.

END OF SECTION 27 05 53

SECTION 27 11 00 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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 specifies the requirements for the Communications Equipment Room Fittings for the Harris Health System.

1. The contractor will provide and build equipment room racks, cable management, and cable raceways per the provided drawings.
2. All miscellaneous equipment and labor to install cable raceways, radius drops, securing, etc. will be included. Cable runway radius drops should be provided for each of the racks in each of the Telecom Rooms.
3. All metal will be bonded and grounded per specifications. The contractor will provide ground wire, straps, and ground buss bars for Telecom Rooms.
4. All equipment racks housing telecommunications Private Branch Exchange (PBX) equipment will be isolated from the floor and metal raceways.

B. Communications Equipment Room Fittings

1. The new Telecommunication Room as indicated on the T drawings.

a. A minimum size of 11' x 17’ for the IDR per ANSI/TIA-1179-A.
b. 24/7 environmental controls – 18 °C to 27 °C (64 °F to 80 °F). The humidity range shall be 20% to 80% relative humidity.
c. Ceiling height a minimum of 10 ft. above finished floor (AFF).
d. No false ceilings.
e. Light fixture height a minimum of 8.5 ft AFF, with a minimum equivalent of 500 lux (50-foot candles) measured 3' AFF, with 30% emergency light fixtures, if available.
f. Dedicated Telecom Room power panels fed from UPS distribution, if available.
g. A minimum of one duplex isolated ground 120-volt power outlet per 6ft intervals with a maximum of four duplex outlets per circuit.
h. Two L6-30R twist lock 30-amp dedicated circuits above each equipment rack. One on normal power and the second one on emergency power. This should be referenced for standard equipment racks with acceptable voltage ranges of 100-240V.
i. Two L6-30R twist lock 20 amp dedicated circuits above each equipment rack. One on normal power and the second one on emergency power. (This is in addition to the L6-30R listed above) This should be referenced when 110V is required for equipment rack(s).
j. One 110V quadplex, on emergency power if available at site, above center of rack row.
k. 8’H x 4’W x ¾” T grade ACX painted plywood on each wall, 24” A.F.F. to the building structure or slab above. Paint plywood on all sides with at least two coats of light white fire-retardant paint, leaving exposed and legible in as small of a footprint as possible, the fire rating stamp in two locations on the board.
l. Fire suppression systems. Wet pipe shall avoid equipment racks where possible and employ drip pans and leak detection where/as needed.
m. A floor rating greater than 4.8 kPa (100 lbf/ft2) distributed loading.
n. A floor rating greater than 8.8 kilonewton (kN) (2000 lbf) concentrated loading.
o. Fully-opening, secured, lockable doors with access control.

p. A Telecommunications Main Grounding Bus Bar (TMGB) in the EF and Telecommunications Grounding Bus Bar (TGB) in the IDR and a Bonding Conductor for Telecommunications (BCT) that bonds the TMGB to the electrical power ground compliant with ANSI J STD-607 B Standards.
q. Equipment racks and overhead ladder tray system as indicated on the T Drawings.
r. Contractor shall provide identification/labeling scheme on all passive OSP and riser components installed in these rooms.
s. All walls and doors must meet a 2-hour fire-rating.

PART 2 – PRODUCTS

2.01 RELAY RACKS – Telecom Rooms

A. Approved Manufacturer:

1. CommScope Equipment Rack, 2-Post, 6 in (152 mm) Channel x 7 ft (2134 mm) H – 19 in (482.6 mm) Aluminum (45U) 12-24 Tapped Rails, Black, 760082495 | RK6-45A
2. CommScope Equipment Rack, 4-Post, 36 in (914 mm) D x 7 ft (2134 mm) H – 19 in (482.6 mm) Alu (45U) 12-24 Tapped Rails, Black 760082560 | RK4P45-36A

B. Equipment Racks:

1. Constructed of painted aluminum
2. 84” in height
3. Black finish
4. Supplied with #6 AWG ground lug kit
5. Supplied with spare screws (minimum 50)
6. Mounting holes shall be drilled and tapped each side at 5/8”-5/8”-1/2” patterns compatible with EIA 1-1/4”-5/8” alternating patterns.
7. Include base flanges with mounting holes securing the rack to the floor. Each mounting hole must be at least 5/8” in diameter.
8. Contractor shall not install any equipment below 8 RU.

C. Where the rack is to be mounted to VCT flooring or bare concrete, an insulating pad must be used, and care must be taken that anchors, used to secure the rack to the floor, do not come in contact with any reinforcing steel embedded in the concrete slab.

D. Contractor shall provide all connection, supporting and grounding hardware for a complete overhead runway system.

2.02 CABLE MANAGEMENT

A. Approved Manufacturers:

1. CommScope – Vertical – 6” – (VCM-DS-84-6B) & 12” – (VCM-DS-84-12B)
2. CommScope – Horizontal – 1RU, 19”, SS, Black 760072942 | HTK-19-SS-1U

B. Vertical Cable Management:

1. Standard vertical management provides a cost-effective, adaptable, vertical cable management system for open rack system.
2. One rack unit (RMU) interval cable guide fingers shall be used for easy and organized pathways for cables and patch cords. Cable guide fingers shall be made of durable, flame-retardant (UL 94V-0) plastic to withstand wear-and-tear and prevent accidental breakage.
3. The vertical wire manager shall include an aluminum Snap-on, hinged cover to easy hide cable for a professional look.
4. The covers shall swing on hinges to open left or right, allowing quick access to the cable from either direction for easy moves, adds, and changes. The covers shall sit on top of

the cable guide fingers to provide additional room for organizing.

5. Management spools shall be available for standard or enhanced vertical cable managers to support fiber and copper cable/patch cords.
6. 6 in. and 12 in. double-sided vertical wire managers will be required.
7. Black finish

2.03 CABLE RUNWAY SYSTEM

A. Approved Manufacturer:

1. CommScope

B. Ladder tray is required within the telecommunications rooms to provide a suitable pathway to route all cabling into and out of termination equipment, mounted in equipment racks or on backboards attached to walls.

C. Special accessories shall be furnished as required to protect, support and install a ladder tray support system.

D. Fill Ratio: Cable Tray may be filled to 50% of total fill capacity per TIA 569-B

E. Maximum-stacked height of cable installed in cable runway shall be 2-1/2”. Increase width of runway or provide additional runs of cable runway required to fulfill requirements.

F. Cables entering all Telecommunications Rooms must take the longest route to their termination point within each room to allow for maintenance slack in each run.

PART 3 – EXECUTION

3.01 GENERAL

A. Telecommunications rooms are generally considered a zone serving facility. These rooms may be equipped with fiber and copper cables, wall mounted termination blocks/patch panels, rack mounted copper and fiber patch panel terminations, vertical and horizontal cable management systems and equipment racks. Cable Contractor shall provide proper identifications/labeling scheme for all structured cabling components installed in these rooms.

B. Follow manufacturer’s recommended installation and termination practices.

C. Cabling within racks and enclosures: provide adequate length of cabling. Train conductors to termination terminal points that follow manufacturer’s installation procedures for maintaining cable performance specifications. Provide lacing/mounting bars to restrain cables, to prevent straining connections, and to stop bending cables to smaller radii than minimums recommended by manufacturer.

D. Equipment Racks: Provide 19” wide x 7'-0” tall racks with number of vertical rack sections as required to allow space for termination of all fiber and data/voice cabling plus mounting space for multi-port Switches required to cross-connect all data jacks.

E. Install radius drops on top of equipment racks to protect cabling bend radius. Install rack to runway elevation kits above each equipment rack.

F. Locate/space racks and enclosures (cabinet) according to ANSI/TIA guidelines for front and around access.

G. Vertical wire management: single-sided vertical rack cabling sections shall be a minimum width of 6 inches or wider. Reference T. Drawings

H. Entrance: Arrange and coordinate locations of distribution frames, patch panels, cross-connections (furnished by others) in communication rooms and racks to optimize space requirements of any service provider requirements, telephone system and LAN equipment.

I. Provide cable runway in equipment room above all racks and up to cross-connects/runway/conduits/sleeve's entering room from corridors. Form a complete runway system by ringing the room and connecting all hardware installations. Route the cables within the room by taking the longest available path through the perimeter cable tray. Attach grounding lugs to each rack/cable raceway, conduit, etc. Refer to 'T' drawings for details.

J. Coordinate runway locations with lighting, air-handling systems, and fire extinguishing systems so that fully loaded trays will not obstruct or impede their operation.

K. Provide horizontal cable runways. Equip each 19” rack with overhead ladder style cable runway installed between the wall and horizontal/equipment racks. Refer to COMMUNICATIONS “T” drawings for proposed locations and sizing of each runway. Securely attach to wall studs with support brackets (and racks if applicable), in accordance with manufacturers written instructions.

L. Provide ground lug for each 19” rack. Racks shall be grounded to wall mounted ground bus bar using #6 AWG stranded, green jacketed, insulated copper conductor bonded to 2 OT wire. Furnish all required bonding material and hardware, and bond to building grounding electrode subsystem TMGB in Entrance Facility. If crimp connectors are used to bond the #6 AWG wire, follow NEC bonding procedures/specifications.

M. An inert dielectric material shall separate dissimilar metals apt to corrode through electrolysis under the environmental operating conditions specified.

END OF SECTION 27 11 00

SECTION 27 13 00 – COMMUNICATIONS BACKBONE CABLING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The contractor shall install 24 strand single-mode fiber optic cable from the MDR to the IDRs. Refer to the Technology Drawings for details.

B. The contractor shall install 100 pair 24 AWG copper cable from the 2nd floor Telephone Equipment Room to the IDRs. Refer to the Telecom Drawings for details.

C. The contractor shall install RG-11 Coaxial Cable from the head end to the new IDRs. Refer to the Technology Drawings for details.

D. The contractor shall install 24 strand OM3 multi-mode fiber optic cable from the MDR to the new IDRs. Refer to the Technology Drawings for details.

E. The contractor shall install four “Green” 4 pair 24 AWG Cat 6 UTP (Overhead Paging System) copper cable from the overhead paging head end to the new IDRs. Refer to the Technology Drawings for details.

F. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing, unless otherwise specified, in performing the following operations recognized as necessary for the installation, termination, and labeling of copper backbone infrastructure as described on the Drawings and/or required by these Specifications.

1.02 RELATED SECTIONS

A. 27 05 00 Common Work Results for Communications

B. 27 05 26 Grounding and Bonding

C. 27 05 28 Pathways and Spaces

D. 27 05 53 Identification for Communications Systems

E. 27 11 00 Communications Equipment Room Fittings

F. 27 13 00 Communications Backbone Cabling

G. 27 15 00 Communications Horizontal Cabling

H. 27 16 00 Patch Cords, Station Cords, & Cross-Connect Wire

I. 27 20 00 Data Communications Equipment

J. 27 30 00 Voice Communications Equipment

1.03 COORDINATION

A. Contractor shall coordinate the work specified in this Section with the work in other parts of the Contract document.

B. Plans in general are diagrammatic. It is the full responsibility of the Contractor to be familiar with the location of equipment involved under the work of other trades to eliminate conflicts between the multi-pair copper cable installation and the work of other trades.

C. All questions and issues with regard to coordination shall be directed to the Owner.

D. The contractor shall observe the bending radius and pulling strength requirements of all backbone cables during handling and installation.

1.04 SUBMITTALS

A. All submittals for substitutions or modifications shall be made to the Owner for approval prior to start of work. (See Section 27 05 00)

B. The Contractor shall submit a copper cable pulling plan for all multi-pair copper cables with a pair count of 25 pairs or greater, that includes, but is not limited to, the following:

1. Each cable run and route.
2. Date and duration of the pull.
3. Pulling methodology and equipment setups.
4. Pulling tension calculations for each pull in the run.
5. Safety issues and precautions to be taken.

1.05 QUALITY ASSURANCE

A. Verification: The Owner will maintain inspection personnel on the job site. It is incumbent upon the Contractor to verify that the installation and material used has been inspected before it is enclosed within building features, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected.

B. Equipment Qualifications: The Contractor is to use equipment and rigs designed for pulling, placement and termination of cable; including reel trucks, mechanical mules, sheaves, shoes, anchors etc., and equipment for drilling masonry, installing anchors, etc., to install support and cable management hardware.

C. Backbone Cable Testing

1. Complete end-to-end test results for all copper UTP and fiber optic lines installed is required.
2. All fiber optic cable must be visually inspected and optically tested on the reel upon delivery to the installation site. Using an Optical Time Domain Reflectometer (OTDR), an access jumper with like fiber, a pigtail, and a mechanical splice, all fibers shall be tested for continuity and attenuation. Testing for continuity and attenuation on the reel must confirm factory specifications to ensure that the fiber optic cable was not damaged during shipment. The test results must match the results of the factory-attached tag on the reel, or the fiber shall not be used. Reel data sheet must be provided showing test results.
3. Contractor shall use a Power Meter/Light Source and type 1 OLTS or fiber testing.
4. End to end (bi-directional) test measurements shall be provided for single-mode fibers (2 wavelengths per test is required). Test results must be submitted for review as part of the installation inspection requirements. Test results shall be in paper form and electronic form, and must contain the names and signatures of the technicians performing the tests.
5. Testing shall be performed on 100% of the fibers in the completed end-to-end system. ANSI/TIA-568-D, Annex H, provides the technical criteria and formulae to be used in fiber optic testing. Additionally, all fiber optic cable links must pass all installation and performance tests both recommended and mandated by the cable manufacturer.
6. 100% of all pairs in backbone copper cables shall be tested for continuity and wire-map.

D. Format

1. Test Results must be submitted in 2 formats. First, must be original file(s) down loaded from tester. Second, the file must be cohesively placed in Excel format with the following fields: ER/TR RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary and delivered in electronic format.
2. Care with reference to above format criteria, should be taken when recording the information in the tester, proper consistency with port identification is required.
3. As Built drawings must be submitted with .dgn or .dwg file extensions.

PART 2 – PRODUCTS

2.01 GENERAL

A. Cables and Termination hardware shall be technically compliant with and installed in accordance with referenced TIA/EIA documents.

B. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of National Electrical Code and shall meet specifications of NEMA (low loss), UL 444, and ICEA (where applicable).

2.02 MULTI-PAIR COPPER CABLE

A. Manufacturer:

1. CommScope/SYSTIMAX

B. Copper Cabling:

1. 100 Pair – Category 3, Plenum Rated, White (MID 107766057)
2. 4 ea. Category 6, Plenum Rated, Green (MID 760249102)

C. Copper Termination Hardware

1. Circa or ITW Protection Block with Solid State Modules
2. CommScope rack mounted Category 5e patch panels.
3. All blocks shall include labeling strips, bracket kit, and distribution rings.
4. Provide QTY 2 (1000ft) reels of 2-pair cross-connect Cat3 cable.
5. 66-Blocks for Overhead Paging System Riser.

2.03 FIBER OPTIC CABLE

A. Manufacturers:

1. Outside Use – CommScope – All dry outside plant stranded loose tube
2. Indoor/Outdoor Use – CommScope – Tight Buffered Plenum
3. Indoor Use – CommScope – Interlocking Armored Plenum

B. Fiber optic cabling:

1. 24 strand Single-mode Interlocking armored plenum (CommScope/SYSTIMAX) – P-024-DZ-8W-FSUYL
2. 24 strand OM3 Multi-mode interlocking armored plenum (CommScope/SYSTIMAX) – Patient Monitoring P-024-DZ-5L-FSUAQ

C. Outside Plant cable shall be TeraSPEED® Single Jacket/Single Armor, Gel-Free, Outdoor Stranded Loose Tube Cable. D-xxx-LA-8W-F12NS where xxx represents strand count required.

D. Indoor/Outdoor Fiber shall be TeraSPEED® Indoor/Outdoor Plenum Distribution Cable, interlocking aluminum armored with plenum jacket. P-xxx-OZ-8W-FSUBK where xxx represents strand count required.

E. Fiber optic cables shall always have minimum 20-foot service loop at the terminating ends and all approved splice points. Place service loops with large bend radii neatly bundled on walls or on the attached to the bottom side of ladder trays in 'figure-8' configuration.

F. Indoor Backbone Fiber Optic Cable

1. Cable must be suitable for installation in free air, in building risers, in conduit, in cable tray and in innerduct
2. Cable shall meet the following specifications:

a Jacket Material: PVC or FEP or equivalent as required for cable rating
b Buffer Diameter:900 microns (tight buffer)
c Jacket Color

i Single-mode: YELLOW
ii Multimode: AQUA

d Cable Rating: OFNR or OFNP as required by cable installation environment.
e Strength Member: Aramid Yarn
f Storage Temperature: -40° to +70°C (no irreversible change in attenuation)
g Operating Temperature: -20° to +70°C (no irreversible change in attenuation)
h Humidity Range: 0 to 100%
i Maximum Tensile Strength:

i During Installation – 2700 N (no irreversible change in attenuation)
ii Long Term – 1000 N

j Bending Radius:

i During Installation – 20 times cable diameter
ii No Load – 10 times cable diameter

2.04 FIBER OPTIC PIGTAILS AND TERMINATION HARDWARE

A. Manufacturers:

1. CommScope/SYSTIMAX (Single Mode)– FAWLCUCOC
2. CommScope/SYSTIMAX (Multimode) – FAXLCUCOC

B. Pigtails will be used at both ends of the backbone fiber and must adhere to the following requirements:

1. LC-type.
2. Accept fibers having clad diameter of 125 microns.
3. Accept fibers having buffered diameter of 900 microns.
4. Sustain minimum of 200 mating cycles.
5. Pigtails shall be color-coded (Blue, Orange, Green, Brown, Slate, White, Red, Black, Yellow, Violet, Rose, and Aqua).

C. Connector ferrule shall be or ceramic or glass-in-ceramic

D. Connectors shall meet the following performance criteria:

	Test Procedure	Max Attenuation Change
2.	Cable Retention (FOTP-6)	0.2 dB
3.	Durability (FOTP-21)	0.2 dB
4.	Impact (FOTP-2)	0.2 dB
5.	Thermal Shock (FOTP-3)	0.2 dB
6.	Humidity (FOTP-5)	0.2 dB

E. Optical fiber shall be fusion spliced with LC terminated pigtail

F. Attenuation per mated connector pair shall not exceed 0.75dB

G. Maximum Reflectance of patch-cords with the correct matching connectors shall be:

1. Single-mode: -40 dB

H. Fiber termination hardware

1. CommScope Fiber Optic Patch Panel – HD-1U
2. CommScope Fiber Optic Modules – G2-SP-12LCG-PT

2.05 POWERED FIBER SOLUTION

A. Manufacturer

1. CommScope Powered Fiber Cable System, complete with all materials, accessories, and labor required for a turnkey end-to-end installation.

B. General Requirements

1. Contractor shall furnish and install all cabling and components required for a complete powered fiber solution including, but not limited to:
    a. DC power supplies, power shelves, power modules, and slot fillers.\
    b. DC rectifier shelves, rectifier modules, rectifier controllers, and slot fillers.
    c. Hybrid powered fiber cable with a minimum of 4 single-mode OS2 fibers and 12 AWG stranded conductors for power distribution.
    d. PoE extenders (minimum 1-port, 60 W) with outdoor-rated enclosure, cover, and pole-mount assembly.
    e. Single-mode SFP+ transceivers supporting TX/RX fiber connections.
    f. Fiber patch panels, splice trays, adapter panels, and patch cords to terminate single-mode fiber within the MDF room.
    g. Category 6 patch cords to field devices such as pole-mounted security cameras, video intercoms, and POS stations.
    h. Category 6 patch cords and fiber-to-copper media converters as required for device connectivity to the network in the MDF room.
2. Contractor shall provide a complete turnkey solution for any cable distances exceeding 295 feet from network equipment to connected device.
    a. Coordinate installation with Harris Health IT prior to deployment.
    b. Coordinate with Division 26 electrical contractor for power requirements supporting DC power supplies and rectifiers within the MDF room.

C. Powered Fiber Cable

1. Single-mode OS2 construction with 12 AWG conductors:
    a. PFC-S02L12 – OSP rated.
    b. PFC-S04L12 – OSP rated.

D. MDF Equipment and Components

1. Power Supply Assembly (typical configuration): PFP-PX-S1 Distribution Shelf, PFP-PX-8M Module, PFP-PX-SF Slot Filler, PFP-SPS-1600M Rectifier Module, PFP-SPS-C1 Rectifier Controller, PFP-SPS-SF Slot Filler, and associated interconnect cabling and grounding conductors.
2. CommScope fiber terminations including FAWLCUCOC pigtails and FEWLCLC42-JXF007 patch cords (or as required for system design).
3. Surge suppression modules such as Ditek DTK-2MHLP48B and DTK-4MB base assembly.
4. Hardened single-mode SFP transceivers (Transition Networks TN-GLC-LX-SM-RGD or approved equal).
5. Media converters, fiber panels, splice cassettes, patch cords, and all miscellaneous materials for power and grounding connections as required.

E. Edge Devices

1. PoE Extenders (PFU-P-C-O-060-01 or approved equal). (1 Port for Site Cameras)
2. PoE Extenders (PFU-P-C-O-060-02 or approved equal). (2 Port for MAMMO Unit)
3. Hardened single-mode SFP transceivers (Transition Networks TN-GLC-LX-SM-RGD or approved equal).
4. CommScope powered fiber cable terminations using FAWLCUCOC pigtails.
5. CAT6A F/UTP outdoor-rated patch cords (CO11192-01F006 or approved equal).

6. Provide minimum 16 AWG ground wire from each PoE extender to an approved ground point.

F. Representative Materials

1. Products referenced in this section represent typical CommScope Powered Fiber Solution components, including: hybrid powered fiber cables, power supply shelves, rectifier modules, PoE extenders, fiber termination hardware, media converters, and associated grounding and surge protection devices. Specific component quantities and configurations shall be as required to meet the design intent for each project and approved by the Owner prior to installation.

G. Installation and Execution Requirements

1. Install all systems in accordance with manufacturer's published instructions and applicable codes and standards.
2. Locate power supply equipment in a safe area with access to fiber network infrastructure and either 120 VAC, 240 VAC, or 48 V UPS power.
3. Consider the following parameters prior to deployment: distance from power supply to device, maximum device power consumption, number of devices, cable type, and fiber management requirements.
4. For duct installation, use PE-jacketed outdoor cable; avoid twisting, use standard cable lubricants, and employ a figure-8 layout if a reel cannot be positioned at the pull site.
5. Although PE-jacketed cable is direct-burial rated, install below-grade runs in conduit for long-term reliability.
6. Powered fiber cable is not rated for aerial self-support; utilize approved lashing methods.
7. Use standard wire strippers and snips for cable access.
8. To prevent shrink-back and enhance coupling, form slack coils (approximately five loops input and five-and-one-half loops output) at each splice closure or tap in accordance with manufacturer guidelines.
9. For buried duct installation, use polyethylene PE-jacketed outdoor cable; LSZH riser-rated indoor/outdoor cable may be used where required but with reduced pull lengths due to friction.
10. Provide grounding at each PoE extender, rectifier chassis, distribution panel, and rectifier return lug.
11. Torque all cable glands to manufacturer-specified values.

PART 3 – EXECUTION

3.01 CABLE INSTALLATION

A. Submit the cable pulling plan to the Owner prior to commencement of the operation.

B. The route of multi-pair copper cable installation is as described herein or as shown on the Drawings.

C. When breaking out any multi-pair copper cable of 50 pairs or greater for splicing or termination, the binder groups shall have PIC color coded cable ties attached to the cable at the point of fan -out from super groups for splicing, and at the point of fan-out for termination on termination blocks.

D. Ensure the cables are pulled into the ducts in a manner observing the bend radii and tension restrictions of the cable.

E. Use appropriate shoes, guides, wheels and lubricants to prevent damage to the cable jacket and sheath during installation.

F. Install shield bond connectors to the shields of all cables terminated at the Protector Panels.

G. Apply an appropriate amount of damming compound over the end of filled copper cables in indoor or dry environments to prevent seepage of cable filling compounds where encapsulate will not be used.

H. Prior to closure assembly in dry or indoor installations, all exposed cable pairs shall have the filling compound thoroughly cleaned off the cable insulation using appropriate cleaning solvents.

I. All pairs spliced shall be tested and all splice-related faults cleared prior to sealing the closure assembly.

J. All multi-pair copper cable pairs installed shall be tested for standard wire mapping, continuity, opens, shorts and grounded pairs. Record and deliver all test results in paper and electronic media.,

K. The Owner is to be notified at least 24 hours prior to testing to allow observation at the Owner's discretion. If the Owner confirms his intention to observe, a reasonable starting time will be agreed upon. Should the Owner not be present at the scheduled commencement time, the Contractor may begin testing as scheduled.

L. All test results are to be recorded and turned over to the Owner for checking.

M. Terminate fibers in a consistent, consecutive color-coded manner at each end. Use color-cod recommendations by hardware manufacture.

N. Provide a minimum 36” of slack of buffered fiber inside each fiber optic patch panel.

O. Testing of pressurized splice cases: All exterior splice cases shall be pressure tested at 10 lbs. PSI and maintain a minimum of 98% of this pressure for a minimum of 24 hours and a minimum of 95% for 48 hours.

3.02 CABLE AND TERMINATION PANEL LABELING

A. Label the installed cables in accordance with Section 27 05 53

3.03 CABLE SUPPORT

A. Provide cable supports and clamps to attach cables to backboards and walls.

1. Attach horizontal and vertical backbone cables at 2 foot intervals using Owner approved supports.
2. No tie wraps will be allowed; Velcro only throughout the entire system.
3. Use Velcro for routing, securing backbone, riser and horizontal cables in a neat, loose but secure manner.
4. Attach cables to manhole racks using Owner approved methods.

3.04 AS BUILT DRAWINGS

A. Provide three (3) copies of E and three (3) copies of C size prints along with CAD files in .dwg or .dxf formats showing floor plans with room numbers and actual backbone cabling and pathway locations and labeling. The deliverable is required within 5 business days of final cable testing.

1. Red Line Drawings: Contract must kept one (1) E size set of floor plans on site during work hours with installation progress marked and backbone cable labels noted. Contractor may be asked to produce these drawings for examination during construction meetings or field inspections.

END OF SECTION 27 13 00

SECTION 27 15 00 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for the Communications Horizontal Cabling System for the Harris Health System.

B. Section includes twisted pair cable, connectors, faceplates, and testing.

C. All voice and data horizontal cables shall consist of plenum rated, Category 6A, 4 pair UTP copper cable from the appropriate Telecommunication Room to each Workstation Outlet location as indicated on the Telecommunications Drawings.

D. Installation and termination of voice and data Category 6A as designated on the on the Telecommunications Drawings.

E. Installation and termination of two (2) Category 6A cable with a 20’ service loop at each Wireless Access Point Outlet as indicated on the Telecommunications Drawings. Provide labor to move 20% of the access points after the owner completes the wireless coverage survey. All Wireless Access Points are Owner provided and Contractor installed.

F. Installation and termination of coaxial cable CATV locations as indicated on the Telecommunications Drawings.

G. All information outlets will be flush-type mounted into conduits and boxes.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 – PRODUCTS

2.01 GENERAL

A. Cables and termination hardware shall be technically compliant with and installed in accordance with referenced ANSI/TIA documents.

B. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of National Electrical Code and shall meet specifications of NEMA (low loss), UL 444, and ICEA (where applicable).

C. The project shall be registered for a CommScope Twenty-Five (25) Year SYSTIMAX Solutions Extended Product Warranty and test data submitted for acceptance.

D. Horizontal Cable and Termination Components specified are to function as a System.

1. If different manufacturers of cabling and termination components are used, they shall recognize each other in their Certification Programs for warranty purposes with the termination component manufacturer providing the certification.

E. Horizontal Cable types include:

1. 4-pair Copper Unshielded Twisted Pair (UTP)
2. Quad Shielded RG6 75-ohm coaxial cable (for CATV applications only)

F. If the interior of walls is not obstructed, the contractor shall conceal horizontal distribution wiring internally within the walls. If such obstructions exist, the contractor shall secure approval from the GC prior to the use of an alternate method.

G. Every effort will be made to schedule the requirements under this contract in such a manner so as to complete all above-ceiling work prior to ceiling tile installation. In the event that the contractor is required to remove ceiling tiles, such work shall not break or disturb the grid and must be coordinated with the GC.

H. The contractor shall provide detailed cable-run diagrams for cable runs within raised floors showing the exact locations of cable for review and approval by the Harris Health System designee.

I. Station cables and tie-cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.

J. All horizontal 4PR UTP cabling shall be terminated on 360-E-Mod-2U Panels on the rack.

2.02 4-PAIR UTP HORIZONTAL COPPER CABLE

A. Plenum–rated, Category 6A Small Diameter Unshielded Twisted Pair (UTP)

1. Color:

a. Blue – Network

B. Plenum–rated, Category 6A Small Diameter Unshielded Twisted Pair (UTP)

1. Color:

a. Orange- Patient Monitoring

C. Plenum-rated, Category 6A Small Diameter Unshielded Twisted Pair (UTP)

1. Color:

a. Orange – Nurse Call

D. The 4 pair UTP cable shall be Underwriter Laboratories (UL) listed type CMP.

E. Manufacturers:

1. CommScope/SYSTIMAX GigaSPEED X10D (2091SDB) – Cat6A
2. CommScope/SYSTIMAX Voice Riser (2010) – Cat3

F. Note: The minimum acceptable electrical performance characteristics of the 4-pair horizontal UTP copper cable based on CommScope SYSTIMAX 2091SDB Category 6A must meet the following requirements:

1. ETL verified to meet or exceed ANSI/TIA-568-D.2-1, Category 6A performance requirements.
2. Minimally tested to 500 MHz.
3. Exhibit nominal Velocity of Propagation of 66%.
4. Exhibit a maximum dc Resistance of 7.61 ohms/100 m | 2.32 ohms/100 ft
5. Exhibit a mutual capacitance at frequency of 6.0 nF/100 m @ 1 kHz
6. Cable shall not incorporate an overall shield.

2.03 HORIZONTAL COAXIAL CABLE

A. Horizontal Coaxial Cable shall be RG6- type (Series 6), Quad-shield, plenum-rated.

B. Manufacturer:

1. CommScope 2227V

C. Cables shall be suitable for installation in environment defined and shall meet Plenum - CATVP rating as defined by NEC.

D. Both CATV and network cabling will be sometimes routed in the same pathways. Contractor must maintain organized separation from network cabling to prevent interference on the network cabling from EMI produced by the broadband system.

E. Coaxial cable shall be sweep tested 1 MHz to 3 GHz.

F. RG- Type (Quad-shield)

1. Center Conductor: 18 AWG solid bare copper or copper-clad steel.
2. Dielectric: Foam FEP or equivalent as required for cable rating.
3. First shield: Aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric.
4. Second shield: 34 AWG aluminum braid wire (0% coverage).
5. Third shield: Non-bonded aluminum foil shield.
6. Fourth shield: 34 AWG aluminum braid wire (40% coverage).
7. Jacket: Commflex(V), Foam FEP, or equivalent as required for cable rating.
8. Impedance: 75 ± 3 ohms
9. Nominal Velocity of Propagation (NVP): 84% nominal
10. Maximum Attenuation:

a. 50 MHz: 1.48 dB/100 ft
b. 700 MHz: 5.96 dB/100 ft
c. 1 GHz: 7.45 dB/100 ft
d. 2.2 GHz: 11.54 db/100 ft

2.04 TELECOMMUNICATIONS FACEPLATES

A. Manufacturer:

1. CommScope/SYSTIMAX – (M10L-xxx & M14L-xxx) (verify that the communications face plate matches the color of the electrical faceplates)

B. Faceplate housing shall be one-piece, flush mount style that fits standard NEMA openings.

C. Faceplates shall have two separate labeling areas.

D. Label areas shall be covered with a clear plastic insert.

E. Unused ports shall have blank inserts installed.

2.05 WALL PHONE-MOUNT FACEPLATES

A. Stainless – CommScope – (M10LW-Stainless Steel)

B. Including Label Field

C. Wall mounted telephone faceplates: Provide stainless steel faceplate with wall phone hanging stubs wired with integral 8-position, 8-conductor data jack wiring in accordance with the T568-B wiring designation for the termination of UTP cables specified herein.

2.06 WIRELESS ACCESS POINT FACEPLATES

A. Surface mounted, plenum rated, biscuit block with plenum rated, modular jack or connector.

B. Made of High Impact thermoplastic.

C. Surface Mount Box: (SMB-2P-262)

2.07 MODULAR OUTLETS/ INSERTS

A. Manufacturer:

1. CommScope/SYSTIMAX

B. Modular jacks shall be 8 pin-8 conductors, non-keyed.

C. Insulation displacement type contact.

D. Jack inserts shall meet or exceed the performance requirements of the cable being installed.

E. Cat6A Data jack: MGS600-318 blue outlets

F. Cat6A Jacks for Patient Monitoring and Nurse Call: MGS600-112 orange outlets

G. Outlet Icon: M61A-318

H. Outlet Dust Cover: M20AP-318

2.08 PATCH PANELS

A. Manufacturer:

1. CommScope/SYSTIMAX

B. 360-E-ANG-MOD-2U-48 modular patch panels.

C. For those locations with existing IDR's that have VP360 panels installed, use VP360 panels.

2.09 COAXIAL CONNECTORS

A. Coaxial Connectors shall be threaded male F-type.

B. Male F-connectors shall be:

1. Matched to cable type(s) used.
2. Single piece connector.
3. Incorporate compression connectors with a compression installation tool.

PART 3 – EXECUTION

3.01 GENERAL

A. Follow manufacturer's installation guidelines.

B. All data and voice cabling and terminations and termination hardware shall be ANSI/TIA wiring configuration T568B.

C. The maximum horizontal Permanent Link distance shall be 295 feet

D. Adhere to the manufacturer's guidelines on bend radii and maximum pulling tension during installation. Notice that the recommended minimum bend radius for a cable during installation is typically greater than the recommended bend radius after the cable is installed. This is to minimize tension and deformation as the cables pass around corners during installation. The maximum pull-force guideline for 4-pair horizontal balanced twisted pair cables is 110 N (25 lbf).

E. Provide a minimum of 10-foot service loop for every horizontal cable and 20-foot service loop for Wireless Access Points in ceiling above outlet. Locate service loop where horizontal cable run transitions to the last J-Hook support before the cable enters the fishable wall, conduit, surface raceway or box.

F. Keep all items protected before and after installation from dust and moisture proof barrier materials/envelopes. If wiring is terminated on data jacks prior to painting, carpet installation, and general finish clean-up, these jacks shall be placed in a protective envelope to ensure dust, debris, moisture, and other foreign material do not settle onto jacks, contacts. Envelope

will be removed on final trim out after other trades have finished their work. If wiring is terminated on patch panels prior to completion of build-out of Telecom Room, these ports shall be protected with blue painter's tape placed over all ports of patch panel. Painters tape to be removed after Telecom Room is built out and cleanup of space is complete. It shall be the contractor's responsibility to ensure the integrity of these protective measures throughout the life/installation of the project.

G. Provide a minimum of 5-foot service loop at telecommunications/data rooms or by routing the cables within the room by taking the longest available path through the perimeter cable tray.

H. Limit the size of cable bundles along pathways and in communications equipment rooms to 24 cables for category 6A.

I. The horizontal distance is the cable length from the mechanical termination of the media at the horizontal cross-connect in the telecommunications room to the telecommunications outlet/connector in the work area. The maximum horizontal distance shall be 295 ft, independent of media type.

J. The length of the cross-connect jumpers and patch cords in the cross-connect facilities, including horizontal cross-connects, jumpers, and patch cords that connect horizontal cabling with equipment or backbone cabling, shall not exceed 5 m in length. For each horizontal channel, the total length allowed for cords in the work area plus patch cords or jumpers plus equipment cables or cords in the telecommunications room shall not exceed 10 m (33 ft).

K. Cable and components shall be visually inspected for proper installation. Cable stress, such as that caused by tension in suspended cable runs and tightly cinched bundles, shall be minimized. Plenum rated Velcro ties used to bundle cables shall be applied loosely to allow the Velcro tie to slide around the cable bundle. The Velcro ties shall not be cinched so tightly as to deform the cable sheath. Cable placement shall not deform the cable sheath. Tightly bundled cables are not acceptable.

L. Minimum bend radius: The minimum bend radius for cable will vary depending on the condition of the cable during installation (tensile load) and after installation when the cable is at rest (no-load).

M. The minimum bend radius, under no-load conditions, for 4-pair unshielded twisted-pair (UTP) cable shall be four times the cable diameter.

N. Copper cable splicing or bridge tapping is unacceptable.

O. Minimum power separation for UTP cabling systems:

1. Motors or transformers: 4 feet
2. Power cables and conduits: 1 foot parallel, 3 inches crossover
3. Fluorescent lights: 5 inches
4. Above ceiling tiles: 3 inches
5. Access above cable tray: 12 inches
6. Hot Flues, Steam pipes, Hot water pipes and other hot surfaces: at least"

P. Cables shall be terminated with connecting hardware of the same category or higher. To maintain the cable geometry, remove the cable sheath only as much as necessary to terminate the cable pairs on the connecting hardware. The connecting hardware manufacturer's instructions for cable sheath strip-back shall be followed. When terminating Category 6 and Category 6A cables, the cable pair twists shall be maintained to within 13 mm (0.5 in) from the point of termination. For best performance when terminating cable on connecting hardware, the cable pair twists shall be maintained as close as possible to the point of termination.

Q. Horizontal Cat 6A cables must be installed on the same floor as the MDR/IDR serving them.

3.02 SITE QUALITY CONTROL, TESTING, AND INSPECTION

A. Approved UTP/Fiber test equipment: Fluke Versive DSX cable analyzer and Fluke OptiFiber OTDR.

B. Every cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA/EIA-58-D.2-1 “Transmission Performance Specifications for 4-pair Category 6 and/or 6A Cabling”.

C. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the telecommunication wall outlet in the work area against the “Permanent Link” performance limits specification as defined in ANSI/TIA/EIA-58-D.2-1.

D. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

E. Test Plan: Provide a complete and detailed test plan for the cabling system specified herein including a complete list of test equipment for UTP and light guide components and accessories. Include procedures for certification, validation, and testing. Furnish factory reel tests for all cable. Owner will require the Telecommunications Cabling System installed by the contractor is fully certified to meet all necessary requirements to be compliant with referenced IEEE and ANSI/TIA communications specifications. Must show proof of test equipment certification and installer training with qualifications in submittals.

F. The approved test equipment shall comply with the accuracy requirements for level IV field testers as defined in ANSI/TIA-568-D.2-1. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table B.2 of Annex B of ANSI/TIA-568-D.2-1. (Table B.3 in this document specifies the accuracy requirements for the Channel configuration.)

G. The test plug shall fall within the values specified in E.3.2.2 Modular test plug NEXT loss requirements of ANSI/TIA-568-D.2-1.

H. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

I. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Cable Contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss Change, the adapter cord cable shall not be of twisted-pair construction.

J. One hundred percent of the installed cabling links must be tested and must pass the requirements of the standards in this section. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with the Test Result Documentation as listed below.

3.03 SITE TESTING, INSPECTION AND ACCEPTANCE

A. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

B. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks.

C. A representative of the design team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing commences.

D. At the conclusion of field testing, at a time scheduled by the Owner's representative, the Owner's representative will select a random sample (up to 10%) of the installed links in each wiring closet. The Cable Contractor, under supervision of the Owner's representative, shall test these randomly selected links and the results are to be stored in accordance with the requirements in Test Result Documentation as listed below.

E. The results obtained shall be compared to the data originally provided by the Cable Contractor. If any (one or more) of the sample test reports displays a fail or fail* result, the Cable Contractor shall resolve any conditions causing the failed test and under supervision of the Owner's representative shall repeat 100% of the testing and the cost shall be borne by the Cable Contractor.

3.04 PERFORMANCE TEST PARAMETERS

A. The test parameters for Category 6 are defined in TIA Category 6 and/or Category 6A standard, which refers to the ANSI/TIA-568-D.2 standard. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test all measurements (at each frequency in the range from 1 MHz through 100 MHz) must meet or exceed the limit value determined in the above-mentioned standard.

1. Wire Map

    a. Wire Map shall report Pass if the wiring of each wire-pair from end to end is determined to be correct. The Wire Map results shall include the continuity of the shield connection if present.

2. Length

    a. The field tester shall be capable of measuring length of all pairs of a basic link or channel based on the propagation delay measurement and the average value for NVP (1). The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the Permanent Link configuration (90 meters – 295 feet) plus 10% to allow for the variation and uncertainty of NVP.

3. Insertion Loss (Attenuation)

    a. Insertion Loss is a measure of signal loss in the permanent link or channel. The term “Attenuation” has been used to designate “Insertion Loss.” Insertion Loss shall be tested from 1 MHz through 250 MHz in maximum step size of 1 MHz. It is preferred to measure insertion loss at the same frequency intervals as NEXT Loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results for the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which this worst case value occurs, and the test limit value at this frequency.

4. NEXT Loss

    a. Pair-to-pair near-end crosstalk loss (abbreviated as NEXT Loss) shall be tested for

each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1 through 250 MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the standard as shown in Table 1, column 2. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst-case NEXT margin (2) and the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

5. ELFEXT Loss, pair-to-pair

    a. Pair-to-pair FEXT Loss shall be measured for each wire-pair combination from both ends of the link under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ELFEXT Loss that must be evaluated and reported in the test results. ELFEXT measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ELFEXT is to be measured from 1 through 250 MHz and the maximum step size for FEXT Loss measurements shall not exceed the maximum step size defined in the standard as in Table 1, column 2.
    b. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst-case margin and the wire pair combination that exhibits the worst value for ELFEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

6. PSELFEXT Loss

    a. Power Sum ELFEXT is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs on the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through 250 MHz in frequency increments that do not exceed the maximum step size defined in the standard as shown in Table 1, column 2. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

7. Return Loss

    a. Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured from 1 through 250 MHz in frequency increments that do not exceed the maximum step size defined in the standard as shown in Table 1, column 2.
    b. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

8. ACR (Attenuation to crosstalk ratio)

    a. This parameter is not demanded by the standard but may be required in order to obtain the premise wiring manufacturer's warranty. ACR provides an indication of bandwidth for the two wire-pair network applications. ACR is a computed parameter

that is analogous to ELFEXT and expresses the signal to noise ratio for a two wire-pair system. This calculation yields 12 combinations – six from each end of the link. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst-case margin and the wire pair combination that exhibits the worst value for ACR. These wire pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

9. PSACR

    a. [This parameter is not required by the standard but may be required in order to obtain the premise wiring vendor's warranty]. The Power Sum version of ACR is based on PSNEXT and takes into account the combined NEXT disturbance of all adjacent wire pairs on each individual pair. This calculation yields eight combinations -one for each wire pair from both ends of the link. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PSACR. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

10. Propagation Delay

    a. Propagation delay is the time required for the signal to travel from one of the link to the other. This measurement is to be performed for each of the four wire pairs. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay. The report shall include the propagation delay value measured as well as the test limit value.

11. Delay Skew [as defined in ANSI/TIA-568-D.1; Section 11.2.4.11]

    a. This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.

B. Test Result Documentation

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.
2. The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test and that these results cannot be modified at a later time. Superior protection in this regard is offered by testers that transfer the numeric measurement data from the tester to the PC in a non-printable format.
3. The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.
4. The test results shall be provided in native format (.flw) in addition to PDF format.
5. General Information to be provided in the electronic data base with the test results information for each link:

k The identification of the customer site as specified by the end-user.
l The identification of the link in accordance with the naming convention defined in the overall system documentation.
m The overall Pass/Fail evaluation of the link-under-test.
n The name of the standard selected to execute the stored test results.

o The cable type and the value of NVP used for length calculations.
p The date and time the test results were saved in the memory of the tester.
q The brand name, model and serial number of the tester.
r The identification of the tester interface.
s The revision of the tester software and the revision of the test standards database in the tester.
t The test results information must contain information on each of the required test parameters.
u The name of the person performing the test.

6. The detailed test results data to be provided in the electronic database for each tested link must contain the following information:

   a. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. In this case, the PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.

   i Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.1 m (1) and the test limit value.
   ii Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value.
   iii Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value.
   iv Attenuation: Minimum test results for the worst pair.
   v Return Loss: Minimum test results for the worst pair as measured from each end of the link.
   vi NEXT, ELFEXT, ACR: Minimum test results documentation for the worst pair combination as measured from each end of the link.
   vii PSNEXT, PSELFEXT, and PSACR: Minimum test results documentation for the worst pair as measured from each end of the link.

END OF SECTION 27 15 00

SECTION 27 16 00 – COMMUNICATIONS CONNECTING CORDS, DEVICES AND ADAPTORS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for the Communications Connecting Cords, Devices and Adaptors for Communications Systems for the Harris Health System.

B. Section includes:

1. 4-pair Modular Category 6A Small OD Patch Cords
2. Single-mode Fiber Optic Patch Cords
3. Coaxial Patch Cords

1.02 RELATED REQUIREMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 27-05-00 Common Work Results.

C. Section 27-05-26 Grounding and Bonding for Communications Systems.

D. Section 27-05-28 Pathways for Communications Systems.

E. Section 27-05-53 Identification for Communications Systems.

F. Section 27-11-00 Communications Equipment Room Fittings

G. Section 27-13-00 Backbone Cabling Requirements

H. Section 27 15 00 – Communications Horizontal Cabling

PART 2 – PRODUCTS

2.01 COPPER PATCH CORDS

A. Approved Manufacturers: CommScope SYSTIMAX

1. Category 6A/Class Ea – MiN06A, CO199K2-0ZF007 (BLUE) (Workstation, 100% of horizontal cables installed)
2. Category 6A/Class Ea – MiN06A, CO199K2-06F007 (ORANGE) (Patient Monitoring, Nurse Call, 100% of horizontal cables installed)
3. Category 6A/Class Ea – MiN06A, CO199K2-0ZFxxx where xxx is length in footage (BLUE) (IDR Network Switch Connectivity, 100% of 6A installed)
4. Category 6A/Class Ea – MiN06A, CO199K2-06Fxxx where xxx is length in footage (ORANGE) (IDR Network Switch Connectivity, 100% of 6A installed)
5. Category 6A/Class Ea – MiN06A, CO199K2-0ZF003 (BLUE) (VOIP Phones, 75% of horizontal cables installed)
6. Category 6A/Class Ea – MiN06A, CO199K2-0ZF001 (BLUE) (VOIP Wall Phones, 5% of horizontal cables installed)

B. Patch cords shall meet or exceed performance requirements of TIA Category 6A.

C. Copper patch cables shall be of the same category and manufacturer as the cable listed in Section 27 15 00.

D. Patch cords shall be plenum-rated with T568B pin out.

E. Quantities and Colors: Data patch cables are in the following quantities:

1. Patch cables for data shall be Cat6A, Minimum OD, Blue for Data Drops, Orange for Nurse Call and Patient Monitoring
2. Patch cables at workstation shall be blue and all 7’ in length. CO199K2-0ZF007 (BLUE), CO199K2-06F007 (ORANGE).
3. Patch cables in existing IDR’s with existing modular patch panels shall be blue and orange from 5’ to 10’ in length. CommScope part number CO199K2-0ZFxxx and CO199K2-06Fxxx where xxx is the length in feet.
4. Two (2) patch cables category 6A shall be provided for each horizontal run in the colors and lengths mentioned above.
5. All patch cables for Telecom Rooms shall be Category 6A or above factory made, field terminated patch cables are strictly prohibited. Field terminated patch cables are strictly prohibited.

F. At minimum, every horizontal cabling permanent link in the installation shall meet or exceed performance characteristics of the field test specifications defined in ANSI/TIA/EIA-568-D.2-1 “Transmission Performance Specifications for 4-pair 100 Ohm Category 6A Cabling”.

G. Patch cords shall be in original packaging when presented to owner. E.g., sealed plastic bags, boxed.

H. Legacy System Patch cords shall be installed by the contractor into the patch panels and put into the cable management pathways on the right side of the front of the rack.

I. The cables will be bundled 6 cables per bundle using Velcro Brand One-Wrap Strap, ¾” Black 330 Part # 189645 one foot from both ends and two additional wraps separated by at least 12 inches in the middle of the bundle.

2.02 FIBER OPTIC PATCH CORDS – SINGLEMODE

A. Approved Manufacturers:

1. CommScope SYSTIMAX – FEWLCLC42-JXFxxx where xxx is footage

v Color: Cable jacket – YELLOW, Connectors – BLUE.
w Duplex LC-LC type fiber optic patch cable for fiber optic termination.
x Riser Rated, 1.6 mm cordage.
y Duplex patch cords shall be configured per TIA/EIA-568-D-1.
z Fiber optic patch cables types shall coincide with terminated fiber optic type.
aa Field terminated patch cords are strictly prohibited.

2.03 FIBER OPTIC PATCH CORD QUANTITIES

A. Furnish LC-LC Duplex Single-mode Fiber Optic Patch Cords in the same quantities as the number of fibers terminated in each room and in the following lengths

1. 20% each- 5’, 6’, 7’, 8, 9’

2.04 COAXIAL PATCH CORDS

A. Series 6 Coaxial – CP-3FT

PART 3 – EXECUTION

3.01 PATCH CABLES

A. Fully cooperate and coordinate with Owner's Voice and Data Communications Equipment providers as required to ensure proper integration and connectivity between systems.

B. Care must be taken to protect the minimum bend radius of 4 times the cable diameter on all copper patch cables.

C. Furnish labeled floor plan and Excel run sheet to Owner's Voice and Data Communications Equipment providers two weeks prior to occupancy.

D. Furnish and install all patch cords in conjunction with Owner's Voice and Data Communications Equipment providers.

E. Provide adequate technician support when Owner's Voice and Data Communications Equipment providers are planning and installing new voice and data equipment installation and connectivity.

F. After installation of patch cords/jumpers provide and deliver any remaining patch cords/jumpers to the owner. Refer to the General Contractor for contact details.

END OF SECTION 27 16 00

SECTION 27 20 00 – DATA COMMUNICATIONS EQUIPMENT

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 specifies the requirements for the Data Communications Equipment for the Harris Health System Sunset Clinic in Houston, Texas.

B. Data Communications Equipment

1. Data Communications Equipment includes customer owned routers, servers, Ethernet switches, personal computers, printers, wireless access points, etc. required to connect the Emergency Center Renovation to the rest of the campus and the internet.
2. Data Communications Equipment at Harris Health System is provided by Owner.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 COORDINATION

A. Cable Contractor shall fully cooperate and coordinate with Owner as required to ensure proper integration and connectivity between systems.

B. Cable Contractor shall furnish labeled floor plan and excel run sheet to Owner two weeks prior to occupancy.

C. Cable Contractor shall furnish and install all patch cords in conjunction with Owner.

D. Cable Contractor shall provide adequate technical support to Owner during planning, installation and connectivity of new voice and data equipment.

E. Cable Contractor shall provide adequate technician support first business day after data equipment installation and connectivity.

END OF SECTION 27 20 00

SECTION 27 40 00 – AUDIO-VIDEO SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes furnishing, installing, testing, and documenting audio-visual systems for Remote Viewing Systems, Conference Rooms, Breakrooms, and Lounges. Refer to the Responsibility Chart on the AV index sheet for specific items/portions of work and who is providing it for the project.

B. These systems include some or all of the following:

1. Wall-mounted, ceiling and ceiling-hung speaker systems.

2. Mounting of flat panel displays and video projectors.

3. Audio input/output panels, microphones, wireless microphone systems, mixers, switchers, audio processors, and amplifiers.

4. Video input/output panels, PTZ cameras, video switchers, and scalers.

5. Video conferencing codecs, microphones, cameras, mounts and cables.

6. Programmable audio-visual remote and automated control system and associated support devices for controlling audio and video systems, etc.

7. Floor, wall, and desktop connection hubs for audio, video, broadband, LAN, remote control signaling, computer, and pull junction boxes.

8. Wiring and connectors.

9. Mobile carts for certain use case scenarios and room designs

10. Hardware that will provide the ability to use PCs or Laptops as soft codecs (MS Teams, Zoom, Doxy.me etc.) utilizing existing or newly provided. Neat Video Conferencing or applicable / HH approved Microsoft Teams Room (MTR)

11. -Extron Media Pro 200 (for use in larger systems using 3rd party control; Creston/Extron)

1.03 OVERVIEW

A. The work detailed by these specifications and drawings has been specified to meet certain requirements for performance. Some information, such as exact equipment models, layout, wire routing, additional conduit and power requirements, etc. has been omitted. It shall be the responsibility of the Contractor to translate these specifications and drawings into a complete design package containing all necessary elements for a complete turnkey installation including all material, labor, warranties, shipping, and permits.

B. General elements of the work shall consist of but not be limited to:

1. Procure all permits and licenses required to complete this installation.

2. Attend pre-construction/pre-submittal meeting with the Owner and Consultant to review the design package for the Audio-Video Systems.

3. Prepare a schedule of work.

4. Submittal preparation and processing prior to ordering equipment.

5. Attend the submittal review meeting.

6. Provide materials necessary to complete the Audio-Video Systems.

7. Perform camera pre-installation sign-off walk-through with Owner and Consultant.

8. Installation of cameras and camera cabling.

9. Provide all required software and licenses to the Owner.

10. The contractor shall provide continuous on-site supervision of the installation technicians. On-site supervision shall include daily supervision of the work, updating work site progress drawings to reflect changes and installation details, preparing weekly progress reports and attendance at site coordination meetings as directed by the Owner and Consultant.

11. The Contractor shall provide all miscellaneous hardware including cable management devices, termination cabinets, wire and cable labeling materials, fasteners, hangers, and brackets as required.

12. The contractor shall provide all materials, equipment, labor, and all other incidental material, tools, appliances, and transportation as required for a complete and functional audio video system (AVS) as described herein and supplementary drawings.

13. Coordination with all trades and Owner representatives as required facilitating the installation of the control system equipment including Door Hardware, Fire Alarm, Blinds, Shades, HVAC, and Electrical Divisions.

14. Coordinate receipt of owner-furnished equipment.

15. Install according to contract documents and manufacturers' recommendations.

16. Protect new and existing facilities finishes and equipment.

17. Maintain construction materials and refuse within the area of work.

18. Clean the work area at the end of each day.

19. Provide system software and programming and other materials necessary for the Audio-Video Systems to function by standard industry practices.

20. Program Audio-Video Systems and load with user-defined text and specified operations per design specifications and drawings.

21. Provide preliminary e-Control / web-GUI for all programmed interfaces and room systems to be reviewed by Harris Health AV Representative.

22. All touch panel and internet controls must have “User interface” (Basic functionality) and Lock able / password “Admin user interface” (Advanced functionality). Coordinate all programming with the Owner and Consultant for approval.

23. Provide network control and maintenance information for all rooms that contain control systems capable of enterprise-level management solutions.

24. Providing (3) final programming changes for all systems within the warranty period after the acceptance date.

25. Perform initial testing, programming, and adjustments with written reports.

26. Make final adjustments, calibrations, and programming modifications as directed by the Owner, Consultant, and Harris Health Representative.

27. Demonstrate all systems for final user acceptance testing.

28. Preparation of O&M manuals and as-built documents for the Owner's use.

29. Provide (2) trainings for the Owner's staff, facility personnel and technical staff.

30. Providing warranty service for a period of one year from acceptance date.

31. Provide extended system support options.

1.03 DEFINITIONS

1. AVS: Audio-Visual System.
2. OWNER: Harris County Hospital District
3. CFCI: Contractor Furnished Contractor Installed
4. OFOI: Owner Furnished Owner Installed.
5. CONTRACTOR: Contractor or subcontractor providing and installing the Audio-Visual System.
6. PROVIDE: Furnish, install, commission, test, and warrant.
7. WORK: Action required furnishing, installing, commissioning, testing, and warranting the Audio-Visual Systems.
8. COMPONENT: Any item of equipment or material that is an element of the Audio-Visual Infrastructure System.
9. ZONE – Separate parallel signal path with independent processing and alternate program capabilities.
10. AGC: Automatic gain control.
11. CCD: Charge-coupled device.
12. CTS: Certified Technology Specialist.
13. MPEG: Moving picture experts group.
14. NTSC: National Television System Committee.
15. UPS: Uninterruptible power supply.
16. POE: Power over Ethernet.

17. MTR: Microsoft Teams Room

1.03 PERFORMANCE REQUIREMENTS

1. These specialized AVS systems are designed to efficiently support the Owner's various facilities and activity areas in a manner, which can be proficiently managed by the staff. Work shall include the complete turnkey installation and commissioning of these systems per the following specifications and drawings.

1.03 SUBMITTALS

A. Contractor's on-site CTS supervisor shall review, approve, and sign off all submittal documents.

B. Provide documentation as outlined in quality assurance. Submit all supervisor and installation team members' resumes and manufacturer certification certificates.

C. Product Data:

1. Provide an index list of all system components including manufacturer and model number. The index list shall be arranged alphabetically by the manufacturer and then model number.

2. Manufacturer's literature sheets for all materials and equipment, including warranty information, recommended preventative maintenance, and spare part inventory recommendations. Literature containing more than one device shall be clearly marked to delineate the item(s) included in the Work. Literature shall be ordered to match the index list.

3. Clearly indicate color or special finishes.

4. Correlate products with 274000 Specification and use in the Project.

D. Pricing Forms: The contractor shall submit completed pricing form that includes an itemized listing of all equipment, materials and labor required for the installation of the system as specified herein for bid response consistency and change order pricing. The listing shall contain item description, item model number, quantity, unit cost and extended labor, material, and installation cost required to provide a complete and functional system for each room type.

E. The following format must be used for bid response packages. Products and pricing are for illustration purposes only and are not specific to this project.

Huddle Spaces

- Speakerphone
- Displays if Applicable 43" to 55" (owner to decide)
- HDMI/USB-C Input passive input plate (owner to decide if needed)
- Room Scheduler

Small Conference Room 4-6 Occupants

- 65" Interactive Flat Panel Display (IFPD)
- Viewsonic IFPD - Interactive Flat panel display ; Neat
- Neat Bar Camera/Microphone/Speaker
- Harris Health SFF PC with wall mount and Logi wireless mouse and keyoard (OFCI)

- Medical School PC with wall mount (OFCI if specified)
- Presentation Switcher
- Keypad with Control
- Room Scheduler

Medium Conference Room 10-12 Occupants

- 65” to 75” Viewsonic IFPD - Interactive Flat panel display https://neat.no/
- Neat Bar Pro Camera/Microphone/Speaker
- Harris Health SFF PC with wall mount and Logi wireless mouse and keyoard (OFCI)
- Medical School PC with wall mount (OFCI if specified)
- Presentation Switcher
- Keypad with Control
- Room Scheduler

Mobile Cart 4- 12 Participants

- Mobile cart with heavy-duty castors
- 75” Flat Panel Display
- Neat Bar Camera/Microphone/Speaker
- SFF PC with Wireless mouse and keyboard

Large Conference Rooms: Occupants 14-35

- 85” Flat Panel Interactive Display (IFPD) {may require 2-3 displays depending on the size of the space, either side by side or on opposite wall}
- Neat Bar, Pro,Vaddio, Aver, Logi PTZ USB cameras
- USB or Cat 6 Ceiling Microphone
- Ceiling Speakers and Amplifier
- Video or IP matrix solution (if applicable)
- Extron control system if applicable
- Harris Health SFF PC with wall mount and Logi wireless mouse and keyoard (OFCI)
- Medical School PC with wall mount (OFCI if specified)
- Room Scheduler
- Confirm room sources with owner and Harris Health AV representative

Multipurpose rooms & Auditoriums 25+ Occupants

- 85”-98” Displays/Projector 105” - 135” diagonal (Size and type of Display based on room size; may need additional displays as a confidence monitor or secondary displays for rear participants to see clearly)

- Vaddio, Aver PTZ, Logi USB cameras
- USB or Cat 6 Ceiling Microphone, Ceiling Speakers, Subwoofers and Amplifier
- Ceiling Speakers and Amplifier
- Video or IP matrix solution (if applicable)
- Extron control system if applicable
- SFF PC with wireless mouse and keyboard
- Room Scheduler
- Confirm room sources with owner and Harris Health AV representative

Patient Consult Rooms
- 55” display
- Neat Bar Camera/Microphone/Speaker (if applicable)
- SFF PC with Wireless mouse and keyboard

Staff Lounges
- One 65” screen to display EPIC data
- One 65” screen with SFF on the back
- Two Harris Health workstations
- One UT workstation
- Three 24” monitors
- 1 standard printer
- Neat Bar Camera/Microphone/Speaker (if applicable)
- Ceiling speakers & Amplifier
- Bluetooth receiver with volume control

Break Room
- 55” display
- TV Tuner (live air antenna)
- SFF PC (if applicable)

Interactive displays
- ViewSonic
- Neat

Videoconferencing Solutions
- Neat
- MTR (to be reviewed by Harris Health AV Representative)

JOB SUMMARY

F. Programming:

1. Provide and coordinate with the Owner and Harris Health AV Representative on all possible control functionalities based on project drawings and specifications.
2. Provide web control/web GUI for all programmed interfaces and room systems.
3. Provide screenshots/templates and a narrative description of all “User Interfaces” and “Admin Interfaces” functionality. The contractor must have written approval of control layout and functionality prior to installation of programming.
4. Provide the Owner with a full-functioning control system.
5. The owner may use AV control system up to 6 months after substantial completion, with (2) changes. After which the Contractor must provide the Owner (1) final programming change to any and all AV control systems (3 changes Maximum) But not limited to:
    a. Touch Panels
    b. Key Pads
    c. Functionality
    d. Control
    e. Added equipment

G. Shop Drawings:

1. The contractor’s on-site CTS-D supervisor shall review, approve, and sign off all shop drawings, coordination drawings, and as-built drawings documents.
2. Reproducing Contract Documents for shop drawings is not acceptable.
3. Shop drawings to include the following:
    a. Drawing legend sheet describing all symbols used on the drawings.
    b. Floor plans with all devices and wiring raceway depicted.
    c. Wire runs with tags for type, gauge, quantities, and cable identifiers.
    d. System riser diagram indicating all field devices, riser paths, and room designations.
    e. Block diagram for each system showing all equipment and signal pathways.
    f. Point schedules defining interconnection of all inputs and outputs for all equipment including data connections and other systems with cable identifiers.
    g. Elevations of equipment racks and teaching consoles.
    h. Fabrication shop drawings for all custom components.
    i. Diagrams for power, signal flow, control wiring and grounding.
    j. Include plans, elevations, sections, details, and attachments to other work.
    k. Drawings must be legible. To be provided in PDF or Visio Format.

H. Coordination Drawings: Reflected ceiling plans, drawn to scale, with ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated, using input from installers of the items involved. Provide similar elevation drawings for wall-mounted items.

I. Samples: Provide as requested for colors and texture coordination.

J. Partial submittals shall not be acceptable without prior approval.

K. No portion of the work shall commence, or equipment ordered, until the Harris Health AV Representative has approved the submittals.

L. The Contractor shall not be relieved from any contract-required responsibility by the Harris Health AV Representative's approval of submittals.

M. Nothing in the specification shall relieve the Contractor of system package design responsibility, including, but not limited to, all equipment furnished under this Contract. The Contractor is, in all cases, solely responsible for the performance of the delivered AVS, and for furnishing complete system documentation for each and every part of the system.

N. Extended AVS Support.

1. Provide pricing for AVS hardware and software support including necessary reconfiguration and data base changes for years 2 through 5.

O. Resubmitting.

1. Make corrections or changes in Submittals as required by the Consultant’s stamp instructions or written response by HH AV Representative and attached comments and resubmit.
2. Identify changes on resubmittals by clouding. Only indicated changes will be reviewed when resubmitted.
3. Added drawings shall be clearly identified.
4. The contractor shall be responsible for project delays caused by rejected submittals.
5. Consultant shall be compensated for additional services for submittals rejected more than twice. The amount of such compensation shall be incorporated by change order and withheld from the Contractor’s Application for Payment.

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1.07 QUALITY ASSURANCE

A. Installer Qualifications:

1. The AV Contractor performing the installation shall have a minimum of 5 years of experience in the installation of AVS systems of similar size and scope.
2. An AVIXA CTS shall supervise and approve all on-site work as a recognized member of the Contractor’s installation team. All installation team members must demonstrate knowledge and compliance with all AVIXA, TIA, UL, and NEC methods, standards, and

codes. Submit resumes of the entire team and complete training courses and certifications.

3. All members of the installation team must be certified by the Manufacturer as having completed the necessary training to complete their part of the installation.

4. HH AV representative or owner may make such investigations as deemed necessary to determine that the Contractor is responsive, responsible and qualified in the area of work contemplated by the Contract. In this regard, the Contractor shall furnish to the HH AV Representative or Owner such information as requested for this purpose. Information and data may include (but not necessarily be limited to): Date of organization and/or incorporation and number of years engaged in this business under the present firm's names; list of major equipment owned by the company; list of principal personnel who will be involved in the execution of this contract with the experience and qualifications of each person.

5. The AV contractor shall have local in-house engineering and project management capability consistent with the requirements of this project. The Contractor shall provide a project manager who shall be the same individual throughout the project and shall be the person responsible for system programming, preparation of Operation and Maintenance Manuals, Training, Programs, Schedules and Test Protocols, documentation of system testing, maintenance of record drawings and coordination and scheduling of all labor.

6. Contractor shall be or have direct relations through their subcontractors, an authorized manufacturer’s representative for all products they furnish or install.

7. AV Contractor shall have a local organization capable of providing maintenance and service for the specified system. Facility shall be no more than 100 miles from Owner's site.

8. AV Contractor shall be capable of providing emergency service on a 24-hour, 7 days a week basis.

9. If AV contractor is working under a General Contractor, the AV vendor must notify Harris Health AV Representative to any changes that can affect the scope of work, and will be required to enter a formal change through the change management process.

B. Conflicts:

1. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify in writing to Consultant of any such occurrences before the purchasing of any equipment, materials and/or installation. The Consultant will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event, Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications.

C. The Contractor shall provide all materials, equipment and installation in compliance with the latest applicable standards from ANSI, ASTM, FCC, IEEE, NCTA, NEC, NEMA, NFPA, REA, TIA/EIA, and UL including but not limited to:

2. American National Standards Institute (ANSI).

3. ANSI T1.404 (DS3) and CATV Applications.

4. American Society For Testing And Materials (ASTM).

5. Americans with Disabilities Act (ADA).
6. EIA/TIA-569 Standard, Commercial Building Standard for Telecommunications Pathways and Spaces.
7. EIA/TIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
8. National Cable Television Association (NCTA).
9. NCTA-02 NCTA Recommended Practices for Measurements on Cable Television Systems.
10. National Electrical Code (NEC) (Latest revision and pertinent addendums).
11. Article 250, Grounding.
12. Article 300, Part A. Wiring Method.
13. Article 310, Conductors for General Wiring.
14. Article 800, Communication Systems.
15. National Fire Protection Association (NFPA) Publications (Latest revisions and pertinent addendums).
16. Underwriters Laboratories (UL).

4. 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. NECA 1 Good Workmanship in Electrical Contracting.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: System components shall be equipped and rated for the environments where installed.

B. Environmental Conditions.

1. Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

a. Interior, Controlled Environment: System components installed in conditioned interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing.

b. Interior, Uncontrolled Environment: System components installed in non-conditioned interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing.

c. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)] dry bulb and 20 to 90 percent

relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.

1.07 PROJECT COORDINATION PLAN

A. AV Contractor shall submit a project plan detailing the steps and associated timeframe to meet the General Contractor's schedule requirements. Project plan should include benchmarks for items such as regular project meetings, equipment order and delivery, installations, configuration and calibrations, testing and burn-in, training, substantial completion notification, testing and final acceptance.

B. AV Contractor assumes total responsibility for coordinating with building trades or other parties as may be identified by the General Contractor.

C. Coordinate the size and location of conduit systems, back boxes, and provisions for electrical power to equipment of this Section.

D. The AV Contractor must obtain written permission from the General Contractor prior to routing and/or installing cable, equipment or service through the facility.

E. Contractor shall prepare the installation schedule to coordinate sequencing, dependencies and priorities of the system installation including work by other trades.

1.10 COMMISSIONING

A. Commissioning of systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure.

B. Training of the HH AV Representative or Owner's on operation and maintenance personnel is required in cooperation with the HH AV Representative or Owner's Representative. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with theHH AV Representative or the Owner's Representative after submission and approval of formal training plans.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Approved manufacturers:

1. Absen
2. AKG
3. Atlas Sound
4. Audio Technica

5. Audix
6. AVFI
7. Aver
8. Axis
9. Barco
10. Belden
11. BSS
12. Cables to Go
13. CAD
14. Canon
15. Chief Manufacturing
16. Christie
17. Cisco
18. Clevertouch
19. Clock Audio
20. CommScope.
21. Community
22. Covid
23. Crestron
24. Crown
25. Da-Lite
26. Denon
27. Digital Projection
28. DNP
29. Draper
30. Electro-Voice
31. Elmo
32. Ergotron
33. Extron
34. FSR Inc.
35. Furman
36. Gepco
37. Hitachi
38. Hoffman
39. Hubbell
40. Jabra
41. JBL
42. JVC
43. Lab Gruppen
44. LG
45. Liberty Wire and Cable
46. Listen Technologies
47. Lowell
48. Logi
49. Magewell
50. Mersive
51. Middle Atlantic Products
52. Neat
53. NEC
54. Neutrik
55. Newline
56. Panasonic
57. Peerless
58. Pelco
59. Planar
60. Polycom
61. Premier
62. Primeview
63. QSC
64. Radio Design Labs
65. Rane
66. Samsung
67. Sennheiser
68. Sharp

69. Shure
70. Sony
71. Sound Control Technologies
72. Spectrum Furniture
73. Stewart Filmscreen
74. SurgeX
75. Tannoy
76. Tascam
77. Toshiba
78. Tripp Lite
79. Vaddio
80. Valcom
81. ViewSonic
82. Windy City Wire
83. wePresent
84. West Penn Wire
85. Williams Sound
86. Wiremold

2.03 FLOOR BOX/POKE-THROUGH

A. Approved products:

1. Floor box (FB)
    a. Wiremold EFB8S(-OG)
2. Floor poke-through (PT)
    a. Wiremold 8AT
3. Or approved equal

2.04 AUDIOVISUAL CAMERA

B. Approved products:

1. Axis
    a. P9106-V
2. Provide Axis Camera Station S1116, configure for 16 camera split-view and single camera full-screen view.
3. Provide Cisco SG350 series switch or approved equal
4. Conferencing: Neat
5. Conferencing Aver PTZ Tracking Camera

2.05 PAGING SPEAKERS/SYSTEM

1. Refer to Section 275117 – Overhead Paging System

2.06 FLAT SCREEN DISPLAYS WITH MOUNT

A. IFPD or Flat Panel displays

B. See plans for size and locational requirements.

C. Impact resistant protective enclosure with key lock and integrated fan shall be CFCI at locations noted on plans.

D. In neuro psychiatric areas, display will need anti-ligature enclosure

E. Articulating mounts preferred

2.07 SMALL AV RACK

A. Approved products:

1. Middle Atlantic (SR)
    a. SRSR 4-14
2. Welded CRS construction using 14, 16 and 18 gauge material.
3. Powder coated finish.
4. 11 ga rack rails tapped with 10-32 mounting holes at standard EIA spacing that complies with TIA/EIA-310-D.
5. Fill empty rack spaces with blank panels.
6. Rack-mounted power:
    a. Distribution - Middle Atlantic PD-915R-PL
    b. UPS - Middle Atlantic UPS-1500R
7. Ventilation: A low-noise fan for forced-air cabinet ventilation.
    a. Coordinate type and location with millwork.
8. Service Light: At top rear of rack with an adjacent control switch.
9. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
10. Provide proper lacing bars with velcro ties for cable management.

2.08 VIDEO PROJECTOR

A. Approved products
1. Epson
    a. PowerLite 2250U with mount (OFCI)
    b. Other projectors allowed, with HHS written approval

2.09 VIDEO PROJECTION SCREEN

A. Approved products
1. Dalite Advantage Electrol with High Contrast Matte White Material.
2. Draper Access Fit E with black-backed Contrast White Material.
3. Provide a low-voltage interface & wall-mounted switch.

2.10 PASSIVE A/V CONNECTION PLATES

A. Provide types, sizes and configurations per drawings and schedules with the following minimum features:

1. Stainless steel, silver anodized aluminum. White and almond with HHS written approval
2. Engraved legends.
3. Solder, pass thru and pigtail style connection and connectors as required

B. Approved manufacturers:

1. Liberty / Panelcrafters
2. Crestron
3. Extron
4. C2G

2.11 CABLES

A. All AV cabling is to be provided by AV Contractor.

B. All category cable data runs that terminate in an IDF are to be provided by the Data Contractor.

C. Provide green cable for all paging horizontal cabling.

D. Provide types and quantities per drawings and schedules.

E. Conductor Sizing:

1. Insulation shall be rated for a minimum of 300 volts.
2. Wire types and minimum sizes:
    a. 70 Volt Speaker Cable - 16 AWG, twisted, stranded CL2/CL2P.
    b. Low Impedance Speaker Cable – minimum 12 AWG, twisted, stranded CL2/CL2P.
    c. Microphone Level Cable - 22 AWG, with 22 AWG drain wire, shielded, twisted, stranded CL2/CL2P.
    d. Line Level Cable - 22 AWG, with 22 AWG drain wire, shielded, twisted, stranded CL2/CL2P.
    e. Low Voltage Control Cable - 18 AWG twisted, stranded CL2/CL2P.
    f. CAT-5e - Unshielded, 24 AWG
    g. Digital Media – Per manufacturer of video equipment to be served.

F. Minimum acceptable AVS systems wiring performance standards shall be as follows:

1. Speaker cable - Per ANSI WC57 standard test.
2. CAT-5/6 - Per ANSI/TIA/EIA-568-8.1 standard test.

3. Fiber optic cable - Per ANSI/TIA/EIA-568-B standard test.
4. RS 232 - Per ANSI/ WC66 standard test.
5. Line level shielded audio cable - Per ANSI WC66 standard test.
6. Microphone level shielded audio cable - Per ANSI WC66 standard test.
7. Video coax cable - Per ANSI/TIA/EIA–TSB-67standard test.
8. Multi-conductor control cable - Per ANSI WC57 standard test.

G. Approved manufacturers:

1. Liberty
2. West Penn Wire
3. Windy City Wire
4. Extron
5. Crestron

2.12 AV PATHWAY

A. Approved manufacturers:

1. Panduit
2. Cooper B-Line
3. Or approved equal

B. J-hooks shall be installed 4ft to 5ft apart. Uniform spacing should be avoided to minimize problems with signal degradation.

C. J-hooks shall be supported from decking or building structure using methods approved by the manufacturer.

D. Cable count shall not exceed manufacturer’s recommended maximum. Add separate parallel J-hook pathway when cable count requires it.

2.13 CABLE CONNECTORS

A. Approved manufacturers:

1. Liberty
2. Extron
3. BTX

2.14 AV PATCH CABLES

A. Provide AV patch cables for all AV plates and interconnectivity locations.

B. Minimum 9’ cables

C. Approved manufacturers:

1. Extron
2. Crestron
3. Cables To Go (Premium)
4. Or approved equal

PART 3 - EXECUTION

3.01 CONSTRUCTION MEETINGS

A. The Consultant and/or Owner will hold regular construction meetings to review the installation schedule. It is mandatory that the AV Contractor's project manager attend each meeting.

3.02 SITE INSPECTION

A. Continuously verify that the site conditions are in agreement with the Contract Documents and the AVS design. Notify Owner's representative immediately of conditions that affect the performance of the installed system.

B. Coordinate any required work that is not specified in the Contract Documents.

3.03 COORDINATION

A. Adequate conduit and back boxes are provided for the specified system installation.

B. Adequate power has been provided for the specified system installation.

C. Verify mounting location of all devices with HH AV Representative or Owner prior to installation.

3.04 GENERAL

A. The AV Contractor shall be responsible for providing all wire and cable as required for complete and operational system.

B. All cables must be continuous runs from device location to the final point of termination. No mid run cable splices will be allowed.

C. Make connections and splices with solderless devices that are mechanically and electrically secure in accordance with manufacturer's recommendations.

D. The cable installation techniques shall be such that the mechanical and communications characteristics of the cables are not degraded at the time of installation. Any special environmental requirements for equipment shall be specified.

E. Wiring Method: Install cables in raceways except in accessible indoor ceiling spaces, in hollow gypsum-board partitions, and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.

F. Distribution of the cabling will be accomplished through cable trays, J-hooks, cable runways, conduit raceways, ducts, core holes, extended columns, false half columns and plenums. Horizontal cable segments will be placed in cable trays and when they leave cable trays will be supported by j-hooks. Where cables converge at equipment room locations, they will be supported by cable runways and distribution rings. All cable placements shall be based on the enclosed drawings.

G. The Contractor shall not place wiring in the same conduit or raceway with wire for electrical power distribution.

H. Connectors to all devices in system shall be protected against moisture. Approval of the method shall not relieve the Contractor of full responsibility for proper application and workmanship of the materials in the manner specifically approved. All connector threads shall be treated with an approved silicone lubricant.

I. The Contractor shall be responsible for providing approved grounds for all AVS system equipment per the manufactures recommendations. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework. All ground connections shall consist of minimum 12 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. Contractor must notify the Owner prior to making any changes in submitted system design and/or installation.

J. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

K. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. 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.

L. Grounding: Provide independent-signal circuit grounding per practices published by the manufacturer.

3.05 IDENTIFICATION, LABELING AND DOCUMENTATION

A. The Contractor shall label all termination devices, panels, enclosures and equipment rooms. The Contractor will mark each unit with permanently attached markings that will not impair the equipment or present a hazard to maintenance personnel.

B. Place wire identification numbers ¼" on each end of all conductors and or connectors by using sleeve type heat shrinkable markers. Install markers to be readable from left to right or top to bottom. Wire numbers shall be computer printed (Brady TLS2200 with Permasleeve cable marking labels or equivalent). Hand written labels are not acceptable.

C. Audio Visual cables must be labeling in according to signal flow drawing cable number and include the devices to and from connection. Example "V001 Video Switcher – PC"

D. All AV power cables must be labeled to reflect the device they are providing power to. To be labeled at outlet with device name/description and labeled at device noting power.

E. Mark all spare conductors.

F. Contractor to maintain a progress set of design documents on the Project site. These documents shall be updated daily to reflect the current condition of the work and available for review by the Consultant and Owner when requested.

G. If changes occur prior to acceptance testing altering the documentation previously furnished. The Contractor shall formally update and reissue the relevant documentation to the Consultant and Owner.

H. Consultant and Owner will review all documentation for accuracy and completeness and may reject substandard submittals.

I. The Contractor shall establish and maintain complete system documentation, including documentation procedures, operational information, configuration information and drawings. Documentation shall include the following:

1. Floor plan drawings indicating device locations, unique system point numbers with device legends indicating manufacturers and model numbers for each device.
2. The unique system point number of a device shall identify either through the software or hardwire connection, the specific device or group of devices associated with the unique point number in the system.
3. Floor plan drawings indicating conduit and wire routing and junction box locations.
4. Wire routing shall include cable identification and terminal strip numbers.
5. Mounting details for all equipment and hardware.
6. Functional block diagrams for each system.
7. Wiring details showing rack elevations, equipment wiring and terminations and inter-rack wiring.

3.06 FIELD QUALITY CONTROL

A. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

B. Pre-testing: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.

C. Test Schedule: Schedule tests after pre-testing has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

D. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

E. Remove and replace malfunctioning items and retest as specified above.

F. Record test results for each piece of equipment.

G. Re-test: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.07 ADJUSTING

A. Speaker Systems

1. Equalize speaker systems flat from 80 Hz to 2 KHz with a 2dB per octave roll-off thereafter. Program a high pass filter at 60Hz with 12dB per octave roll off and a low pass filter 15 KHz with 12 dB per octave roll off.

2. Use a minimum of three measurement locations in the system’s intended coverage area to calibrate the system response.

3. Verify system gain and amplifier levels.

4. Verify speaker polarity

5. Adjust appropriate speaker delays.

6. Set and adjust limiters.

7. Contractor shall provide for calibration of the system:

    a. Sound analyzer (SmaartLive, TEF SoundLab, Meyer’s SIM or equivalent) with trained operator for adjusting and verifying delay timing, cabinet aim and equalization.

    b. Suitable calibrated microphone.

8. The Contractor shall coordinate this testing and calibration. It is anticipated that this work will take 1 hour per classroom. It will be necessary to have a quiet room during these times.

9. Contractor to record all measurements, settings and adjustment for inclusion in the O&M manuals.

B. Adjust limit switches on electric operated projection screens.

C. Adjust back focus on all video cameras.

D. Occupancy Adjustments: When requested within 12 months following the of date of Substantial Completion, provide on-site assistance in adjusting systems to suit actual occupied conditions and to optimize performance of the installed equipment. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of equipment.
3. Adjust all presets; consult Owner's personnel.
4. Recommend changes to the AVS to improve Owner' utilization of the system.
5. Provide a written report of adjustments and recommendations.

3.08 TRAINING

A. AVS training shall be provided for the operator/user and technical staff. Operator/user training shall minimally consist of one (1), 1-hour sessions for each system type. Technical operation and maintenance training session shall minimally consist of two (1), 1-hour sessions for each system type. Training sessions to be coordinated with the Owner and scheduled prior to substantial completion.

B. A complete operation and maintenance manuals and preliminary as-built drawings shall be delivered to the Owner one week prior to the training sessions.

C. Operator/user training shall minimally consist of:

1. Provide custom system specific printed reference material for each trainee that documents and explains in layman's terms:
    a. System block diagram.
    b. Normal day-to-day operation.
    c. Operator selectable features.
    d. Provide a hands-on training with Q & A session.
2. Provide and review a custom, system specific, quick reference guide for the inexperienced operator.

D. Technical Operations and Maintenance training shall consist of:

1. The technical explanation shall be sufficiently thorough that: staff personnel shall be able to make any programming changes required, analyze malfunctions and make equipment substitutions or bypasses necessary to maintain system operation except for the malfunctioning equipment or circuits.
2. Provide printed reference material for each trainee that documents and explains in technical terms:
    a. System block diagram with technical features.

b. Technical operation, adjustments and programming.

c. System features and programming.

d. Review of as-built drawings.

e. Provide a hands-on training with Q & A session.

3.09 WARRANTY

A. The Contractor shall warrant the system for parts and labor for one (1) year. Warranty commences at the time of substantial project completion and acceptance by HH AV Representative or Owner. Nothing shall be construed to limit this obligation to a shorter period.

B. Warranty service shall be rendered on-site by request of Owner to repair or replace any defective materials, equipment and workmanship without cost to the Owner, unless the Owner has previously given the Contractor a written acceptance of such condition.

C. The Owner shall give prompt notice of the defect(s) either verbally or in writing to Contractor.

D. Perform preventative maintenance during the warranty period, which includes:

1. Cleaning and inspection of all devices every 6 months.

2. Clean and vacuum console and rack equipment every 6 months.

3. AV Contractor will reach out to HH AV Representative 30 day’s prior to the 6-month scheduled maintenance.

E. Service technician performing service / warranty work shall check-in and out with HH AV Representative or Owner for each visit.

F. Provide a written report to Owner documenting any work performed during the warranty period within 24 hours of such event. Report shall detail work performed, equipment repaired or replaced, etc.

G. Provide loner equipment that is equivalent to the malfunction equipment for any equipment not field repairable.

H. Repair or Replacement Service.

1. Repair or replacement service during the warranty period shall be performed 7 days a week, 24 hours a day and with a 4 hour response time.

2. Emergency repair or replacement service during the warranty period shall be performed 7 days a week, 24 hours a day and with a 4 hour response time.

3. If the Contractor cannot restore system operation during the warranty period within 2 business days of the system failure, the Owner reserves the right to require the Contractor to provide on-site manufacturer's service technicians at no additional cost.

4. The Owner reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided the expansion is performed by an authorized dealer for the affected equipment.

3.10 SUBSTANTIAL COMPLETION

A. Work must meet the following requirements to qualify for the Owner's consideration of Substantial Completion:

1. All AVS devices shall be fully installed, powered, online and fully operational.
2. All sub-system interfaces must be complete and operational.
3. All training complete.
4. Owner may utilize the system for its designed intent.

B. Contractor will provide a list of remaining work items and approximate completion date.

C. Contractor will certify in writing that all remaining work is minor in nature and will be completed in less than 30 days.

3.11 TESTING REQUIREMENTS

A. The Contractor shall perform sample tests in the presence of the Consultant, HH AV Representative and Owner. Performing the testing procedures specified herein assures that the communication cabling and system electronics meets the performance characteristics specified.

B. All testing shall comply with EIA/TIA Standards and that of the equipment manufacturers. If testing indicates that the performance characteristics are not met, the test shall be failed test and any other test that may be affected by the modification and/or repair shall be rerun and verified.

C. Test equipment will be provided by the Contractor to test and to certify the 100% operational condition of all materials and equipment.

D. The Contractor shall prepare and submit all test procedures and data forms for the pre-installation, post installation and subsystem test to Owner. The test procedures shall have Owner approval before the tests.

3.12 SYSTEM CHECK OUT AND VERIFICATION

A. Verify continuity of cabling between field devices and controllers.

B. Commission all devices from field to front end.

C. Contractor supplied "As Built" Drawings shall show conduit routing.

D. Review all as-built documentation and Operation and Maintenance manuals with Owner. Revise and reissue as required.

E. Provide as-built / record drawing documentation in hard copy, PDF and AutoCAD formats.

F. Demonstrate proper sequences of operation for all devices.

3.13 FINAL ACCEPTANCE OF SYSTEMS

A. Each area of construction completed and submitted as complete shall meet the following criteria under testing:

1. System must meet all specifications as described in these instructions.

2. Operational prints, manuals, signal logs, and as-built prints must be furnished.

3. Visual testing and signal verification will be conducted at random locations to determine that the equipment performs satisfactorily.

B. Specifications set forth for the construction of the system have been devised in order to ensure system compatibility and performance. Compliance with these specifications will be determined during periodic observations of construction. Repeated failure to comply with the specification will be considered before the initial acceptance phase of the plant commences.

C. Within ten days of receipt of the final acceptance notice, the HH AV Representative or Owner's representatives shall schedule and perform the final inspection. When the work is found acceptable under the contract documents and the contract is fully performed, declare the project complete.

END OF SECTION 27 40 00

SECTION 27 51 17 – OVERHEAD PAGING SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Overhead paging Systems will be required in class I buildings and when shown on construction drawings.

B. The General Contractor/Construction Manager shall furnish, install and program all equipment including, but not limited to, outlet boxes, wiring, speakers, and all other necessary equipment to provide a complete operating system as indicated with the contract documents. The General Contractor/Construction Manager shall provide all the necessary wall plates, specialty boxes, etc., not provided by others.

C. Equipment manufactured by Valcom Inc., The VE-6090-1 IP Server shall be considered as meeting all specifications and as the base bid. The Harris Health System must approve alternate systems. Verify with Harris Health System if there is an existing VE-6090-1 IP Server in place which may be utilized or if a new server is required prior to pricing. Alternate bidders supplying another system shall make aware their intentions and provide all information, including catalog cuts, shop and working drawings, data sheets, and a demonstration of the proposed system features. This information must be presented to the relative parties as to allow sufficient time to review all materials.

D. The intent of this specification is to maximize communication between the administrative areas while reducing maintenance and operational costs.

E. Under this specification, the system shall provide a complete paging system for the entire hospital OR expansion.

1.02 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.03 SYSTEM DESCRIPTION

A. System Features:

1. System will provide for Feedback elimination and call stacking for times when high traffic on the intercom is expected no page will be lost or not broadcast.
2. Direct dialing from administrative telephones to any location equipped with a speaker.
3. Automatic gain control on intercom speech to assure a constant talkback speech level.
4. Microprocessor-based system capable of expanding to over 500 zones.
5. The system shall interface with any telephone system, thus allowing the hospital district to upgrade or replace their intercom/paging system without purchasing a new telephone system to get the features described herein. Any system that does not allow these features or functions and its proprietary to one or only a few telephone systems are not acceptable.
6. Distribute an emergency announcement from a telephone to all furnished with a loudspeaker. This emergency announcement shall have the highest priority over all system functions.
7. Distribute general announcements from an administrative telephone. This announcement shall be capable of all-call, group or multiple group calls.
8. Speakers shall be 2ft x 2ft with volume adjustable lay-in for all drop ceiling applications.
9. Provide a three (3)-digit numbering plan.

10. Facilities for three (3) call-in priority levels. The priority levels are as follows:
    a Normal Only
    b Emergency Only
    c Normal/Emergency
11. All levels shall be on a priority basis, incoming intercom calls will be displayed in the order of these levels with Emergency as the top priority.
12. Programmable features shall be stored in Electrically Erasable Programmable Read-Only Memory (E2PROM) memory and not be lost due to power failures.
13. Manually distribute an emergency alert tone via pushbutton or interfaced contact closure.
14. Provide (1) port to be connected to the telephone system from the intercom system. This intercom line shall provide built-in Enhanced Caller Line Identification. Systems that require priority hardware and software to a specific telephone system to offer this feature are not acceptable.

1.04 SUBMITTALS

A. See Section 01 3000 (01300) - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

C. Product Data: Provide data showing electrical characteristics and connection requirements for each component.

D. Test Reports: Indicate satisfactory completion of each test recommended by the manufacturer.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate that installation is complete and system performs according to specified requirements.

H. Project Record Documents: Record actual locations of speakers, control equipment, and outlets for input/output connectors, cables routing with labeling.

I. Operation Data: Include instructions for adjusting, operating, and extending the system.

J. Maintenance Data: Include repair procedures and spare parts documentation.

K. QUALITY ASSURANCE

L. Conform to requirements of NFPA 70 and Federal Communications Commission.

M. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

N. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

O. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of project with a minimum of five years documented experience.

P. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.05 MAINTENANCE SERVICE

A. The General Contactor/Construction Manager shall provide a twelve (12) month guarantee of the installed system against defects in material and workmanship. All warranty material shall be provided at no expense to Harris Health System. The guarantee period shall begin on the date of acceptance by Harris Health System.

B. The Sub-Contactor shall maintain an adequate parts inventory to perform necessary service and upgrades.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Valcom: Standard Speakers and System

2.02 AMPLIFICATION AND CONTROL EQUIPMENT

A. Valcom Control Unit:

1. Rack mounted VE-6090-1 IP6000 server controller
2. Registers to phone system VIA SIP license with two available FXO fall back circuits
3. Provides audio feedback elimination
4. Provide off-site programming via Browser base programming
5. Capable of using Valcom IP speakers
6. System speakers capable of using standard UTP telephone/data wiring for installation, thus allowing for only one type of wiring infrastructure

B. Valcom Paging Speakers/Horns:

1. 2’x2’ Lay-in Speakers- VE-4022A
2. 8” Recessed Speaker- VE-4020A, include back can (V-9915M) and pre-construction ring (V-9912M).
3. Verify speaker types and quantities on plans.

C. Valcom Volume Control:

1. Volume control will be handled by the software deployed by the client.

D. Valcom Power Supply:

1. Power for each speaker will be from a POE port from the client’s network switch.

E. Protection:

1. The General Contractor/Construction Manager shall provide all necessary protection on the AC power feed and on all station lines entering and leaving the building.
2. The General Contractor/Construction Manager shall note the type of protection devices and all relative information in the system drawings.
3. The Contractor shall provide a battery back-up for the control unit and all power supplies.

2.03 WIRE AND CABLE

A. Wiring shall be in accordance with the manufacturer's specifications. Wiring shall meet all local and state codes.

B. Blue plenum-rated Category 6A cable CommScope part number 2091B used to cable all speakers.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. All equipment, unless otherwise specified, shall be new, free from defects, and best craftsmanship in its class.

C. Install input circuits in separate cables and raceways from output circuits.

D. Leave 10 feet excess cable at each termination at speaker in a figure 8 service loop.

E. Leave 6 feet (2 M) excess cable in a teardrop outside of each IDR.

F. Provide protection for exposed cables where subject to damage.

G. Support cables above accessible ceilings in cable tray, conduit or every 5' minimum with metal J-hooks. All cables must be self-supported. They must not attach or rest on any other trades such as sprinkler pipes, electrical, ceiling tiles or HVAC. Se section 270528 for pathway specifications.

H. Provide STI EZ Path sleeves accordingly when penetrating through fire-rated walls.

I. Firestop all single, side-penetrated, fire-rated walls.

J. Label all speakers in order of connectivity and dial code.

K. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items may include hardware, rack panels, 66 blocks, plywood and other devices that are required for installation.

L. Label all IP speakers with IDR, cable number and MAC address with a font large enough to be seen when standing on the floor.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection and testing and document results.

B. Measure and record sound power levels at designated locations. 70db plus or minus 5dB is acceptable.

C. The General Contractor/Construction Manager shall inventory the necessary parts in order to maintain and service the equipment being supplied. This equipment shall be in direct relation to total systems installed as recommended by the manufacturer.

3.03 MANUFACTURER'S FIELD SERVICES

A. Provide the services of manufacturer's technical representative to prepare and start system.

B. Include making final wiring connections, inspection and adjusting of completed installation, and systems demonstration.

C. Certify that installation is complete and performs according to specified requirements.

3.04 ADJUSTING

A. Adjust appropriate sound level.

B. Adjust devices and wall plates to be flush and level.

3.05 DEMONSTRATION

A. Demonstrate operation of systems.

B. Conduct walking tour of Project. Briefly describe function, operation, and maintenance of each component.

C. Use submitted operation and maintenance manual as reference during demonstration.

3.06 OWNER PERSONNEL TRAINING

A. The General Contractor/Construction Manager shall furnish two hours of in-service training with the system. The sessions shall facilitate the training of personnel in operating the installed system. Coordinate all documentation and training information with Harris Health System.

B. Provide detailed operation and maintenance instruction and training.

C. Provide local classroom facilities.

D. Use submitted operation and maintenance manual as reference during training. Supplement with training materials as required.

3.07 WARRANTY

A. Provide a minimum of 1 year warranty for Overhead Paging System contractor supplied parts.

B. Provide a minimum of 1 year warranty for labor on all Overhead Paging System equipment.

END OF SECTION 27 51 17

SECTION 281300 - SECURITY AND CCTV SYSTEMS

PART 1 - GENERAL

A. The conditions of the General Contractor (General, Supplementary and other Conditions) and the General Requirements are made part of this section. The complete installation shall conform to the requirements set forth by the National Electrical Code, all State and Local Building Codes as required by the “Authority Having Jurisdiction” and the requirements of the owner.

B. Harris Health Systems, “the owner”, has a system wide Security Control System (SCS) consisting of the Software House CCure Access Management System that provides door monitoring, intrusion alarm and access control functions and the American Dynamics Victor Video Management System (VMS) that provides CCTV control and monitoring functions. All SCS and VMS systems shall be an extension of these systems unless specially approved by the Harris Health Department of Public Safety.
   1. Harris Health requires at a minimum that all exterior doors be equipped with card access or electronic door position monitoring.

C. Harris Health System’s Department of Public Safety provides the Owner's System Administrator, and is responsible for the operation and maintenance of the ACMS and VMS and will, with the Owner's Representative, work with the Design Professional to ensure design criteria are satisfied. All equipment and materials provided shall be new and unused and of the most current model or revision. All components of this system shall be installed in a workmanlike manner, following security industry “best practices” and in strict adherence to the manufacturer’s specifications and applicable codes. Wire and conduit shall be installed consistent with Harris Health System Information Technology Department standards.

D. An approved Security System Contractor shall be utilized and shall be responsible for all costs associated with the installation of this equipment.

1.02 Definitions

A. Owner: Harris Health Systems

B. Harris Health System Contact: the designated owner’s representative

C. General Contractor: The General Contractor is the firm contracting with the Owner to perform and manage the Work required for the construction of the facility. The General Contractor is responsible for coordinating all sub-contractor work and any Owner assigned specialty contractors.

D. Security Contractor: The Security Contractor is the firm contracting with the General Contractor to perform the Work required for the security installation and to provide maintenance for all devices in the project. (alternate: The Security Contractor shall be selected by the Owner as a Specialty Contractor).

E. Security Control System (SCS): All components of the Security access control, communication, and CCTV systems provided under this section.

F. Work: The Work is all equipment, labor, material and services necessary to produce the construction in accordance with the Contract Documents.

1.03 WORK INCLUDES

A. Furnish and install all equipment, accessories and materials in accordance with these specifications and drawings to provide a complete and operating Security and CCTV System.

B. The scope of work for the Electrical Contractor shall include, but not be limited to providing the following:
   1. 120-volt power at designated security devices.
   2. 120-volt power, grounding, and fire-resistant backboards located in the IDF rooms.

C. The scope of work for the Security System Subcontractor (the Security Contractor) shall include, but not be limited to providing the following:

1. Local control panels within the IDF.
2. Card readers.
3. Exit motion sensors.
4. Magnetic door locks.
5. Door monitor contacts.
6. Request-to-exit devices.
7. Remote door release devices
8. Sounders and key-switches.
9. Panic buttons
10. Intercom and telephone devices utilized for door and gate control
11. CCTV cameras
12. CCTV camera recording devices
13. Exterior hands-free Emergency Phone systems
14. Termination of all field wiring including the card readers and cameras.
15. Termination of communication field wiring within the IDF.
16. Testing and programming of local system.
17. Reprogramming of existing host computer.
18. Interface with ADA door operators where applicable.

D. Any material and/or equipment necessary for the proper operation of the access control system not specified or described herein shall be deemed part of this specification.

1.04 ACCEPTABLE MANUFACTURERS

A. Acceptable representatives:
1. Marvin Machado, Walker Engineering, 7761 W. Little York Rd, Houston, Texas, 77040; 713-864-3801/832-421-2700; Email: mmachado@walkertx.com
2. Craig Harris, Tech Systems, 3400 Corporate Way, Suite F, Duluth, GA 30096, Phone: 770-495-8700 Ext. 1707, Email: charris@techsystemsinc.com.
3. Jeffrey Head, Security Control Systems, Inc., 10645 Richmond Avenue, Suite 180, Houston, TX 77042, Phone: 713-977-7100, Ext 542. Email: jeffreyh@scstexas.com.
4. Steve Greis, Nextgen Security, 600 Century Plaza Drive, Suite C130,Houston, 77073,(832) 706-4551, Email: steve.greis@nextgensecured.com
5. Terri Adams, Siemens Industry, Inc. Building Technologies Division, 8850 Fallbrook Houston, TX 77064 Phone: (346) 260-7195, Email: terri.adams@siemens.com.

1.05 RELATED WORK SPECIFIED ELSEWHERE

A. Electrical General Provisions

B. Basic Materials and methods

C. Fire Stopping and firewall penetrations

D. Door, door frame and door hardware shall be coordinated with Architect and the General Contractor (alternate: Owner). All doors that are monitored or provided with access control devices shall be provided with mechanical panic hardware that has the ability to be manually locked in the event of failure by the Access Control System.

1.06 SCOPE OF WORK

A. Reserved for project-specific security specifications

1.07 PERMITS

A. The Security Contractor shall ensure compliance with and an understanding of all local codes and contract conditions and obtain all permits necessary pertaining to the Work.

B. The Security Contractor shall be responsible for submitting to the local authority having jurisdiction (AHJ) the electric lock/electronic lock procedure submittal for permitting as required. The Security Contractor shall only be responsible for lock permitting of electric locks controlled by the Security System.

C. All approved Permits and support drawings and documentation are to be provided to the DPS Contact as part of Record Documentation.

1.08 SUBMITTALS

The Security Contractor shall not order any equipment and shall not begin any work until the submittals have been approved in writing by Harris Health System. The Security Contractor shall not perform any installation prior to the receipt of a written authority to proceed from Harris Health System

A. Shop Drawings

Prior to assembling or installing the SCS, the Contractor shall provide complete shop drawings which include the following:

1. Architectural floor plans indicating all system device locations.
2. Full schematic wiring information for all devices. Wiring information shall include cable type, cable length, conductor routings, quantities, and point-to-point termination schedules. The Security Contractor shall verify and validate the Wiring Schedule provided with this document.
3. Complete access control system one-line block diagram.
4. Statement of the system sequence of operation.
5. Riser diagrams showing interconnections.
6. Detail drawings showing installation and mounting.
7. Fabrication drawings for console arrangements and equipment layout.
8. All drawings shall be fully dimensioned and prepared in DWG format using any CAD-based software capable of exporting the format (such as AutoCAD).

B. Product Data

Prior to assembling or installing the SCS, the Contractor shall provide the following:

1. Complete product data and technical specification data sheets that include manufacturer's
2. data for all material and equipment, including terminal devices, local processors, computer equipment, access cards, and any other equipment provided as part of the SMS. A system description, including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment shall operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:
   a. Central processor configuration and memory size.
   b. Description of site equipment and its configuration.
   c. Protocol description.
   d. Rigid disk system size and configuration.
   e. Backup/archive system size and configuration.
   f. Start-up operations.
   g. System expansion capability and method of implementation.
   h. System power requirements and UPS sizing.
   i. A description of the operating system and application software.

C. As-Built Drawings

1. At the conclusion of the project, the Contractor shall provide "as built" drawings. The "as built"

2. drawings shall be a continuation of the Contractor's shop drawings as modified, augmented, and
3. reviewed during the installation, check out and acceptance phases of the project. All drawings
4. University of Utah C•CURE 9000 A&E SPECIFICATIONS 5
5. shall be fully dimensioned and prepared in DWG format using any CAD-based software capable
6. of exporting the format (such as AutoCAD).

D. Manuals

At the conclusion of the project, the Contractor shall provide copies of the manuals as described herein. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each security system contractor installing equipment and systems and the nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The manuals shall include all modifications made during installation, checkout, and acceptance. The manuals shall contain the following:

1. Hardware Manuals

The hardware manuals shall describe all equipment furnished including:

a. General description and specifications.
b. Installation and check out procedures.
c. System layout drawings and schematics.
d. Manufacturers' repair parts list indicating sources of supply.

2. Software Manuals

The software manuals shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:

a. Definition of terms and functions.
b. Use of system and applications software.
c. Initialization, start-up, and shut down.
d. Alarm reports.
e. Reports generation.
f. Database format and data entry requirements

3. Operator Manual

The operator manual shall fully explain all procedures and instructions for the operation of the system including:

a. Computers and peripherals.
b. System start-up and shut down procedures.
c. Use of system, command, and applications software.
d. Recovery and restart procedures.
e. Graphic alarm presentation.
f. Use of report generator and generation of reports.
g. Data entry.
h. Operator commands.
i. Alarm messages and reprinting formats.
j. System access requirements.

4. Maintenance Manual

The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

E. System Commissioning

Harris Health requires a complete system commissioning and point-to-point checkout process before a project is considered complete. Every single point on the system will need to be tested for both software and system-level verification before the warranty can begin. The security contractor must ensure every door, sensor and device is set up, calibrated, and operating properly as if any given device has a problem, it could cause the piece of equipment its associated with not to work properly. During construction, the security contractor is to record system progress and the results of their testing and verification process. Before project closeout, submit reports covering every single device and detailing the checkout process and status. All costs for point to point check out and commissioning must be included in contract price. No additional allowance will be granted to complete this process.

1.09 SUBMITTAL OF SAMPLE MATERIALS

A. The Security Contractor shall submit samples of all SCS and Wiring materials, if requested by the Harris Health System Contact.

B. If and when requested, the Security Contractor shall submit samples of any specific SCS devices to the Harris Health System Contact for approval. Samples might include card readers, cameras, communications devices, and other similar SCS equipment. In cases of Alternative Bids, the Security Contractor shall submit samples of all equipment items.

1.10 PROGRAMMING

A. The Security Contractor shall enter and program all SCS data needed to make the system operational. The Security Contractor shall utilize data from the Contract Documents and all pertinent information in the Security Contractor's possession required for complete installation of the database.

B. The Security Contractor shall coordinate and provide specific format requirements for any data request from the Harris Health System Contact, providing at least one (1) week advance notice on required data. The Security Contractor shall request from the Harris Health System Contact any data needed to provide a complete and operational SCS, using standard data request forms, for any data that cannot be easily transmitted using electronic data formats. For any data easily transmitted electronically, the Security Contractor shall specify format and data requirements.

C. It is expected that the Security Contractor follow all naming and programming standards currently in use by the Owner. Additional, required, programming instructions can be found in the attachment: “Harris Health System Security CCURE Programming Instructions.”

D. It is expected that the Security Contractor follow both Harris Health System policies and industry standard protocols when setting up device and/or software system userids and passwords. Manufacturer’s “hardening guides” and cybersecurity installation and setup guidelines are to be followed. No Harris Health System security control, device, or system shall be accessible via the internet without the owner’s written approval. No Harris Health System security control, device, or system shall be accessible via the owner’s intranet without password protection unless the owner’s has provided written approval.

1.11 QUALITY ASSURANCE

A. Manufacturer Qualifications

The manufacturers of all hardware and software components employed in the SMS shall be established vendors to the access control/security monitoring industry for no less than five (5) years and shall have successfully implemented at least 5 systems of similar size and complexity

B. Contractor / Integrator Qualifications

1. The security Contractor shall have been regularly engaged in the installation and maintenance of integrated access control and video management systems and have a proven track record with similar systems of the same size, scope, and complexity.

2. The Security Contractor shall have a minimum of five years' experience in the fabrication, assembly, and installation of systems of similar complexity as specified herein.
3. The Contractor shall have the specified systems in at least three projects of the type and complexity specified herein. This includes the requirement that the Contractor has installation experience of large healthcare installations (300 readers or above) in the Houston Metropolitan Area with the CCure Access Control System.
4. The Security Contractor shall have a service facility and organization with staffing capable of providing comprehensive maintenance and service for the specified systems within a 75-mile radius of downtown Houston.
5. The Security Contractor shall be a certified installer and properly licensed to install, modify, and service the specified systems. The Security Contractor shall supply information attesting to the fact that their firm is an authorized product integrator certified with the both the SCS and VMS.
6. The Security Contractor shall provide factory-certified technicians. Certified technicians shall install and supervise installation, commissioning, and maintenance of the Work. All installing personnel shall be licensed as required by local and/or state jurisdictions. Technicians shall have achieved the status of Advanced Integrator or higher certification from Tyco/Software House/American Dynamics approved training centers. The Security Contractor shall supply information attesting to the fact that their installation and service technicians are competent factory trained and certified personnel capable of maintaining the system and providing reasonable service time.
   (Photocopies of certification should be submitted with package response).
7. The Security Contractor shall ensure compliance with and have a thorough understanding of all local codes and contract conditions pertaining to the Work.
8. The Security Contractor shall have local in-house engineering and project management capabilities consistent with the requirements of the Work. The Security Contractor shall provide a team managed by a project manager responsible for submittals, installation, scheduling, manpower, testing, record documents, subcontractors, etc.
9. The Security Contractor shall
   a. Coordinate all work once awarded, with the named Harris Health System Department of Public Safety (DPS) contact person and/or Project manager.
   b. Comply with city, state, and local regulations concerning licensing and operation of system.
   c. Assume the responsibility for the protection of all finishes in and adjacent to the work area and repair and restore all damage caused to any adjacent building and/or site by any action of the Vendor, its subcontractors or personnel of either in the progress of the work.
   d. Ensure employees and subcontractor meets employee identification requirements and any owner -required safety training.
   e. Upon request, schedule and provide training for operational and administrative staff. These classes shall include, but not limited to the overview of the systems installed, control and setup functions of the system, alarm acknowledgement and event investigation. The administrative staff training shall include system programming and setup, reports and diagnostics of the system, enhanced operations features, password protection setup and network configuration, connection to network setup features if necessary.
10. By submitting a Bid Proposal, the Security Contractor certifies that it is qualified in all areas pertaining to the Work. In the event the Security Contractor becomes unable to complete the Work in accordance with the Security Contractor Documents, or the satisfaction of the Owner or its representatives due to a lack of understanding of the equipment, systems, or services required by the Contract Documents, the Security Contractor shall retain the services of the applicable manufacturer's representatives to expeditiously complete the Work in accordance with the construction schedule at no additional cost to the Owner.
11. Bidders shall submit documentation as required to demonstrate compliance with Contractor Qualifications. References shall include contact information for end users familiar with the installation and continued operation of the systems, and the Security Contractor's work.

Provide a minimum of three (3) references whose systems are of similar complexity and have been installed and maintained by the security system integrator in the last five (5) years.

12. There shall be a local representative and factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for these systems.

C. Testing Agencies
   1. The SMS shall be tested and listed by Underwriters Laboratories (UL) for UL/cUL 294 for Access Control System Units.
   2. The SMS shall be tested and listed by Underwriters Laboratories (UL) for UL/cUL 1076 for Proprietary Burglar Alarm Units.
   3. The SMS shall employ a FIPS 197-listed AES 256-bit encryption between the SMS Servers, Clients, and iSTAR Ultra/eX/Edge Controllers.

D. The SMS shall include full support for FIPS 201 initiative:
   a. Ability to customize a system-wide Card Holder Unique Identification number (CHUID).
   b. Ability to configure custom, extended card formats, including GSA 75-bit Wiegand
   c. standard, and to download them to the card access panels.
   d. Ability to use Hashed Message Authentication Codes (HMAC) for medium assurance profile.
   e. Enhanced data fields per the FIPS 201 standard, including Agency Code, System Code, Credential Series and Credential Issue Code.
   2. 5. The SMS hardware shall comply with the following regulatory requirements:
      a. FCC Class A.
      b. FCC Class B.
      c. CE.
      d. Canadian Radio Emissions requirements.
      e. Restriction of Hazardous Substances Directive (RoHS) 2002/95/EC.
      f. FIPS 140-2 encryption (certified for the iSTAR Ultra/Edge/eX controllers).
   3. 6. The SMS shall support Americans with Disabilities Act (ADA) compliance in door and access operation.

E. Product Standards
   1. All access control hardware and software shall be of a single manufacturer including controller panels, and input and output terminal modules.
   2. All published specifications of the system manufacturer shall be considered as being a part of this specification, even though they have not been written in complete detail.
   3. The base bid shall be based on the products specified. Any substituted product and/or system shall not be accepted without prior approval from the Owner within 10 days of bid date
   4. Materials included in the completed security system installation shall be new and shall fully comply with the latest published specifications and versions of the manufacturer.
   5. Unless otherwise specified, components included in the completed security system shall be standard, unmodified production models.
   6. Equipment, components and materials provided by the Security Contractor shall meet or exceed the performance characteristics and technical specifications for referenced components.
   7. The Security Contractor shall provide complete and detailed technical information for equipment, components and materials. The Owner or its representatives will reject proposed equipment in the event that submitted technical information is not sufficient to readily confirm that proposed equipment, components, and materials will meet or exceed the performance and technical specifications. The Owner or its representatives shall make the final decision as to whether proposed equipment, components and materials are acceptable. In no case shall acceptance by the Owner or its representatives of proposed equipment, components and materials relieve the Security Contractor of his/her responsibility to produce completed systems, which comply with this RFP.
   8. Within the technical specifications for the system, certain manufacturers may be specified. These manufacturers are listed in alphabetical order for example purposes only. (unless followed by “No Exceptions”). The Security Contractor may substitute manufacturers and

models that may be more cost effective or readily available than those specified. Substitutions shall meet or exceed the minimum functional and technical specifications. Acceptance of such substitutions is at the discretion of the Owner and DPS Contact Person (if used).

9. The systems (including software, hardware and firmware) proposed for this project shall have been installed in at least two projects of similar size and nature and shall have been in beneficial use for at least six months prior to submission of the Bid Proposal. Provide a compliance statement from each manufacturer along with references as part of the Bid Proposal.

1.12 Licensing

1. Licensing shall be required for the SCS and VMS software and components.
2. The security contractor must provide licensing upgrades whenever any of the SCS design components exceeds 90% of the owners current SCS License limits for any of the following.
   a. Number of online readers.
   b. Number of online inputs.
   c. Number of online outputs.
   d. Number of card holders.
   e. Number of simultaneous clients.
   f. Number of simultaneous badging stations.
3. The security contractor must provide all licenses for added VMS devices and license licensing upgrades whenever any of the VMS design components exceeds 90% of the owners current VMS License limits for any of the following.
   a. Number of online VMS devices.
   b. Number of simultaneous clients.

1.13 WARRANTY

The SMS shall be provided with a 14-month product warranty from date of shipment or 1 year from date of registration, whichever is shorter. The SMS Hardware shall be provided with a 5-year product warranty from date of manufacture. Software version upgrades shall be available for no charge during this warranty. The software media warranty shall be 90 days per the C•CURE software licensing agreement.

1. The Security Contractor shall warrant to Harris Health System that it is the owner of the equipment and that the equipment will be free and clear of any lien or encumbrance on the final acceptance date.
2. The Security Contractor warrants that the materials and equipment furnished to Harris Health System will be new and of recent manufacture unless otherwise specified in the Contract Documents.
3. During the warranty period, the Security Contractor's maintenance personnel shall initiate all SCS service and repair within four (4) hours from receipt of a report of a SCS malfunction. The Security Contractor shall restore the SCS to proper operating condition within eight (8) hours after receiving a report of system malfunction.
4. For the purpose of this document, SCS malfunctions may be defined as follows:
   a. Complete failure of the components connecting or controlling the system security equipment or interfacing with existing equipment.
   b. Complete or partial failure of the panel or workstation, resulting in the loss of monitoring or reporting capability.
   c. Complete failure of the security equipment, resulting in loss of all system capability.
   d. Failure of security equipment, resulting in loss of use of installed access control stations (Card Readers or cameras).
   e. All other malfunctions shall be considered minor failures.
5. Harris Health System will call a designated Security Contractor-provided telephone number to effect Security Contractor notification of maintenance problems. Harris Health System will make reasonable repeat attempts to make notification. Response time requirements shall be measured from the time of the first attempt by Harris Health System to notify the Security Contractor.

6. The Security Contractor shall maintain an inventory of security equipment spare parts, materials, consumables, and any other system item in order to meet the specified warranty maintenance requirements and keep the security equipment in a continuous operational mode during the warranty period.
7. During the warranty period, maintenance service shall not be assigned or transferred by the Security Contractor to any agent or other Security Contractor.

PART 2 - PRODUCTS

2.01 GENERAL INFORMATION:

A. The SCS shall consist of the Software House C•CURE 9000 system, Software House C•CURE ID Badging Solution, and the Software House iSTAR Ultra family of field controllers. Hardware manufacturers shall be an ISO 9001:2000 registered company.

B. All security control cabling, including all horizontal cabling, for the security devices shown on the floor plan device drawings will be provided by the security contractor. All connectors and other cabling and wire are to be provided by the security contractor.

C. All network Data cable (Cat6A) and telecom cabling will be provided by the General Contractor (alternate: Owner) under the guidelines of the Harris Health System Information Technology Department. Number and location of devices, such as POE IP Cameras and security control panels, requiring network data cable are to be identified to the General Contractor and approved by the owner. Installation of all devices requiring network data cable is to be coordinated with the Harris Health System Information Technology Department.

D. All systems and added equipment shall be for a complete “Turnkey System” including power circuits required for servers and power supplies for the cameras or any other devices/components, interconnections, labor, and required design service. The entire system, including mounting, installing, system programming, connecting, calibrating, aligning, testing, and adjusting is to be the responsibility of one contractor.

2.02 SECURITY ACCESS CONTROL MANAGEMENT SYSTEM OPERATION REQUIRMENTS (ACMS)

A. The Access Control Management System (ACMS) consists of a fully integrated access control and alarm monitoring system consisting of fully redundant file servers, workstations, printers, software, Security Control Panels (SCPs), card readers, and alarm input and output devices.

B. The ACMS is controlled by the Software House CCure 9000 card access system. All additional controls and components shall be compatible and programmed to work with the existing Harris Health System Software House CCure 9000 card access system.

C. This CCure 9000 card access system is established in a centralized manner in which the Department of Public Service (DPS) administrates and monitors the database/server/software configuration. The DPS issues all identification badges and access cards and approves and assigns access levels per departmental request. All security control equipment must be installed and configured to support this centralized monitoring and control program.

D. The ACMS shall include, but not be limited to:

1. Alarm Workstations
   a. Designated alarm monitoring workstations (provided by owner) shall utilize ACMS client software to display alarm, access control, and CCTV events for the location. The security contractor must coordinate naming conventions for system programming and labeling with the owner. Primary alarm monitoring is conducted offsite.
   b. Software configured for on-site reporting should be properly partitioned to report only events or CCTV images that originate at the location. Access levels for on-site use of the ACMS monitoring software shall be programmed to provide both “guard station” and “supervisory” monitoring of card reader and remote control of doors.

c. The ACMS monitoring software must be configured to allow the operator to switch between the software and other applications while the system software is running.
d. The ACMS monitoring software must be programmed to allow the operator to monitor live video or video from cameras activated when an alarm condition occurs. Programming should allow the operator to watch live video, rewind a video clip to the point where an event occurred, or control the movement of any pan/tilt/Zoom cameras installed at the location.
e. The ACMS monitoring workstation must be configured to display the date, time, and number of alarms waiting at all times. The workstations must display and record the alarm messages including the time, date, location, point number, event type, and point status for each transaction.
f. The ACMS monitoring workstation must also monitor the status of the Fire Alarm system relays to provide for fail-safe lock release.
g. Central alarm monitoring commands must always override any on-site workstations and the use of on-site workstations should not cause any appreciable reduction in system processing or response time.
h. The security contractor shall ensure that all alarm and CCTV devices can be accessed and controlled through remote workstations via the owners existing CCURE 9000 security system.
i. All CCTV and alarming devices must be set up as events according to the owner's instructions and their locations properly mapped in the CCURE mapping interface.
j. Setup of areas specified with a card reader with keypad is to include setup of special intrusion zones, personnel groups, and event(s) according to instructions provided by the owner.
k. The CCure 9000 mapping interface is to be utilized for all workstation graphics. Workstation graphics must show the location of all alarm, card access, and camera points. Icons for each must visibly change appearance during alarm conditions. All workstation graphics must be setup so that they may be utilized when the Owner transitions to a CCure 9000 system in mid-2009. Proper function of the graphical interface is to be considered a warranty item.
l. The Owner will provide ACMS workstations. Coordinate workstation requirements with the Owner

2. Security Control Panels (SCP): The SCPs shall:
   a. Support OSDP (Open Supervised Device Protocol), v2.1.6 or higher for directly connected readers. OSDP shall be supported with the iSTAR Ultra and qualified OSDP capable readers using OSDP Secure Channel AES128 encryption.
   b. Be installed in a hardwired configuration only with all readers and field devices home run to central location using composite access control cable. Provide 20% spare capacity on all panels to support future growth. Non-OSDP reader installations and/or wireless locksets must be specifically approved by Harris Health.
   c. Not have any inputs or outputs that not associated with a card reader door. These inputs will require the addition of remote input/output modules to the panel to support the additional I/O requirements. These inputs and outputs may include but not be limited to, panic and lockdown switches, elevator controls, fire alarm inputs, door contacts, intrusion detectors, call buttons or other monitoring/control systems.
   d. Collect alarm input point status.
   e. Access control data:
      1) Multiplex the data.
      2) Transmit the data back to the system file server workstation.
   f. Support a minimum of fifteen (15) card readers.
   g. Support a minimum of fifteen (15) supervised inputs, in addition to those required for card access-controlled door monitoring and request to exit.
   h. Incorporate Flash ROM to allow for efficient firmware update downloads from the system software and remotely from the system manufacturer.

i. Support secure Ethernet and RS-485 communications topologies.
j. Support Dynamic Host Configuration Protocol to simplify installation.
k. Receive and execute instructions issued automatically or manually from the system file server workstation.
l. Have memory and logic circuits required to ensure continued operation of connected devices without degradation of system security in the event that communications with the system file server is interrupted.
m. Communicate with the system server and system workstation over the owner's local or wide area network. The security contractor is to provide all equipment necessary to facilitate communications, i.e., terminal servers, short haul modems, fiber optic transmission devices, etc. All communications shall be fully supervised.
n. Have the equipped hardware capacity to connect with the listed card reader doors, door contacts, and motion detectors and shall have a minimum of 20% of reader ports, inputs, and outputs available for future controlled doors. The base hardware inputs and outputs on security control panels are not be used for other devices unless specifically approved by the owner.
o. Have the equipped hardware and software capacity to support up to 50,000 cardholders.

3. SCP Power Supplies shall be furnished and installed and shall:
   a. Be dedicated to the SCPs and shall not provide power for locks or any other low voltage device.
   b. Be UL listed and operate with a 120 VAC input voltage and provide filtered and conditioned output voltage required by the SCPs.
   c. Provide a minimum of twelve (12) hours of battery backup to provide continuous operation during power failure.
   d. Include a battery charger to maintain the battery.
   e. Be housed in a locking steel enclosure designed for surface mounting. The housing shall include a tamper switch to sense the removal or opening of the enclosure cover. All SCPs, power supplies, and power distribution cabinets shall be keyed alike.
4. Alarm input and output modules
   a. Alarm input and output modules are to be provided for alarm, annunciating, and other control devices connected to the ACMS.
   b. Alarm input and output modules should be located adjacent to their respective SCP unless otherwise approved by the owner.
   c. All inputs on the system require true 2 resistor end of line supervision with (2) - 1K 1/8 watt 5% carbon film resistors.
   d. All alarm input and output modules are to be mounted in an appropriate enclosure.
5. Card Access Controlled Doors and Gates
   a. Card Reader Controlled Doors and/or Gates shall have a card reader and all necessary components installed to allow the door(s) or gate(s) to be controlled by the system workstation(s) or be set on time schedule control of electric locking mechanism. Doors equipped with card readers shall be installed within ADA standards and specifications.
   b. The Security Contractor shall provide owner-specified composite access control cable from the door/reader to the SCP location. Cabling for Harris Health System Software House card reader installations is normally specified without the use of a Reader Interface Module. The need for and proposed mounting locations of Reader Interface Modules is to be approved by the owner. Other cabling needed for additional inputs/outputs and/or power needs should also be identified and provided by the Security Contractor. The Security Contractor may use the option to subcontract with the Harris Health Systems cable contractor to perform any required work.
   c. Connect the card reader door components and provided locking hardware to new power supplies.
   d. Provide one normally closed magnetic door position switch (concealed where possible and surface mount when necessary) for each leaf of card reader controlled doors to monitor door propping/intrusion alarms and open/closed status.

e. Provide necessary relay(s) for interface with door equipped with electric door operators. Card access-controlled doors with electric door operators shall be configured so that they operate normally by activation switch or presence detector in “unlocked” mode. For entry in “locked” mode, only a valid card read shall be required to activate the operator(s). Relays should be properly timed so that there is no binding of the lock when the operators activate the system.
f. Card access controlled doors also equipped with electromagnetic hold-open devices (MHO) must be interfaced with the ACMS so that the MHO’s only operate when the door(s) is in a “locked” state.
g. Provide monitoring the card reader for invalid card use. The System shall annunciate each condition individually.
h. Provide configuration and setup for “nested anti-passback controls” into and from nested parking areas when required.
i. The System shall automatically relock the lock after the door closes after a valid card read access.

6. Electric Locking Mechanisms
   a. The security contractor should coordinate electric locking hardware for new card reader controlled doors with the Architect and General Contractor prior to preparing pricing. Unless otherwise noted, the security contractor is to provide all electric locking devices and electromechanical releases. The security contractor is to provide relays necessary for interface with electrically operated or handicapped accessible doors or doors equipped with magnetic hold-opens.
   b. New electric lock mechanisms should be selected based on the following preference.
      1) Electromechanical mortise/cylindrical lock and power transfer hinge (for new doors).
      2) Panic devices with electric lever release/retraction and power transfer hinge (Electrified trim release with power transfer hinge preferred for non-operated doors)
      3) Electric strikes (for existing door hardware applications).
      4) Electromagnetic locks (for doors where other electric locking hardware cannot be used).
   c. Electric locks for high security or mental health areas should be rated “high security” or similar.
   d. Electric locks for use in mental health patient areas should be rated “anti-ligature” or similar.
   e. Delayed egress locks are to be used when required by Code.
   f. Door electric locking mechanism power will reside in the SCP location with an exception for panic hardware electric latch retraction devices that are to be connected to a power supply within 25’ of the door.
7. Remote Releases for ACMS controlled doors
   a. Remote release push buttons are to be desk mounted at designated desks to remotely release electric locks on card reader controlled doors. Unless otherwise noted, all remote release button shall operate via in input into the ACMS. Each use of the remote-release pushbutton shall be recorded in ACMS history. The Door-release pushbutton use shall not cause an alarm on the system workstation. When a door release pushbutton is pressed, the ACMS shall unlock the door and shunt the door position switch for a user programmable time-period of one to sixty seconds. The ACMS shall unlock the door and shunt the door position switch no more than one second after the door release pushbutton is pressed. The door release pushbutton shall not affect the request to exit device operation for doors with free egress hardware.
   b. Upon instruction for owner, define an ACMS schedule when the remote release button will be operational.
   c. Door release buttons must appear visibly different from panic or duress devices
8. Emergency Door Release for ACMS controlled doors
   a. Only when required by code, and with Owner’s approval, the Security contractor may add an emergency door release to or for access controlled doors.

b. In addition to any direct unlocking requirements, the emergency door-release button used shall be designed to activate inputs in the ACMS to activate a notification event that describes the emergency unlock function.
c. Emergency Door Release switches shall also be covered with a clear “Stopper” cover of the type used for fire alarm pull stations.
d. Acceptable Manufacturers:
   1) RCI 904P B (blue, wall-mount)

2.03 SECURITY SYSTEM HARDWARE REQUIRMENTS (ACMS)

A. Security Control Panels (SCP).
1. Software House iSTAR SCPs are to be utilized. The Security Contractor must get written approved from the designated Harris Health representative for the proper size of the Istar(s) to be utilized and the exact location(s) for all devices to be installed. If not otherwise specified, the Software House iSTAR Ultra G2 with an integrated PSX Power Solution is to be utilized
2. Mount all panels on a fire-rated plywood backboard that is securely anchored to the wall. The Security Contractor must confirm if the backboard requires painting.
3. Bundle cables inside the panels with Velcro, not tie wraps.
4. Label the cables using a label-maker
5. Create and attach a panel schedule to the new panel that includes the description and location for each installed point used within that panel:
6. Connect and configure the panel tamper switch as an alarm event.
7. Handwritten panel schedules will not be accepted.
8. Within the title block, the panel schedule shall identify the panel name, panel IP, panel MAC ID, and panel address.
9. A minimum of 2 keys shall be left with the Harris Health representative upon final inspection. Do not leave panels unsecured or keys onsite and unattended.
10. If RM4’s are installed for doors, they shall be installed a maximum of 10 feet from their corresponding card reader and shall be mounted inside an enclosure on the secure side of the opening.

B. SCP Power Supplies
1. The Software House PSX Power System shall be provided for all ISTAR SCP’s. It is preferred that that PSX Pre-wired Istar Ultra Power Solutions provided to provide both SCP and door lock power and contained within the same enclosure.
2. One relay output is to be connected to the SCP power fail input and indicate loss of AC power to the PSX Dual Voltage Power System. The second relay output is to be connected to the SCP low battery or fault input to indicates low battery or a problem within the power supply.

C. Card Readers
1. The Security Contractor shall provide and install Multi Technology card readers that shall be controlled by the ACMS. The Security Contractor shall install the card readers within Americans with Disabilities Act standards and specifications.
2. Card Reader, standard
   a. Card readers shall read the Owner’s existing HID 125kHz Corporate 1000 access cards, 13.56MHz ISO14443/ISO15693 card serial numbers, and cardholder number and biometric template data from a secured contactless smartcard chip on the access cards.
   b. Card readers shall also read NFC & BLE mobile credentials.
   c. Card readers must effectively operate if mounted directly to a metal surface and have a minimum read range of 4 inches. Card Readers shall be provided with a manufacturer recommended UL Class 2 power supply and shall provide necessary output voltage to allow the card reader to operate at its maximum specified read range.

3. Acceptable Manufacturers
   a. Wavelynx ET20-7/ET10-7
   b. HID SCR-SIG-40NKS (with owner's approval)
   c. Software House SWH-6000/6100 (with owner's approval)

D. Card Reader with keypad (pharmacy entrance doors)
1. Card readers shall read the Owner's existing HID 125kHz Corporate 1000 access cards and 13.56MHz ISO14443/ISO15693 card serial numbers.
2. Card readers shall also read NFC & BLE mobile credentials.
3. Card readers must effectively operate if mounted directly to a metal surface and have a minimum read range of 6 inches. Card Readers shall be provided with a manufacturer recommended UL Class 2 power supply and shall provide necessary output voltage to allow the card reader to operate at its maximum specified read range.
4. Installation is to include proper configuration of intrusion zone and personnel groups.
5. Acceptable Manufacturers
   a. Wavelynx ET25-7
   b. SWH-6200 (with owner's approval)
   c. HID SCR-SIG-40KNKS (with owner's approval)

E. Card Readers, parking-long range (with owner's approval)
1. Card readers shall read the Owner's existing HID 125kHz Corporate 1000 access cards.
2. Card readers must effectively operate if mounted directly to a metal surface and have a minimum read range of 8 inches. Card Readers shall be provided with a manufacturer recommended UL Class 2 power supply and shall provide necessary output voltage to allow the card reader to operate at its maximum specified read range.
3. Parking card readers are to be mounted on a pedestal-mounted acrylic spacer large enough to include the reader and a hands-free
4. Unless otherwise noted, the security contractor shall provide the mounting surface(s) and pedestal(s) for all parking card readers.
5. Acceptable Manufacturers
   a. HID Maxiprox (with owner's approval)
   b. Falcon S1R1235 metal stanchion
   c. Falcon MCH5375-1CR MaxiProx acrylic spacer kit
   d. Or approved equivalent

F. Electro-Mechanical Locksets
1. Electro-mechanical locks shall comply with requirements for size, finish, type, etc., as set forth for non-electric locks and shall conform to ANSI A156.23. Locks shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical locks shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty.
3. Electro-mechanical locks shall ben field-selectable to provide fail secure or fail-safe function. Unless otherwise indicated or required by Life Safety Code, electro-mechanical locks are to be configured as fail-secure and will operate as passage set when energized,
4. Electro-mechanical hardware shall be rated to operate with the specified reader composite cable and provided power supplies so that voltage drop does not exceed 5% of load's stated voltage.
5. Electro-mechanical hardware is to be furnished with power transfer devices, junction boxes, and other accessories needed for a complete, efficient installation. Installation of Electro-mechanical hardware is to include coring of doors when required. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation.
6. Power Transfer Devices shall provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2" x 4 1/2" butt hinges or 3/4" offset pivots. When door is in closed position, transfer unit shall be concealed. Transfer

units shall contain ten 24 AWG UL approved conductors with a rating of 10 Amps at 24 VDC (Class 1 low voltage)

7. Acceptable Manufacturers
   a. Stanley Best HW Series
   b. Stanley Best KW Series
   c. Or approved equivalent

G. Integrated Electro-Mechanical Locksets
1. Integrated Electro-Mechanical Locksets shall be Sargent/Corbin Russwin grade 1 mortise locks that includes the card reader, latch bolt position (DPS) monitor, and door-handle REX sensor integrated into the lock housing.
2. Integrated Electro-Mechanical Locksets shall comply with requirements for size, finish, type, etc., as set forth for non-electric locks and shall conform to ANSI A156.23. Locks shall be UL listed for labeled doors.
3. Integrated Electro-Mechanical Locksets shall provide fail-secure function and will operate as storeroom-function lockset when de-energized, unless otherwise indicated. All Integrated Electro-Mechanical Locksets shall include a key override (to be fitted with the owner's Best MX-8 core). High security applications shall include the deadbolt option
4. Integrated Electro-Mechanical Locksets must include a card reader that reads the Owner's existing HID 125kHz Corporate 1000 access cards.
5. Integrated Electro-Mechanical Locksets must be furnished with specified power transfer devices, junction boxes, and other accessories needed for a complete, efficient installation. Doors must be provided with either pre-installed ASSA ABLOY ElectroLynx cabling or a minimum 5/8"chase or raceway to allow installation of ElectroLynx retrofit cables with Molex connectors. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation.
6. Whether the installation used pre-installed or retrofit cable, all ElectroLynx cable sets are to be provided to provide connectivity from the ceiling termination point to the hinge and from the hinge to the door hardware.
7. Power Transfer Devices must consist of McKinney QC Concealed Circuit Electric Hinges with ElectroLynx 8 position and 4 position connectors.
8. Acceptable Manufacturers
   a. Sargent or Corbin Russwin H1 Harmony Series Lockset
   b. McKinney QC Series Hinges
   c. Assa Abloy ElectroLynx Series cabling
   d. Or approved equivalent

H. Electro-Mechanical Exit Devices:
1. Electro-mechanical exit devices shall comply with requirements for size, finish, type, etc., as set forth for non-electric devices. Exit devices shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical exit devices shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty.
3. Electro-mechanical exit devices are to be furnished with power transfer devices (armored cables loops are not to be utilized), junction boxes, and other accessories needed for a complete, efficient installation. Installation of electro-mechanical exit devices are to include a local power supply, when specified by the manufacturer.
4. Electro-mechanical exit devices shall provide fail safe function and will operates as panic hardware when de-energized
5. Electro-mechanical exit devices shall operate with latch retraction: Upon signal, unit's latch retracted (unlocks).
6. Power Transfer Devices shall provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2" x 4 1/2" butt hinges or 3/4" offset pivots. When door is in closed position, transfer unit shall be concealed. Transfer units shall contain ten 24 AWG UL approved conductors with a rating of 10 Amps at 24 VDC (Class 1 low voltage).

7. Power Supply Units for electro-mechanical exit devices shall be designed for the device utilized. Output power shall be field selectable for either 24 volts DC at 1 ampere or 12 volts DC at 2 amperes. The Power supply unit shall have a terminal block that shall accept 14-gauge stranded wire and shall be mounted in an enclosure not less than 10" x 10" x 4" deep, constructed of 19-gauge steel with a hinged cover. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation.
8. Acceptable Manufacturers
    a. Von Duprin Quiet Electric Latch Retraction-QEL or approved "quiet, low amperage" equivalent

I. Access Control Interface for electrically operated or handicapped accessible doors
1. Interfaces for operated access control doors must provide adjustable timed relay control to allow proper integration of locking devices, electric door operators, and/or locks that latch upon fire alarm activation. This functionality is to include the following:
    a. Access control locked mode allows for door to unlock and then activation of door operator after valid card is presented to the card reader.
    b. Access control unlocked mode allows for activation of door operator when paddle is depressed or when door operator motion sensor detects presence.
    c. Delayed locking of door locks until both door leafs are closed
2. Interfaces for operated access control doors are to be installed in a surface mounted steel enclosure(s) mounted above the accessible ceiling in a surface mounted steel enclosure mounted on the secure side of the door.
3. Acceptable Manufacturers
    a. Kouba LDAADC4 (include SWH RM4E/R8 as required)
    b. SDC UR Series
    c. Or approved equivalent

J. Electric Strike
1. Electric strikes may be required for projection additions or completion.
2. Electric strikes must comply with BHMA Std. 501, Grade 1 requirements and UL 1034, Burglary-Resistant Electric Locking Mechanisms. [At fire-rated openings provide UL listed Fire Door Accessory, category 10B, for use with 3 hour "A" labeled doors.].
3. Electric strikes must be solenoid actuated, heavy-duty, tamper-resistant electric strikes constructed of corrosion-resistant metals, with stainless steel cases and springs. They are to be non-handed, field-reversible, and horizontally adjustable to compensate for door/frame misalignment. Electric strike function shall be Fail-Secure (unlocked when energized) with 24V solenoid operating voltage. The strike should accommodate internal switches for remote monitoring and control as required.
4. The Security Contractor must ensure that electric strikes are compatible with types and models of locksets or exit devices being installed. The electric strike must allow the lock's latch trigger to properly operate. Finish is to be stainless steel unless otherwise noted
5. Minimum Specifications
    a. Construction: Tamper resistant, heavy duty, stainless steel.
    b. Adjustment: Horizontal adjustment to compensate for door and frame misalignment.
    c. Application: As required for each location to accommodate existing lock set (e.g. mortise, cylindrical, etc.).
    d. Latch protection: Provide strike latch guard to prevent tampering with the latch bolt.
6. Acceptable Manufacturers
    a. HES 1006 series (mortise)
    b. HES 1600 series (deadbolt/cylindrical)
    c. HES MUNL (mortise, "quiet" applications)
    d. Or approved equivalent

K. Electromagnetic lock

1. Electromagnetic locks are to only be installed when required for proper door function. Electro–Magnetic Locks are to be considered prohibited without a written exception from the Harris Health Security Representative.
2. Where required, locks shall include filler plates, angle brackets or glass door brackets as required for door and frame assembly as recommended by manufacturer. Coordinate installation with General Contractor and Architect.
3. Minimum holding force for standard interior doors shall be 1,200 pounds. Minimum holding force for perimeter, mental health, and high security areas shall be 1,500 pounds
4. Shear locks are prohibited.
5. Installation shall be done to Code required by the AHJ. All magnetic locks shall release immediately upon or signal from the fire protective signaling system. The locks shall remain unlocked until the fire protective signaling system has been reset.
6. Acceptable Manufacturers
   a. Rutherford Controls (RCI) 8300 Series
   b. Schlage M490/492 Series (high security)
   c. Or approved equivalent

L. Delayed egress locking devices
1. Delayed egress locking devices are to be used when required by Code or to deter unauthorized egress.
2. Delayed egress locking devices on access doors into controlled areas must be approved by the Harris Health Security Representative.
3. Installation shall be done to Code required by the AHJ.
4. Desired function is as follows
   a. Pre-activation warning tone to sound whenever egress pressure is applied to door
   b. Activation alarm to sound at end of count down.
   c. Reset of activation alarm shall require key reset at door or, when controlled by access control, by console operator.
5. Acceptable Manufacturers
   a. Schlage M490DE (magnetic lock)
   b. Vonduprin CHEXIT
   Or approved equivalent

M. REX Devices
1. Provide UL Listed REX devices in accordance with local codes to detect authorized exits through card reader controlled doors including, but not limited to.
   a. REX motion sensors.
   b. REX buttons for doors with electromagnetic locks.
2. Wire the REX devices to the REX input of the SCP.
3. For doors with electromagnetic locks, additionally wire REX devices to directly interrupt power to the lock in accordance with local life safety codes.
4. For doors equipped with electric locking mechanisms that are free exiting at all times (e.g. electromechanical mortise/cylindrical locks, electric strikes, etc.), the REX motion sensor shall only shunt the intrusion alarm output and shall not unlock the lock. Use of graphics shall not affect the request-to-exit motion sensor operation for doors with free egress hardware.
5. Locate and adjust REX motion sensor to minimize improper activation (e.g. objects pushed beneath or between doors, corridor traffic, etc.).
6. Provide all signs and/or labels as required to meet local codes and be accepted by local life safety officials.

N. REX Motion Sensor
1. Minimum Specifications
   a. Detection technology: Passive infrared.
   b. Detection pattern: Adjustable to provide coverage of immediate door area.
   c. Output contacts: Two configurable with adjustable activation time (connect one contact to SCP REX Input and one contact to interrupt lock power for electromagnetic locks).
   d. Power requirements: 12-24 VDC.

e. Mounting: Surface mount to wall, ceiling, or door mullion.

2. Acceptable Manufacturers
   a. Bosch/Detection Systems Inc. Model DS160.
   b. Or approved equivalent.

O. REX Button
1. Provide REX buttons for unlocking card reader controlled doors with electromagnetic locks.
2. Activation of the REX button shall release the lock and shall shunt the intrusion alarm output.
3. The REX button shall contain an adjustable-time unlock relay for door unlock and shall be intrinsically fail-safe in order to release the door(s) in the event of a failure of the exit control circuitry within the SCP.
4. Wire the REX button as follows:
   a. One normally open momentary pushbutton contact wired to activate the timed unlock relay.
   b. One normally closed momentary pushbutton contact wired in series with lock power for fail safe lock release.
   c. One normally open momentary pushbutton contact wired to the SCP request to exit input.
   d. One user adjustable (1 to 60 seconds) hold open relay normally closed contact wired in series with lock power to lock control.
5. The REX button shall be labeled to meet local codes and accepted by local life safety officials. Provide instructional signage as required to comply with local codes and life safety requirements.
6. Provide wall mount or mullion mount styles as required.
7. Acceptable Manufacturer
   a. Designed Security, Inc.
   b. Locknetics.
   c. Security Door Controls.
   d. Or approved equivalent.

P. Key Switch Override
1. When approved by owner, provide wall-mounted key switch override to provide function of 1) overriding card access functions OR 2) providing lock and unlock function of connected electronic lock.
2. Key switch to be mounted per reader mounting specifications and, when used to override the card reader, should be mounted adjacent to the reader.
3. Key switch overrides must be provided with a small format 7pin IC core mortise cylinder.
4. Acceptable Manufacturers
   a. Camden CM-1130 Key Switch, SPDT N.O. and N.C. Maintained

Q. Tamper Switch
1. Provide normally closed tamper switches to monitor the secure status of all SCPs, power supplies, power distribution enclosure units, and interface cabinets.
2. Minimum Specifications
3. Type: Plunger.
   a. Configuration: Normally closed when the cabinet door is closed.
   b. Mounting: Fastened within cabinet with no access to fasteners when cabinet is closed.
4. Acceptable Manufacturers
   a. Honeywell.
   b. Flair.
   c. GE Security.
   d. Or approved equivalent.

R. Door Position Switches
1. Provide supervised, normally closed single and double pole double throw, door position switches to monitor the open/closed status of card-access controlled doors and other specified

doors, gates, and hatches. Provide concealed door position switches unless otherwise specified or required.

2. Concealed Door Position Switch
   a. Minimum Specifications
      1) Gap: One inch between the magnet and switch.
      2) Configuration: Normally closed when the door is closed.
      3) Mounting: 3/4 inch diameter hole in door and frame.
3. Surface Mount Door Position Switch
   a. Minimum Specifications
      1) Gap: Two inches between the magnet and switch.
      2) Configuration: Normally closed when the door is closed.
      3) Construction: Heavy duty aluminum housing.
      4) Mounting: Surface to door and frame.
   b. Provide armored cable from the switch location to the associated junction box in order to conceal and protect the wire.
4. Overhead Door Position Switch
5. Minimum Specifications
   a. Gap: Three inches between the magnet and switch.
   b. Configuration: Normally closed when the door is closed.
   c. Construction: Heavy duty.
   d. Mounting: Floor.
6. Provide armored cable from the switch location to the associated junction box in order to conceal and protect the wire.
7. Acceptable Manufacturers
   a. GE Security (Sentrol).
   b. Flair.
   c. George Risk Industries (GRI).
   d. Or approved equivalent.

S. Duress (Panic) Button
   a. Provide duress buttons flush mounted on walls or surface mounted below desks and counter tops. Verify duress button types, locations, and mounting requirements with the Owner.
   b. Unless otherwise noted, duress buttons are to be non-latching “under-counter” types (use latching types when buttons are installed in series), surface mounted below counter tops or in the knee space of desks in an accessible location. Verify the exact location with the Owner. Exposed cable shall be armored and securely fastened to prevent tampering.
   c. Wall mounted panic buttons shall be a non-latching type and must be visibly marked with the wording “panic” or similar.
   d. Panic button shall have a separate raceway from IT data cabling to the mounting surface. Coordinate requirements with the Architect and General Contractor.
   e. Configure ACMS system to annunciate duress alarms as the highest priority alarms with associated camera display(s).
   f. Acceptable Manufacturers
      1) United Security Products HUB-DL-M (desk/counter button)
      2) STI SS2204ZA-EN (wall mount, “EMERGENCY-PUSH FOR HELP”)
      3) Alarm Controls Model PBM-1-1 (wall mount)

T. Lockdown or other event Control Button
   1. Provide flush mounted wall mount lockdown or other event control buttons to provide event activation through the SCS. Verify button types and colors, locations, and mounting requirements with the Owner.
   2. Control buttons should be momentary, must be visibly marked with the function wording (i.e. “Lockdown”) and activate an alarm event on the ACMS. “Stopper” coverers are preferred.
   3. Acceptable Manufacturers
      a. Dortronics 5216-MP23/BxE6 (requires engraving)

b. STI SS2324LD-EN (lockdown button, white)

U. Fireman's Unlock Control Button
1. Provide flush-mounted wall mount control buttons to provide override of electric locking systems.
2. Fireman's unlock control buttons are provided only when required by Code or local AHJ. Verify function, button types and colors, locations, and mounting requirements with the Owner.
3. Control buttons must be visibly marked with the function wording "EMERGENCY UNLOCK" or wording required by Code.
4. All fireman's Unlock buttons must also activate an alarm event on the ACMS unless specifically approved by the owner.
5. "Stopper" coverers for wall mounted buttons are preferred.
6. Acceptable Manufacturers
   a. Dortronics 5216-MP23PP/RxE6 (requires engraving)

V. Door Control Panel/Door Release Push Button
1. The Security contractor shall provide, install or reconnect door control panels and/or door release push buttons as require on designated desks or counters.
2. As design of the system may require single or multiple, momentary or latching systems, The Security Contractor must obtain approval from the Harris Health Security Representative of the solution to be utilized. Door release panels controlling multiple doors must be properly labeled.
3. The Door-release pushbutton use shall be designed to activate inputs in the ACMS to perform as follows:
   a. When a door release pushbutton is pressed, the ACMS shall unlock the door and shunt the door position switch for a user programmable time-period of one to sixty seconds.
   b. The ACMS shall unlock the door and shunt the door position switch no more than one second after the door release pushbutton is pressed. The door release pushbutton shall not affect the request to exit device operation for doors with free egress hardware.
   c. The door release pushbutton shall not cause an alarm on the system workstation.
4. Door release buttons must appear visibly different from any emergency activation switches including panic, duress, lockdown, or HVAC shutdown devices
5. Acceptable Manufacturers:
   a. Assa Abloy TS-18 (single, under counter)
   b. Securitron PB3N (single, wall)
   c. RCI 909S MO (single, wall or desk)
   d. Alarm Controls DTC series (multiple, desktop)

W. Emergency Door Release for ACMS controlled doors
1. Only when required by code, and with Owners approval, the Security contractor may add emergency door release to or for access controlled doors.
2. In addition to any direct unlocking requirements, the Emergency door-release button use shall be designed to activate inputs in the ACMS to activate a notification event that describes the emergency unlock function.
3. Emergency Door Release switches shall also be covered with a clear "Stopper" cover of the type used for fire alarm pull stations.
4. Acceptable Manufacturers:
   a. RCI 904P B (blue, wall-mount)

X. Gate Control Panel
   a. Provide a gate control panel capable of supporting at least six zones/gates. Verify type, location, and mounting requirements with the Owner. Include control cable to all perimeter parking gates and connect to gate controller provided by others.
   b. Verify with the General Contractor gates to be controlled by the lock control panel.
   c. Gate control panel functions should be "open", "closed" and momentary.
   d. Acceptable Manufacturers

1) Securitron
2) Or approved equivalent

Y. Intrusion Sensors

a. Glassbreak, motion, and/or combination detectors should be installed in locations to provide optimum intrusion protection. The security contractor is empowered to select the proper device or devices to protect the facility. Device selections are to be made on ensuring rapid early detection of human targets without triggering false alarms. Whenever possible, devices should be ceiling mounted and capable of providing 360º of coverage
b. The security contractor is empowered to select the proper device or devices to protect the facility. Coordinate device applications, locations, and requested additional devices with the Owner to provide protection as required.
c. Dual Technology Curtain Motion Sensor

1) Minimum Specifications
a) Detection technology: Combination passive infrared/ microwave.
b) Detection pattern: 35 feet X 30 feet.
c) Alarm output: Normally closed contact.
d) Power requirements: 12-24 VDC.
e) Mounting: Surface wall mount.
f) Acceptable Manufacturers
(1) GE Interlogix. AP series
(2) or approved equivalent

d. Dual Technology 360 degree Motion Sensor

1) Minimum Specifications
a) Detection technology: Combination passive infrared/ microwave.
b) Detection pattern: Three 360 degree fields.
c) Alarm output: Normally closed and normally open contact.
d) Power requirements: 12-24 VDC.
e) Mounting: Ceiling or wall mount.
f) Acceptable Manufacturers
(1) GE Interlogix. AP series
(2) or approved equivalent

e. Glassbreak sensor, 360 degree
1) 1) Minimum Specifications
a) Detection technology: glassbreak.
b) Detection pattern: 360 degree fields with up to 25' radius from sensor to glass.
c) Power requirements: 9 to 16VDC
d) Acceptable Manufacturers
(1) GE Interlogix Shatterpro III series
(2) Or approved equivalent.

Z. Video Intecom Systems

1. Provide a color video intercom system(s) for communication between designated areas.
2. The intercom systems must support a master to door station distance of at least 400’.
3. Intercom masters stations should be configured to communicate with their respective door and parking gate entry substation(s) stations.
4. The door entry substation must provide a viewing angle of 60" degrees vertically and 80" horizontally.
5. Intercoms associated with card reader controlled doors shall use the ACMS to unlock the door. Direct connections to the REX devices should not be used.

6. When required, provide integrated intercom systems capable of multiple, interoperable, master and door stations.
7. Intercom subdoor stations shall be flush mounted, unless otherwise noted on the Drawings.
8. Intercom systems shall be microprocessor controlled and shall incorporate modular components. All circuitry and components shall be arranged on slide-in printed circuit boards using SMD-Technology. Each module shall have its own microprocessor and a fault in one module shall not affect the function of the whole system. The modules shall have diagnostic LED'S for maintenance and fault detection.
9. Acceptable Manufacturers
    a. Axis A8105 with flush mount)/Axis I8016-LVE-Exterior (IP, single or multiple station systems for locations with IP phones or control by PC workstation)- standard
    b. Aiphone JO Series (single door to master systems – analog alternate)
    c. Aiphone KB Series (single door to master systems – analog alternate when privacy handset required)
    d. Aiphone IX Series (IP, multiple station systems requiring master stations-approval required)
    e. Or approved equivalent

AA. Hands Free Telephone
1. The hands-free telephone shall be specifically designed for outdoor applications and shall include the following functions:
    a. A single button call switch.
    b. An LED to identify “call placed” and “call answered” conditions.
    c. Automatic dialing of a primary telephone number when the call button is pressed. The telephone shall automatically dial a secondary telephone number when the primary number is busy or unanswered.
    d. Non-volatile memory requiring no battery backup.
    e. Operating temperature range of –15 to 130 degrees Fahrenheit.
    f. Vandal resistant construction.
    g. Remote programmability.
    h. Adjustable microphone sensitivity to adjust for field conditions.
    i. Auxiliary Output(s) for remotely activation via receiver’s telephone keypad of a siren, light, CCTV camera, or door/gate unlock.
2. Provide auxiliary call button contacts or off-hook detector for each telephone and interface the contacts with the System to log call events in history and provide automatic camera call up when a call is placed from the telephone.
3. Interface the telephone with the Owner’s telephone system.
4. The security contractor shall coordinate all power and conduit needs for emergency phones.
5. Acceptable Manufacturers
    a. IP Communications (video intercom) - standard
        1) Axis I8016-LVE
    b. Analog Communications
        1) Talkaphone Model ETP-401CV with auxiliary output(s).
        2) Or approved equivalent.

BB. Emergency Phones
1. Emergency Phones shall consist of outdoor-rated, vandal resistant and ADA-compliant hands-free speakerphones mounted in either a phone tower or wall mount. Emergency phones shall be VOIP units with an SIP camera integrated into the unit.
2. The Emergency Phone unit shall be totally hands-free on both sides after connection is initiated at site or by attendant.
3. Unless otherwise noted, emergency phones units shall include an SIP capable IP camera that includes a labeling of location. For approved analog phones, a voice location identifier prompt that transmits a recorded message as soon as call is answered. The location identifier message and duration shall be programmable from remote location.

4. Emergency phones shall typically be setup to call an owner-specified IP display phone. When specified, emergency phones shall be configured to be monitored and controlled by a provided base station software package. Configuration is to include calling location and site specific instructions. The configuration is to also include setup for automatic tests of the phones and phone lines.
5. Analog Emergency Phones will be installed with a dedicated communication line and must be capable of operating on standard phone lines or analog PBX extensions
6. Mounts must also be outdoor-rated, constructed of stainless steel and available in brushed finish or painted blue with wording on the side(s). Coordinate color and wording requirements with the owner.
7. All mounts must have an integrated or adjacent blue light strobe (of at least 1.5 million candle power). When the Emergency Phone is not in use, the blue light shall remain lit and visible from a distance. When the button is pressed, the strobe shall flash brightly and continue to flash for the duration of the communication.
8. The security contractor shall coordinate all power and conduit needs for emergency phones. Power and data must be provided on separate conduit.
9. The security contractor shall provide a 24" x 24" concrete foundation where required. The security contractor may also coordinate with the general contractor for the installation of J-bolts in lieu of providing a foundation.
10. Acceptable Manufacturers
    a. IP Communications - standard
        1) Emergency Phone: CB 2-f with LS1000 with camera
        2) Wall mount: Code Blue CB 2-e with LS1000 with camera
        3) Tower Mount: Code Blue CB-RT with LS1000 with camera
        4)
    b. Analog communications-Requires approval
        1) Emergency Phone: Talk-A-Phone Model ETP-400
        2) Wall mount: Talk-A-Phone Model ETP-WM/E
        3) Tower Mount: Talk-A-Phone Model ETP-MT

CC. Off-hook Detector

1. Provide an off-hook detector, powered through the analog telephone line, for each analog hands-free and emergency telephone.
2. The off-hook detector shall activate an internal relay during a call/conversation and shall automatically reset when the telephone call terminates.
3. Connect and program the System and off-hook detector to provide for automatic camera call-up when the associated telephone is in use.
4. Locate off-hook detector within a lockable cabinet in the telephone cable termination closet. Coordinate location with the Owner and provide cable from the off-hook detector cabinet to the nearest SCP input module location.
5. Acceptable Manufacturers
    a. Viking Electronics LDB series.
    b. Or approved equivalent.

DD. Power Supplies

a. Provide power supplies for all System equipment.
b. Provide battery chargers for all power supplies with DC power outputs.
c. Connect and configure the panel tamper switch to the SCP as an alarm event.

d. Minimum Specifications
    1) Type: UL Listed Class II power limited.
    2) Input: 120 V AC plug in within locked cabinet.
    3) Power Output: Regulated and filtered DC. Output current rating of 150% of the actual connected load.
    4) Provide linear output power supplies for equipment as recommended by the device manufacturer.

5) Alarm Outputs: Individual low battery and power fail.
6) Battery Backup: 4 hours of rechargeable backup for the fully loaded DC power supply, regardless of the connected load.
7) Battery Support: Battery charger to maintain battery.
8) Battery: Sealed gel type
9) Enclosure: Key lockable wall mounted steel housing with tamper switch. Enclosure shall be not less than 10” x 10” x 4” deep
10) Enclosure Keying: Key all cabinets alike and on the same key as all security system power supplies and power distribution cabinets.

e. Additional SCP Power Supply Requirements

1) The SCP power supply shall be dedicated to SCPs and devices powered through connection to the SCPs (e.g. card readers, motion sensors, etc.). SCP power supplies shall not provide power for locks.
2) Provide a minimum of 12 hours battery backup.
3) Provide SCP power supply monitoring as follows:
   a) Monitor primary input voltage such that the System shall annunciate primary voltage failures.
   b) Monitor secondary (low voltage) output voltage such that the System shall annunciate secondary voltage failures.
   c) Monitor batteries such that the System shall annunciate low battery voltage conditions.

f. Additional Electric Locking Mechanism Power Supply Requirements

1) Provide power supplies for all electric locking mechanisms.
2) Fail secure electric locking mechanisms shall continue to operate normally upon loss of building power.
3) Fail safe locking devices shall unlock automatically under the following conditions:
   a) Building fire alarm.
   b) Failure of the power supply.
   c) Loss of power to the SCP.
4) Provide power distribution boards with independently fused outputs and relays. Power distribution boards for fail safe locks shall include a fire override relay. Interface the relay with the fire alarm system such that a dry contact from the fire alarm system shall remove power to fail safe devices during a fire alarm.

g. Additional Device Power Supply Requirements

1) Provide device power supplies for all other devices requiring power (e.g. card readers, motion sensors, etc.)
2) Provide power distribution boards with independently fused outputs.
3) Power supplies for devices monitored by remote alarm input modules may be collocated with the alarm input module

h. Acceptable Manufacturers

1) PSX Power Solutions (Dual voltage for SCP and door lock power preferred)
2) Alarm-Saf PS12408 Series
3) Altronix/AL600 Series
4) Power-One/SPL Series
5) Or approved equivalent

EE. Interfaces

1. Digital Video recording unit(s)

   a. ACMS alarms are to be interfaced through an existing CCure 9000 ACMS with the provided digital video recording solution to provide the following:

      1) Linking associated video cameras to System alarms and events.
      2) Playback of recorded video associated with System events on System workstations.
      3) Call up of live camera video on the System workstations through the workstation Graphics.
      4) Monitoring video loss and video motion detection alarms through the System workstations.

2. Fire Alarm System

   a. Interface with the fire alarm systems at each facility to provide for release of fail-safe electric locking mechanisms as required by local life safety codes.
   b. Provide secondary monitoring of fire alarm system alarm conditions for each facility through the System.
   c. The General Contractor will provide fire alarm system interfaces at the SCP locations. Coordinate with the General Contractor as necessary to provide fire alarm interfaces.

3. Cable provided by others
   a. The Security contractor must confirm that horizontal Cat6A data cable for LAN or WAN devices will be provided by others.
   b. The Security contractor must confirm that Telecom (voice) cable for hands-free and/or emergency telephone devices will be provided by others.
   c. All conduit is to be provided by the Security Contractor and other General contractor. Coordinate all cabling and conduit requirements with the General Contractor.
   d. The Security contractor shall coordinate specific cable requirements for cable provided by others with the Owner.
   e. The Security Contractor shall provide all patch cables, connectors, and all other equipment necessary to connect to the owner-provided cable.
      Approved Product: Systimax Cat6A, yellow jacket, 36” standard length (do not substitute).

4. Owner-Provided Data and Voice Communication Networks

   a. Interface Security System equipment to the local area and wide area networks provided by the Owner.
   b. Interface hands-free telephones and off-hook detectors to telephone circuits provided by the Owner.
   c. Coordinate network port locations, quantities, IP addresses, network settings, and other information as necessary with the Owner.
   d. Provide patch cables and all other hardware and software necessary to connect Security System equipment to the Owner’s networks.

5. Power

   a. Interface to 120 VAC power provided by the General Contractor.
   b. Coordinate circuit locations, sources, quantities, loads, receptacle, and other requirements with the General Contractor.
   c. Provide connections, conduit, and additional hardware necessary to connect Security System Equipment to the 120 VAC power.

2.04 PARKING GATE CONTROLS

A. Unless otherwise specified, parking gate card readers, phones, and intercoms will be provided by the Security contractor.

B. Unless otherwise specified, parking gate controls will be provided by others under SECTION 11210 – PARKING CONTROL EQUIPMENT

C. Controlled parking entrances will consist of a SCS card access controlled gate entry and free egress parking gate exit. A hand free telephone with remote release option is also to be provided at the entry parking gate adjacent to the card reader.

D. Controlled parking gate controls shall include, but shall not be limited to the following:
1. Two (2) Barrier Gates, white, with aluminum barrier booms – Magnetic Parking Pro Series, MHTM Microdrive or equivalent;
2. Four (4) Loop Detectors-Cut, Wrap and seal Protector, Safety and Exit;
3. One (1) Card Reader Pedestal with box and sun shield for reader and intercom mounting - Falcon S1R1235 metal stanchion with Falcon MCH5375-1CR MaxiProx acrylic spacer kit or equivalent;
4. Steel Pipe Bollard/Protection, minimum two (2);
5. One (1) long range proximity card reader;
6. One (1) hands free telephone
7. The general contractor is to provide power and conduit to the parking gate locations. The security contractor is to provide all cabling and any necessary conduit to complete the installation.
8. The gate arm shall have a fail-to-open option. This selectable option shall provide an automatic open of gate arm when power is lost. A 15 second delay selection for this option is preferred.
9. The gate arm shall have a down strike safety feature. This feature provides that should any object be struck by the gate arm during its descent, the arm shall immediately reverse and return to the UP position without damage, and remain up from 2 to 60 seconds, until automatically reset by variable control. The sensory function shall be initiated by sensing the internal mechanical action. The external mounting of tubes, wiring, and electrical devices on the gate arm shall not be acceptable
10. Power Supplies, additional cabling, and all parts necessary to complete the work.
11. Complete Installation and Programming of all equipment.

2.05 PERIMETER GATE CONTROLS

A. Controlled perimeter entrances will consist of an SCS card access controlled gate entry and others controlled via a gate control panel in the security office. The SCS card access controlled entry to include a hand free telephone with remote release option.

B. The card access controlled perimeter gate shall include, but shall not be limited to the following:
1. Connect to gate control.
2. Four (4) Loop Detectors-Cut, Wrap and seal Protector, Safety and Exit;
3. One (1) Card Reader Pedestal with box and sun shield for reader and intercom mounting - Falcon S1R1235 metal stanchion with Falcon MCH5375-1CR MaxiProx acrylic spacer kit or equivalent;
4. Steel Pipe Bollard/Protection, minimum two (2);
5. One (1) long range proximity card reader
6. One (1) hands free telephone
7. The general contractor is to provide power and conduit to the perimeter gate locations. The security contractor is to provide all cabling and any necessary conduit to complete the installation.
8. Power Supplies, additional cabling, and all parts necessary to complete the work.
9. Complete Installation and Programming of all equipment.

C. Controlled perimeter gates shall include, but shall not be limited to the following:
1. Connection from security gate control panel to gate control.
2. The general contractor is to provide power and conduit to the perimeter gate locations. The security contractor is to provide all cabling and any necessary conduit to complete the installation.

3. Power Supplies, additional cabling, and all parts necessary to complete the work.
4. Complete Installation and Programming of all equipment.

2.06 CCTV SYSTEM OPERATION REQUIRMENTS (CCTV)

A. The CCTV camera system shall consist of an independent video network of digital IP addressable color CCTV cameras, camera lenses, camera housings, and an on-site network video recording system (NVRS), All NVRS systems are to be connected and controlled by the owners existing Video Management System (VMS). In addition, NVRS systems are to be programmed by the owner's separate ACMS.

B. The design of the CCTV System shall be that all CCTV devices can be controlled from one or more Microsoft Windows-based workstations (provided by Owner) using VMS software and by the Owner's ACMS via CCure software interface. Control and access into the CCTV system through the owners LAN shall be accomplished through the digital video recorders via dual NIC cards.

C. The configurations listed are minimum guidelines and the responsive bidder will be required to specify digital recording hardware that meets or exceeds these requirements. The responsive bidder must also verify that their respective CCTV management software will operate on a server with these specifications. If the camera system requires digital recorders with more performance, storage or throughput, it is the bidder's responsibility to provide adequate hardware to support their system.

D. The Security Contractor with the owner shall field verify to ensure high quality, glare-free, desired field of view of each camera, and clear pictures at the video monitors.

E. The Security Contractor will provide all network POE patch cables, connectors, power supplies, and materials as required. An approved patch cable must be provided with each IP camera utilized.

F. All IP CCTV cameras shall include an option to activate video transmission based on detection of motion, tampering, or other activity.

2.07 CCTV SYSTEM HARDWARE REQUIRMENTS

A. CCTV Cameras, standard applications
   1. Interior IP (Megapixel) CCTV Cameras shall be the mini-dome type and meet the following technical requirements:
      a. 2.0 Megapixel CCD sensor and lens with remote zoom and focus
      b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal range if not otherwise specified).
      c. Automatic Day/Night IR function and iris control
      d. Full motion progressive scan recording in full 1280x1024.
      e. Integrated Power over Ethernet
      f. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
      g. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
      h. Preferred Product: Axis P3265-LV,
   2. Exterior building-perimeter IP CCTV Cameras shall be the mini-dome type and meet the following technical requirements:
      a. 2.0 Megapixel CCD sensor and lens with remote zoom and focus
      b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal if not otherwise specified).
      c. Automatic Day/Night IR function and iris control
      d. Full motion progressive scan recording in full 1280x1024.

e. Integrated Power over Ethernet
f. Exterior, minimum IP66 rating.
g. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
h. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
i. Preferred Product: Axis P3265-LVE

3. Parking Garage IP CCTV Cameras may be a standard or mini-dome type and meet the following technical requirements:
   a. 2.0 Megapixel CCD sensor and lens with remote zoom and focus.
   b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal if not otherwise specified).
   c. Automatic Day/Night IR function and iris control
   d. Full motion progressive scan recording in full 1280x1024.
   e. Integrated Power over Ethernet
   f. Exterior, minimum IP66 rating.
   g. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
   h. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
   i. Preferred Product: Axis P3265-LVE
   j. Alternate Product (license plate/entry): Axis Q1785-LE
4. Exterior Parking Surveillance IP CCTV Cameras shall consist of parapet domes or pendent wall mounts to monitor parking areas. A single exterior IP varifocal camera dome shall cover at least a 90° FOV and meet the following technical requirements:
   a. 5.0 Megapixel CCD sensor and lens with remote zoom and focus
   b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal range if not otherwise specified).
   c. Automatic Day/Night IR function and iris control
   d. Full motion progressive scan recording in full 1280x1024.
   e. Integrated Power over Ethernet
   f. Exterior, minimum IP66 rating.
   g. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
   h. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
   i. Preferred Product: : Axis P3267-LVE
5. Exterior Parking Multidirectional Surveillance IP CCTV Cameras shall consist of a parapet dome or mount that combine multiple cameras on a single mounting. A single exterior IP camera dome shall cover a selected range from 180°to 360° FOV and meet the following technical requirements:
   a. (4) 3.7 Megapixel CCD sensor and lens with remote zoom and focus
   b. Automatic Day/Night IR function and iris control
   c. Full motion progressive scan recording in full 1280x1024.
   d. Integrated Power over Ethernet
   e. Exterior, minimum IP66 rating.
   f. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
   g. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
   h. Preferred Product: : Axis P3719-PLE
   i. Alternate Product (PTZ/360) Axis Q6100-E with AXIS Q6010-E
6. Camera Mounting Hardware
   a. All cameras specified should include housing enclosures as required by the application and manufacture.

b. Interior enclosures shall be provided when needed and shall meet the specifications of the camera manufacturer. All CCTV cameras shall include proper mounting hardware for both suspended ceiling and/or wall mount applications
c. Exterior enclosures shall meet the specifications of the camera manufacturer and shall include proper mounting hardware for parapet or wall mount applications. Roof edge mounts higher than 20' above grade that do not allow the camera to be retracted for servicing are generally not acceptable and require specific approval. Roof edge "flipover" mounts are preferred.
d. Provide approved patch cable to connect IP camera to owner's networks.
e. Approved Product: Systimax Cat6A, yellow jacket, 36" standard length (DO NOT SUBSTITUTE).

B. Special application IP CCTV Cameras
1. Identification view interior IP CCTV Cameras
a. Identification view interior IP CCTV Cameras shall meet the Interior IP camera specification but may be mounted in a discreet-type wall or ceiling camera housing with a lens selection to facilitate the desired identification view. Identification view cameras should be mounted at a height or distance so that the camera angle is not greater than 30 degrees to the subject.
2. Interior IP Multi-view CCTV Cameras
a. Quad-head and fisheye multi-view cameras are generally **not** acceptable and require special approval.
b. Interior IP Multi-view CCTV Cameras shall meet interior IP camera specifications but include independently adjustable varifocal cameras.
c. Preferred Product: Axis AXIS P4705-PLVE
3. Thermal cameras
a. When requested, thermal cameras are to be mounted using exterior camera standards. Preferred Product: AXIS Q1942-E Thermal Network Camera
4. Patient monitoring interior IP CCTV Cameras
a. IR-Illuminated 1.3 Megapixel CCD sensor and lens
b. Megapixel lens shall be variable focal meets field of view specifications required for the application.
c. Automatic Day/Night IR function and iris control. Full motion progressive scan recording in full 1280x1024
d. Integrated Power over Ethernet
e. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
f. Preferred Product: AXIS M1075
5. Patient monitoring interior IP CCTV Cameras for psychiatric and seclusion areas shall meet the interior IP camera specification but must be mounted in an anti-ligature type high security dome or wedge ceiling camera housing with a lens selection to facilitate the desired identification view.
a. Preferred Product: Axis Q9216-SLV
6. Elevator interior IP CCTV Cameras shall meet the interior IP camera specification but must be mounted in a vandal resistance mounting capable of viewing the entire elevator cab.
a. Preferred Product: Axis P9106-V
7. License Plate Recognition (LPR) IP CCTV Cameras shall be specifically approved for LPR recognition. LPR cameras are to be used with the DPS Victor Video Management system in addition to any required parking control equipment. VMS analytic LRC licenses are to be included.
a. Preferred Product: Axis Q1785-LE, (Up to 20ft)
b. Alternate: Illustra Flex 3MP Bullet, 2.8mm (Up to 13ft), 12mm (13 to 42ft)
8. Camera Mounting Hardware

a. Interior enclosures shall be provided when needed and shall meet the specifications of the camera manufacturer. All CCTV cameras shall include proper mounting hardware for both suspended ceiling and/or wall mount applications
b. Exterior enclosures shall be provided and shall meet the specifications of the camera manufacturer and shall include proper mounting hardware for parapet or wall mount applications

C. Rack mounted Keyboard, Mouse, Monitor
1. Provide a rack mounted LCD monitor, keyboards, mouse with KMM switch capable of supporting the provided equipment and at least one additional NVR unit. All necessary connecting cables are to be included to properly install and connect all NVR's located at the respective location.

D. Rack mounted UPS
1. Include a rack mounted UPS (universal power supply). The UPS is to be 200VA or greater and should be specified to protect up the utilized NVRS against power fluctuations or outages of up to 60 minutes. In case of power failure, the NVRS shall be configured to recover fully from a power loss; system settings will recover to the user-defined settings without the aid of an operator.
2. Preferred Product: Tripplite 500 series

E. Network Video recording System(s) (NVRS)
1. The Security Contractor shall provide Network Video Recorders meeting or exceeding the minimum specifications of this document.
2. The NVRS shall be a turn-key, software-based open platform solution that functions as an appliance server. It shall be provided as a bundled server solution with all required hardware and software provided.
3. The NVRS bundled server solution must be suitable for rack mount installations within a standard 19-inch IT server rack.
4. The NVRS bundled server solution must include an Intel Quad-Core CPU, dual Gigabit NICs, and internal hard drive storage. Fibre RAID expansion storage units are to be included as required for defined storage needs.
5. Each server comprising the NVRS system shall be specified to provide performance that meets or exceeds all requirements noted in this section with CPU performance exceeding that required for 30 cameras of the type specified for the project utilizing H.264 recording. The system should be designed so that no more than 40 cameras are recorded on any single bundled server solution
6. The NVRS expansion storage should allow for the recording of video for periods of up to at least 31 days. Storage based on the recording of the project's specified cameras at rated resolutions using the following:
   a. Use 40% motion at 8 FPS for Clinic and office occupancy applications
   b. Use 80% motion at 8 FPS for hospital/pavilion applications
   c. All storage calculations are to be based on H.264 recording. The owner will confirm recording codecs to be setup for actual use.
7. The NVRS unit(s) shall be provided with recording licenses to support the project's specified camera count plus a 10% allowance. Total, licensed, recorded channels provided should exceed system design requirement by 10%. The system should be designed so that no more than 64 cameras are recorded on any single bundled server solution.
8. The unit shall combine multiplexing, sensor/motion detection, video, and audio. The unit must operate in server-client architecture as a network appliance and simultaneously support viewing, recording, and playback of video.
9. The Network Video Recorder shall be TCP/IP and HTTP compliant, enabling administrators to provide better corporate deployment, and provide a standard format for server management.
10. The Security Contractor shall provide all configuration set-ups, and programming, as necessary to connect cameras and program the NVRS to record images based on Motion recording

determined by selecting grids such that movement in the selected grids will trigger the NVRS to create a video file. The motion grid shall include a sensitivity adjustment scale to allow the user to dial down the sensitivity to eliminate false triggers from factors such as light changes, tree branch movement due to winds, animal's etc. This sensitivity adjustment shall be definable by camera.

11. The digital video recording unit(s) shall perform all viewing, playback, and video storage functions simultaneously. Video shall be displayed on a standard PC monitor, and configuration shall be performed with a standard mouse and keyboard. The digital video recording unit(s) shall be configured using an interface application and shall record video continuously, only during alarm events, or only while activity is present. Each camera shall be able to record in different modes and on different schedules or using the same schedule and configuration.
12. Local and remote interfaces shall allow easy search and retrieval of video. User defined parameters shall allow searches based on the time and date the video was captured; whether alarm, motion, or scene loss events occurred; and which camera captured the video. The interfaces shall also permit full video storage management, hardware control, alarm configuration, and export of video and individual frames.
13. The Network Video Recorder software shall be designed to provide both redundancy and high availability as standard built-in features. The Network Video Recorder software shall include configuration support for up to two levels of automatic storage fail-over. In the event that the designated primary storage encounters a problem, the system shall automatically switch to a designated level one storage device to provide continuous recording. In the event that a problem occurs with level one storage device, the system shall automatically switch to an alternative designated level two storage device. Storage fail-over drives are to be included and must be setup on the Network Video Recorder.
14. The Network Video Recorder software must include driver support for IP fixed cameras, IP pan-tilt-zoom cameras, IP MegaPixel cameras, and analog cameras using IP encoders that are from a variety of manufacturers. It is expected that the NVRS support all cameras utilized with MJPEG, MPEG4, and H.264 recording options.
15. Remote connections are available over standard network connections.
16. The digital video recording unit(s) shall be on a rack-mount chassis.
17. Dual network interface connectivity and functionality is required and is to be provided.
18. Preferred Products:
    a. American Dynamics VideoEdge NVR bundled server
    b. American Dynamics Victor software

F. Network Video Recorder – alternate (NVR)
1. When approved by the Owner, provide American Dynamics Exacq A-series IP network video recorder configured to support all applicable NVRS specifications
2. When other departmental access to the alternate NVR is required, the web browser GUI is to be setup with a unique login and password for access.
3. Renovations projects shall require, unless otherwise noted, 16 analog/16 IP channel units.
4. Approved Product: American Dynamics American Dynamics Exacq A-series with +8 EVIP licenses.

G. Video Analytics
1. All NVR devices shall include motion detection analytics.
2. When required by the owner, the following analytic licenses are to be provided and configured
    a. Video intelligence
        1) Crowd Formation
        2) Direction
        3) Dwell
        4) Enter
        5) Exit -
        6) Linger -
        7) Perimeter

8) Object Abandoned/Removed
9) Object Detection
10) Queue Analysis

b. Color Filtering
c. Heat Mapping
d. Point of Sale (POS)
e. License Plate Recognition
f. Facial Biometrics

3. Unless approved by the owner, all analytics are to be provided for and controlled by the American Dynamics VideoEdge NVR's.

H. Management Software and Interface
1. It is intended that the DVRS manufacturer's video client software be utilized. A single client software system for access to all DVRS' is required. This software must include "policy manager/site manager" features for user and userid management, connection and bandwidth monitoring and control status, and bandwidth management to support all DVRU's from a single location. .
2. Client Software is to be setup on all designated security monitoring workstations to provide "virtual matrix" functionality required by the site at which the video is being monitored.
3. Client software shall monitor video loss, device health, and, when designated, video motion detection alarms.
4. In addition, all Digital Video recording unit(s) must be interfaced with the Owner's ACMS for CCure 9000. The interface must be configured to provide at least the following:
a. Linking associated video cameras to System alarms, events, and maps.
b. Playback of recorded video associated with designated system events through the ACMS client software workstations.
c. Call up of live camera video on the ACMS client software workstations through the workstation Graphics either manually or automatically during alarm or programmed video alarm events.
5. The Security Contractor shall be responsible for verifying software currently in use by the owner and, when required, for providing, installing, and configuring the latest software version for all systems required to provide full interface functionality.
6. Preferred Products:
a. American Dynamics Victor software (do no substitute)

I. Other software
1. The Security Contractor shall install and configure the IP camera monitoring software on workstations as directed by the owner.

J. Owner-Provided Data Networks
1. Interface the CCTV System equipment to the independent, local area, and wide area networks provided by the Owner.
2. Coordinate network port locations, quantities, IP addresses, network settings, and other information as necessary with the Owner.
3. Provide patch cables and all other hardware and software necessary to connect Security System equipment to the Owner's networks.
Approved Product: Systimax Cat6A, yellow jacket, 36" standard length (DO NOT SUBSTITUTE).

2.08 CONSOLE AND EQUIPMENT RACKS

A. Functional Requirements

1. Two-post Ladder racks in IDF rooms will be provided by the Owner

2. If required, provide Harris Health System IT-specified four-post racks or cabinets to accommodate equipment.

3. Provide all other consoles, rack shelving, cabinets, turrets, writing surfaces, panels and equipment as required to accommodate equipment. If owner provided racks are to be utilized, mounts and shelving must allow for centered mounting.
4. All racks, rack shelving, and cabinets to be mounted in MDF or IDF rooms must be approved by the Harris Health System Information Technology Department.

B. Acceptable Manufacturers

1. Winsted Prestige Series (basis of design).
2. Emcor Flat Panel 2 (FP2) Series.
3. Or approved equivalent.

2.09 WIRE AND CABLE

A. All cabling must be installed in accordance with Harris Health Division 27 standards. Exceptions must be approved by Harris Health IT Department. All cabling is to be rated for environment it is to be installed within (i.e. plenum, riser, outdoor, indoor, indoor/outdoor)

B. All cabling needed for security equipment is to be provided by the Security Contractor. Security cabling includes, but is not limited to the following:
1. Wire and cable infrastructure between SCP location and reader controlled doors. Cable distance will not exceed 400 feet.
2. Wire and cable infrastructure between SCP or Alarm Input Module locations and door position switch, duress button, intrusion, and other security device locations.
3. All patch cables, connectors, and all other equipment as required for security devices.

C. The Security Contractor should coordinate any other specific cabling needs with the General Contractor. This includes specific cable requirements for POE Cameras, data cable for LAN or WAN devices, and telecom cable for hands-free and/or emergency telephone devices. Cabling needs not identified to the General Contractor at the bid phase of the project will become the responsibility of the Security Contractor.

D. Any conduit needed for security equipment is to be identified to the General Contractor by the Security Contractor. Conduit needs not identified at the bid phase of the project will become the responsibility of the Security Contractor.

E. All exterior and/or parking garage cabling will be contained in conduit. Data and power cabling shall not share a conduit. Cabling used in underground conduit shall be burial grade. The security contractor will provide all conduit needed for security equipment for both cabling provided by the owner and the security contractor.

F. Wire and cable infrastructure between the IDF/SCP location and Emergency Telephones and Hands free telephones will include.
1. One Cat6A Cable.
2. Cables will be coiled at the location of the device.

G. Wire and cable infrastructure to CCTV cameras locations will include.
1. One POE Cat6A Cable.
2. Cables will be coiled at the location of the device.

H. The Security Contractor shall provide all other wire and cable infrastructure necessary for SCS and CCTV devices.

I. The Security Contractor shall provide cables, patch cables, connectors, terminal strips, and all other hardware necessary to connect to cables, networks, and other infrastructure.

J. Minimum Requirements

1. Wire and cable shall be Underwriter’s Laboratories (UL) approved for its intended application, shall meet all national, state and local code requirements for its application, and shall meet or exceed manufacturers' recommendations for the components connected.

2. Provide yellow jackets for all cables.
3. Provide plenum-rated cable as required by code.
4. Wire and cable shall meet individual system or subsystem manufacturer specifications.
5. Insulated wire and cable shall conform to the minimum requirements of Insulated Cable Engineers Association (ICEA) Standards.
6. Wire and cable shall comply with the applicable requirements of the National Electrical Code (NEC), latest edition, in regards to cable construction and usage.
7. Copper wire conductors shall provide conductivity in accordance with the standardization rules of the Institute of Electrical and Electronics Engineers, Inc. (IEEE). The conductor and each strand shall be round and free of kinks and defects.
8. Provide shielded cables carrying where necessary for interference-free signals.
9. Insulation shall be rated for a minimum of 300 V.
10. Color coding shall be accomplished by using solidly colored insulation. Grounding conductors, where insulated, shall be colored solid green or identified with green color as required by the National Electric Code (NEC).
11. Patch Cables

    a. Provide pre-manufactured patch cables (cable, connectors, boots, etc.) as required to connect System equipment to the cable infrastructure.
    b. Patch cables shall be certified for their specific use to meet or exceed applicable industry specifications (e.g. EIA/TIA, ETL, UL, CSA, etc.).
    c. Provide cable lengths as necessary to neatly route cables through cable management systems and other cable organization systems.
    d. Provide connectors as required for proper termination. Provide boots for connectors where applicable to prevent snagging.
    e. Provide yellow jackets for all patch cables.
    Approved Product: Systimax Cat6A, yellow jacket, 36” standard length (DO NOT SUBSTITUTE).

K. Minimum Wire Types and Sizes

1. Low Voltage Power Cable

    a. One pair, 18 AWG minimum, twisted, stranded, insulated, and jacketed.
    b. Increase conductor gauge to be consistent with circuit current ratings and manufacturer's recommendations.
    c. Yellow cable jacket

2. Composite Cable for Card Reader Doors
    a. FRPVC Bare copper conductor 4-component composite cable; each component is shielded and jacketed. Diameters and weights may vary among manufacturers.
    Sheilded
        1) Component 1: 18-4 C Lock Power
        2) Component 2: 22-2C Door Contact
        3) Component 3: 22-4C Rex Spare
        4) Component 4: 22-3P Card Reader
    b. Yellow cable jacket

3. Card Reader Cable

    a. 6-conductor, 22 AWG, stranded, individually shielded twisted pairs, insulated and jacketed.
    b. Yellow cable jacket

4. Alarm Point Monitoring Cable

    a. 2-conductor, 22 AWG, stranded, shielded, insulated and jacketed.
    b. Yellow cable jacket

5. Control Point Cable (Non-Power)
   a. One pair, 22 AWG, twisted, stranded, insulated and jacketed
   b. Yellow cable jacket
6. Control Point Cable (Low Voltage Power)
   a. One pair, 18 AWG, twisted stranded, insulated, and jacketed.
   b. Yellow cable jacket
7. Local Area Network (LAN) Cable
   a. Category 6A (four pair).
   b. Yellow cable jacket
8. Acceptable Manufacturers
   a. Belden.
   b. Southwest Wire.
   c. West Penn Wire.
   d. Or approved equivalent.
9. Cat 6A Data Cable
   a. Refer to Harris Health System Division 27 IT Cabling specifications.
10. Telecom Cable
   a. Refer to Harris Health System Division 27 IT Cabling specifications.

2.10 LIGHTNING AND SURGE PROTECTION

A. With the exception of fiber optic cables, all cables and conductors that act as control, communication, or signal lines shall include surge protection.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate with the General Contractor and Architect to ensure that adequate conduit is provided and that equipment back-boxes are adequate for system installation.

B. Coordinate with the General Contractor and Architect to ensure that adequate power has been provided and properly located for the security system equipment.

C. Coordinate with the General Contractor and Architect to ensure that doors and doorframes are properly prepared for electric locking hardware and door position switches.

D. Coordinate and verify the location of each piece of rack-mounted equipment with the General Contractor and Owner.

E. Coordinate and verify the mounting location and desired field of view for each CCTV camera with the General Contractor and Owner.

F. Coordinate finishes and colors of all equipment with the General Contractor and Owner.

G. Coordinate custom ACMS and NVRS programming and report requirements with the Owner to include:
   1. Naming convention for System programming and labeling.
   2. System programming information.
   3. Custom report requirements. Submit report templates to the Owner for review and acceptance.
   4. Initial database partitioning and setup prior to initial programming and cardholder data entry.

H. It is the responsibility of security contractor to generate an exceptions list prior to bidding or installation that itemizes exceptions taken with door hardware schedules, components or designs being used which may hamper their ability to provide a secure and compliant access control product.

I. A final pre-installation review may be required to include a final device location walkthrough with the general contractor, DPS representative, and project manager prior to acceptance of any access control or CCTV work.

3.02 INSTALLATION

A. General

1. Coordinate equipment installation requirements prior to installation.
2. Make equipment connections in accordance with the approved submittal drawings and manufacturer specifications.
3. Verify acceptance of each type of specified request-to-exit hardware for each application with local life safety code officials. Verify fail-safe and fail-secure lock requirements with the General Contractor and Architect
4. Provide tamper proof fasteners for all equipment in public areas. Fastener finish shall match equipment finish.
5. Seal exterior devices to protect against weather conditions including heat, cold, moisture, dust, and sand.

B. Site Observation

1. Continuously verify that the site conditions are in agreement with the Contract Documents. Submit a report to the Owner documenting changes to the site or conditions that affect the performance of the System. For those changes or conditions, which affect system installation or performance, provide (with the report) specification sheets, or written functional requirements to support the findings, and a cost estimate to correct the deficiency. No deficiency shall be corrected without written permission from the Owner.
2. Specific mounting locations, exact wire and cable runs, and conduit routing have not been specified or delineated on the Security Device Drawings. Coordinate all aspects of the Work with the General Contractor and Owner.
3. The Owner will conduct random site observation visits during the project and prepare reports noting observations. Correct deficiencies noted on the site visit reports. All work shall comply with the Contract Documents, applicable codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.

C. Equipment

1. Provide equipment as specified herein. Additional specific installation requirements are as follows:

    a. SCP Locations

        1) Wire each power supply power fail and low battery alarm contact as an individual alarm input to the System.

    b. Card Readers

        1) Wire and program card reader LEDs to indicate conditions and functions as follows:

            a) Red LED in the normal, locked state.
            b) Green LED upon a valid card read and when the door is in the access (unlocked) condition.
            c) Flashing red LED upon invalid card read, forced door, and held open alarm conditions.
            d) Card reader LED indicators shall operate identically throughout all facilities.

2. Field-verify specific equipment locations to provide the best fit and function. Verify locations with the Owner or its representatives as necessary.
3. Install equipment in accordance with manufacturer specifications.
4. Install equipment to allow adequate clearance for testing and maintenance.
5. Locate end of line devices within the device housing.

6. Provide tamper resistant screws and fasteners for equipment and pull boxes located in accessible and/or public areas.
7. Remove dirt, packaging, wiring scraps, and other debris from equipment, boxes, and cabinets at the end of each work day.
8. Wherever possible, remove contractor and manufacturer equipment logos from security field devices.

D. System Programming and Data Entry

1. Provide all initial system programming and setup of the ACMS including, but not limited to the following:
   a. ACMS Card Reader Information: Coordinate all card reader values and text, including descriptors, alarm messages, CCTV Camera call up, map call up and identification with the Owner.
   b. Input and Output Points: Coordinate all input and output priorities and text, including descriptors, alarm messages, CCTV Camera call up, and map call up and identification with the Owner.
   c. Initial System Users and Levels of Access: This shall include the designation of an Owner's representative at the "Super User" level immediately upon ACMS initialization.
   d. Initial CCTV Camera call-up and alarm information for interface with the DVRs/NVRs.
   e. Initial CCTV Camera call-up and alarm information for interface with intercom, hands-free phone, or emergency phone Systems.
   f. Alarm monitoring and automatic shutdown information for the UPS interface.
2. Provide all initial system programming and setup of the DVRs/NVRS including, but not limited to the following:
   a. On-screen alphanumeric identification of each CCTV Camera, on each Monitor and DVRs/NVRS workstation. Coordinate descriptors with the Owner prior to programming.
   b. Setup DVRs/NVRS for interface with ACMS events, such as a "door held open or door forced alarm" generated on the ACMS Monitoring Station so that an operator can double-click on the camera icon next to the event, and a camera window will open.
   c. Program all exterior PTZ cameras (if utilized) to perform automatic continuous tours.
   d. Provide automatic selection of a CCTV Camera adjacent to a Card Reader upon an invalid card use. Coordinate automatic camera selection requirements with the Owner prior to system programming.
3. Provide all initial system programming and setup of the intercom, hands-free phone, and/or emergency phone Systems including, but not limited to the following:
   a. Initial setup for the interface with the ACMS.
   b. Alphanumeric identification of each Substation and Security Assistance Station, on each Master Station. Coordinate descriptors with the Owner prior to programming.
   c. Automatic selection of CCTV Cameras adjacent to Substations or Security
   d. Assistance Stations as applicable upon call in. Coordinate automatic CCTV Camera selection requirements with the Owner prior to programming.
4. Enter all data needed to make the System operational. Deliver the data to the Owner on data entry forms, utilizing data from the Contract Documents, Contractor's field surveys and all other pertinent information in the Security Contractor's possession required for complete installation of the database. Identify and request from the Owner any additional data needed to make the Security System fully operational and integrated. The completed forms shall be delivered to the Owner for review and approval prior to the Security Contractor's scheduled need date as noted as a milestone in the Security Contractor’s schedule.

3.03 WIRING TECHNIQUES

A. Provide all wire and cable not provided by the Owner or others and as necessary to make the System operational.

B. Provide code compliant fire proofing techniques for all penetrations of fire rated partitions and slabs, where the penetrations are made by or used for installation of the System.

C. Coordinate the routing of wire and cable requiring isolation from power, radio frequency (RF), electromagnetic interference (EMI), telephone, etc. with the Owner.

D. Run all wire and cable continuous from device location to the final point of termination. No mid-run cable splices shall be allowed.

E. Wire and cable within SCPs, power distribution cabinets and other security enclosures shall be neatly installed, completely terminated, pulled tight with slack removed and routed in such a way as to allow direct, unimpeded access to the equipment within the enclosure. All wire and cable shall be bundled and tied. Ties shall be similar to T&B TyRap cable ties.

F. Visually inspect all wire and cable for faulty insulation prior to installation.

G. Provide grommets and strain relief material where necessary to avoid abrasion of wire and excess tension on wire and cable.

H. Make connections with solderless devices, mechanically and electrically secured in accordance with the manufacturers' recommendations. Solderless devices shall provide a hermetic seal and test probe access such that the circuit may be checked without breaking the connection. Wire nuts shall not be an acceptable means of connecting wire and cable.

I. Grounding

1. Ground all equipment in accordance with manufacturers' recommendations. The Security Contractor shall be responsible for any damage to equipment or communications problems that may occur due to improper grounding.
2. Provide all necessary hardware and cable to properly ground security equipment.

3.04 LABELED FRAMES AND DOORS

A. In no instance shall any UL labeled door or frame be drilled, cut, penetrated, or modified in any way without written approval from the Owner.

B. The Security Contractor shall be responsible for replacing any labeled door or frame that is modified without written approval from the Owner and General Contractor.

3.05 LABELING

A. Wire and cables shall be marked as follows:
1. Mark all wire and cable in common at both ends.
2. Install markers to be readable from left to right or top to bottom.
3. Wire numbers shall be computer printed.
4. Hand written labels shall not be acceptable.
5. Labels shall be installed when wire and cables are installed.
6. Labeling shall agree with Record Documentation.

B. Mark all connectors with common designations for mating connectors. The connector designations shall be indicated on the record drawings.

C. Permanently mark all terminals. Terminal and cable markings shall agree with markings shown on record drawings.

D. Coil all spare conductors in device back box or panel wire way. Neatly bundle and tag conductors.

E. Label all equipment including but not limited to SCPs (label shall denote SCP address), DVRs/NVRS (example NVR #I, etc.) and Cameras. Coordinate names, fonts, styles, and devices to be labeled with Owner prior to labeling. Provide computer-generated labels. Hand written labels will not be accepted.

3.06 TRAINING

A. ACMS System
   1. Provide a minimum of 16 hours of ACMS System operator training, and 16 hours of CCTV administrative training, either on or off site on a complete and fully operational system parallel and equal to the system being provided, to representatives of the Owner.
   2. Operator training shall include, but not be limited to the following:
      a. Graphical User interface (GUI) operation
      b. Manual retrieval of achieved events
   3. Administrative training shall include, but not be limited to the following:
      a. GUI operation and configuration variables
      b. Addition and deletion of cardholder credentials

B. NVRS System
   1. Provide a minimum of 16 hours of DVR/NVR operator training, and 16 hours of DVR/NVR administrative training, either on or off site on a complete and fully operational system parallel and equal to the system being provided, to representatives of the Owner.
   2. Operator training shall include, but not be limited to the following:
      a. Graphical User interface (GUI) operation
      b. Manual and automatic camera call-up procedures
   3. Record, label, and catalog all training on flash drive, CD or DVD disk. Provide the CD's to the Owner for future in-house training sessions and reviews. Furnish all temporary equipment necessary for recording training sessions.

C. The Security Contractor shall be on call during the Warranty to answer any questions the Owner may have. Maintain time sheets verifying the total hours of training provided.

D. The Owner reserves the right to use any excess training hours, not used by the time of system completion, for future training as requested by the Owner until the total number of training hours has been completed.

E. The Owner reserves the right to forgo training and request a credit for project training costs.

3.07 SURGE PROTECTION

A. Provide protection against spikes, surges, noise, and other line problems for all system equipment and components.

B. Protect all exterior video, control, power, signal cables and conductors against power surges. Video surge protectors shall not attenuate or reduce video and sync signals under normal conditions. Each surge protector shall be UL Listed.

3.08 POWER REQUIREMENTS

A. 120/208/480 VAC power dedicated to security will be provided by the General Contractor for the Security System. Coordinate circuit locations with the General Contractor.

B. Connect to the AC power and provide duplex receptacles within locked power supply cabinets. Provide UL listed power supplies and transformers with plug type connectors to distribute low voltage power to the system components as required. Plug transformers into duplex receptacles within locked cabinets only.

3.09 SYSTEM PROGRAMMING

A. Submit system-programming forms to the Owner with the prefabrication submittals. Include dates that the Owner must have the forms completed in order to maintain the construction schedules.

B. Program the security systems as necessary.

3.10 SUBSTANTIAL COMPLETION

A. In order to qualify for the Owner's consideration of Substantial Completion, the Work must, at a minimum, meet the following requirements:
   1. All alarm points, access control points, CCTV cameras, DVR/NVR equipment, and intercom/phone substations shall be installed/connected to head end system and fully operational.
   2. All security equipment shall be connected to UPS power.
   3. All DVR/NVR equipment shall be connected to the dedicated security UPS power.
   4. All sub-system interfaces must be complete and operational.
   5. All required operator training shall have been provided to the Owner and its representatives.

B. Substantial Completion shall not be construed as final acceptance of the Work.

3.11 SYSTEM ACCEPTANCE

A. Final acceptance testing of the Work will be conducted by the DPS Contact Person. Prior to any final acceptance testing, the Security Contractor shall submit two sets of preliminary (draft) Record Drawings to the DPS Contact Person. The preliminary Record Drawings are to be used by the DPS Contact Person to conduct the system final test.

B. Submit a paragraph-by-paragraph completion matrix indicating completion or delinquency for each item included in the Specification and all subsequent addenda and bulletins as part of the Work. Indicate completion of the requirement by the word "Completed" following each paragraph number. Indicate delinquency for the requirement by the words "To Be Completed" following the applicable paragraph number. Should work on any item be under way, but not yet fully complete, indicate the extent (or lack thereof) of completion to date, and the proposed date of completion.

C. Conduct a complete test of the entire Security System and provide the DPS Contact Person with a written report on the results of that test. During the course of this test, place the integrated Security System in service, and calibrate and test all equipment.

D. Following completion of the initial testing and correction of any noted deficiencies, conduct a five-day burn-in test. The intent of the burn-in test shall be to prove the Security System by placing it in near real operating conditions. During this period the Security System shall be fully functional and programmed such that all points, interfaces, controls, reports, messages, prompts, etc. can be exercised and validated. Record and correct any system anomaly, deficiency, or failure noted during this period. Scheduling of the final acceptance test shall be based on a review of the results of this burn-in test.

E. Deliver a report describing the results of functional tests, burn-in tests, diagnostics, calibrations, corrections, and repairs including written certification to the DPS Contact Person that the installed complete Security System has been calibrated, tested, and is fully functional as specified herein.

F. Prior to the final acceptance test, coordinate with the DPS Contact Person for security related construction clean up and patch work requirements. Security equipment closets and similar areas should be free of accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, remove all waste materials, rubbish, the Security Contractor's and it's subcontractors' tools, construction equipment, machinery and all surplus materials.

G. Upon written notification from the Security Contractor that the Security System is completely installed, integrated and operational, and the burn-in testing completed, the DPS Contact Person will conduct a final acceptance test of the entire system.

H. During the course of the final acceptance test by the DPS Contact Person, the Security Contractor shall be responsible for demonstrating that, without exception, the completed and integrated system complies with the contract requirements. All physical and functional requirements of the project shall be demonstrated and shown. This demonstration will begin by comparing "as built" conditions of the Security System to requirements outlined in the Specification, item by item. Following the Specification compliance review, all Security System head-end equipment will be evaluated.

I. In order to sufficiently demonstrate the Security System's functionality, the console operator on duty and their superior may be requested to perform certain daily operations inherent to the Security System.
   1. 1. These operations may include, but not be limited to the following:
      a. Manually locking and unlocking of doors within the ACMS.
      b. Verifying the status of current alarm/control points within the ACMS.
      c. Responding to alarms
      d. Adding/deleting personnel from the cardholder database
      e. CCTV Camera call-up on various monitors
      f. Manipulation of PTZ cameras
      g. Changing settings on various pieces of equipment (i.e. DVR/NVR System, DVR/NVR Client Software).
      h. Adding a CCTV Camera to the DVR/NVR Client Software.
      i. Changing the frame rate of a camera recording on a DVRNVR.
      j. Correct CCTV Camera call-up on certain alarms within the ACMS
      k. NVRS motion detection or lack of no motion detection automatic notification sent over network to a software routine in the ACMS to be able to automatically activate events based on the alarms received from the NVRS.
      l. CCTV PTZ control via the ACMS and/or DVR/NVR Client Software.
   2. As all of these operations depend heavily on the training outlined within the Specification, the Security Contractor shall have completed all of the required training prior to initiation of the final acceptance test.

J. The functionality of the various interfaces between systems will be tested. This testing will include, but not be limited to the following:
   1. Generation of alarms from related systems activation or failure (i.e. loss of communications, fire relay activation, etc.)
   2. Fire alarm system fail safe lock release
   3. Control of any externally controlled devices and database system(s).

K. Following the Security System head-end equipment and console review, the installation of all field devices will be inspected. This field inspection will weigh heavily on the general neatness and quality of installations, complete functionality of each individual device, and mounting, back box and conduit requirements compliance.

L. All equipment shall be on and fully operational during any and all testing procedures. Provide all personnel, equipment, and supplies necessary to perform all site testing. Provide a minimum of two employees familiar with the system for the final acceptance test. One employee shall be responsible for monitoring and verifying alarms while the other will be required to demonstrate the function of each device. Supply at least two two-way radios for use during the test. A manufacturer's representative may be present on site to answer any questions that may be beyond the technical capability of the Security Contractor's employees, if the Security Contractor so elects or by specific request of the DPS Contact Person or Owner, at no charge to the DPS Contact Person or Owner.

M. Upon successful completion of the final acceptance test (or subsequent punch list retest) the DPS Contact Person will issue a letter of final acceptance. The DPS Contact Person retains the right to suspend and terminate testing at any time when the system fails to perform as specified. In the event it becomes necessary to suspend the test, the Security Contractor shall work diligently to complete/repair all outstanding items to the condition specified in the Specification and as indicated on the Security Device Drawings. The Security Contractor shall supply the DPS Contact Person with a detailed completion schedule outlining phase-by-phase completion dates and a tentative date for a subsequent punch list retest. During the final acceptance test, no adjustments, repairs or modifications to the system will be conducted without the permission of the Owner.

3.12 RECORD DOCUMENTATION

A. Record Documentation shall include all information required in the Pre-fabrication Submittals but revised to reflect "as installed" conditions.

B. General Description and Requirements:
   1. Submit Record Documentation in accordance with the DPS Contact Person's construction schedule.
   2. Record Documentation shall consist of Record Drawings and Operation and Maintenance Manuals.
   3. Provide a letter of transmittal with Record Documentation identifying the name of the Project, Security Contractor's name, date submitted for review, and a list of items transmitted.
   4. Prior to the final acceptance of the Work, submit two draft sets of the Record Drawings portion of Record Documentation to the DPS Contact Person. The draft copy shall be used during the final acceptance testing by the DPS Contact Person.

C. Record Drawings
   1. Update all record documentation to reflect changes or modifications made during final acceptance testing as required and provide electronic copies both in CAD and PDF formats. Submittals are be.
   2. Produce all Record ('as-built') Drawings both in CAD and PDF formats. CAD drawings are to be prepared using the latest version of AutoCAD... Record Drawings shall, at a minimum, include the following:
      a. Floor plan drawings indicating device locations, with device legends indicating manufacturers and model numbers for each device.
      b. Floor plan drawings indicating wire routing. Wire routing shall be delineated in straight-line runs and be tagged with cable identification and terminal strip numbers to coincide with the installation.
      c. Mounting details for all equipment and hardware.
      d. Functional block diagrams for each subsystem.
      e. Wiring details showing rack elevations, equipment wiring and terminations, and inter-rack wiring.
      f. Wiring diagrams for all custom circuitry including interfaces to various control output controlled devices, i.e. overhead doors, fire alarm system interface, etc.
      g. Wiring diagrams for networking of NVR and ACMS.
      h. Wiring diagrams for each data-gathering panel (SCP). Wiring diagrams shall be identical to those laminated and located with each SCP.
      i. Typical point-to-point wiring diagrams for each piece of equipment and groups of equipment within the system.
      j. Layout details for each riser location, including security panels, power supplies, junction boxes, conduit, and any other security related equipment.

D. Operation and Maintenance Manuals
   1. Provide electronic copies of Operational and Maintenance Manuals both in PDF formats. Provide on transportable media when required
   2. Operation and Maintenance Manuals shall apply to all security related devices, equipment and software modules.
   3. Operation and Maintenance Manuals shall be formatted as follows:
      a. Bind each manual in a hard-back loose-leaf binder.
      b. Identify each manual's contents on the cover.
      c. Provide a table of contents and tabulated sheets for each manual. Place tab sheets at the beginning of each chapter or section and at the beginning of each appendix if applicable.
      d. Any hardware manual demonstrating more than one model number of device on any one page shall be clearly marked as to delineate which model has been implemented in the Work.
   4. Operation and Maintenance Manuals shall include, at a minimum, the following:
      a. Operational description of each subsystem.
      b. Detailed programming descriptions for each subsystem, including step-by-step procedures with illustrations identifying how computer screens will appear after each entry.

c. Explanations of subsystem interrelationships. Explanations shall include operations of each subsystem and operations unique to the interfaces between each of the subsystems and possible conflicts that may occur with the interfaces. Each explanation shall be identified, tagged, bound and indexed into a single binder.
d. Electrical schematics for each piece of equipment specified.
e. Power-up and power-down procedures for each subsystem.
f. Description of all diagnostic procedures.
g. A menu tree for each subsystem. The tree shall provide a graphical flow of commands within the menu system.
h. Setup procedures for each component of the subsystems.
i. A list of manufacturers, their local representatives and subcontractors that have performed Work on the Project. The list shall include contact names, phone numbers and addresses for each.
j. Installation and service manuals for each piece of equipment.
k. Maintenance schedules for all installed components. Schedules shall include inspections and preventative maintenance schedules, and documentation of all repaired or replaced equipment.

5. Operation and Maintenance Manuals shall include a separate section for each software program incorporated into the Project. The software section shall include, at a minimum, the following information:
   a. Definitions of all software related terms and functions.
   b. Description of required sequences.
   c. Directory of all disk files.
   d. Description of all communications protocols, including data formats, command characters, and a sample of each type of data transfer.
   e. Instructions for manufacturer supplied report generation with illustrations showing what reports should look like and screen-by-screen illustrations for each entry made.
   f. Instructions for custom report generation.
   g. Database format and data entry requirements.

E. Procedure for Resubmitting
1. Make corrections or changes in Record Drawings as required by the DPS Contact Person and resubmit when the DPS Contact Person's stamp requires re-submittal.
2. Clearly identify changes made other than those specifically requested by the DPS Contact Person when resubmitting Record Drawings. Changes shall be clouded or similarly highlighted as coordinated with the DPS Contact Person. Only changes that have been specifically requested by the DPS Contact Person or have been clouded by the Security Contractor will be reviewed on re-submittals.
3. Any drawing sheets added to the re-submittal shall be clearly identified and clouded, and shall not change the sheet numbering scheme for previously issued Record Drawings.
4. The Security Contractor shall be responsible for any delays caused by the re-submittal process.

ATTACHMENTS – PROGRAMMING INSTRUCTIONS FOR CCURE

ATTACHEMENT 1 - PROGRAMMING INSTRUCTIONS

GENERAL INFO

A. NOTE: The following information is provided to assist in adding and updating C*CURE9000 hardware device configuration and programming. This document intends to provide programming for Harris Health System C*CURE9000 software to ensure a consistent environment based on the following methodology

- Naming conventions for iSTARs, INPUTS, OUTPUTS READERS and DOORS include references to make it be easier for our support staff to troubleshoot.
- Naming conventions for CLEARANCES are designed to allow for easy assignment with minimal need to reference lookup data.
- Naming conventions for EVENTS and DOOR GROUPS are designed primarily to allow for quick referencing for monitoring.

B. DPS Administration must always be notified in advance of planned installations or programming of any nature.

C. A Harris Health System-provided vendor account is required to access Harris Health System computers and the Harris Health System CCure 9000 system. Vendors should ensure that this access is properly setup before beginning work assignments at Harris Health System. This account must be renewed daily.

D. A database partition is currently used at Harris Health System for Harris Health and Community Health Center locations. Please contact DPS Administration if additional is needed for Community Health Center installations.

E. The DPS ACMS is currently partitioned between HCHD and CHC operations. DPS alarm monitoring is generally divided into three basic groups (Ben Taub, LBJ, and ACS-Administration). The security vendor should ensure all programming and monitoring privileges match the designated monitoring group for the site's control devices and confirm which partitions are to be used and if any are to be added..

F. Unless otherwise noted in this document, you shall always check/enable "Send State Changes to Journal", in order to provide database logging capability should there be a problem with a device. If there is a problem with a device, a database "Journal Replay" can be used to locate problems

G. Unless otherwise noted in this document, all devices should be programmed to activate a CCURE event in the case of network communications failures, power loss, and/or supervisory conditions. Existing CCURE events based on monitoring groups may be used for this purpose.

H. The Standard Naming format that is used throughout this document is based on the following:

<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location code and building number (two or three Letter Acronym)
FLR – Is the floor number on which the panel is located
<USER DEF> – Is the general room or location of the device controlled or monitored
<SUFFIX> – is an abbreviation (from a defined list) for the device that defines the function.

I. Submit programming names for security control devices on a standard Software House CCure installation template for owners review and approval at least two weeks before activation. Confirm door groups and clearance setup before activation of controls.

iSTAR PANEL CONFIGURATION NOTES

A. Please obtain all IP addresses from DPS Administration before beginning installations. The device mac address(es) must be provided. To receive a static IP address, provide device switchport information and equipment mac addresses at least two weeks before planned installation date. Submit information on DPS excel template.

1. Once the IP address has been programmed. Please contact the Harris Health System Network Operation Center (NOC) to ensure communications has been established.

2. All IP addresses must be “static” (non-DHCP).

3. Trigger Events to be programmed for each Istar will include the defined locations “Comm failure” event to activate in the event the Online status is offline. See Events section

iSTAR PANEL NAMING

F.

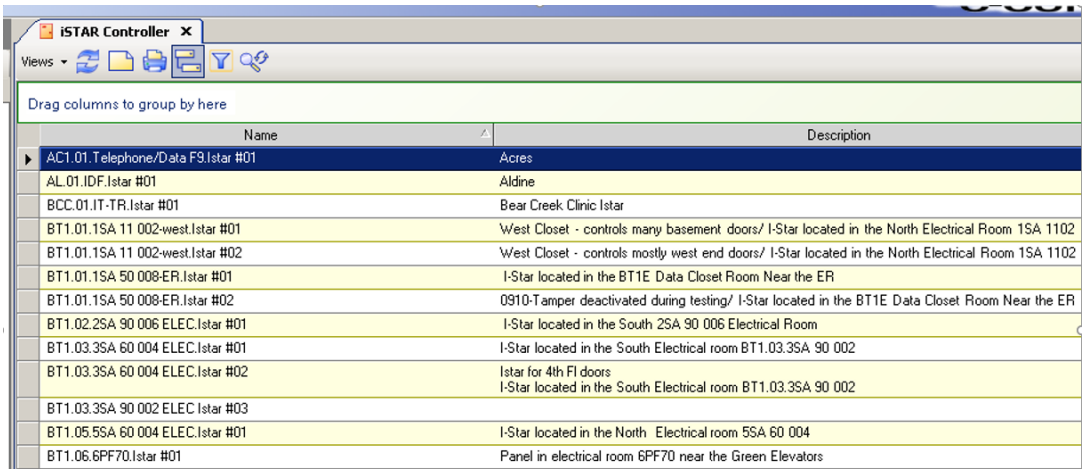
A. The format that was developed for the Harris Health System implementation of the C*CURE9000 system is:
<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location (two or three Letter Acronym)
FLR – Is the floor number on which the panel is located
USER DEF – Is the room number in which the panel is located
SUFFIX – is the type of panel and sequentially numbered panel of the building

1. Current List of Acceptable SUFFIX Entries
    a. iStar (Istar pro)
    b. iStarEx
    c. iStarU…

2. Example: If a Clinic (SETT) has only one iSTAR panel, it would be identified as:
“SETT.01.012 ISTAR #1”.

3. Example: If a Hospital building has three iSTAR panels on the 1st floor, in the same room, they would be identified as:
“LB1.01.112 ISTAR #1”
“LB1.01.112 ISTAR #2”
“LB1.01.112 ISTAR #3”

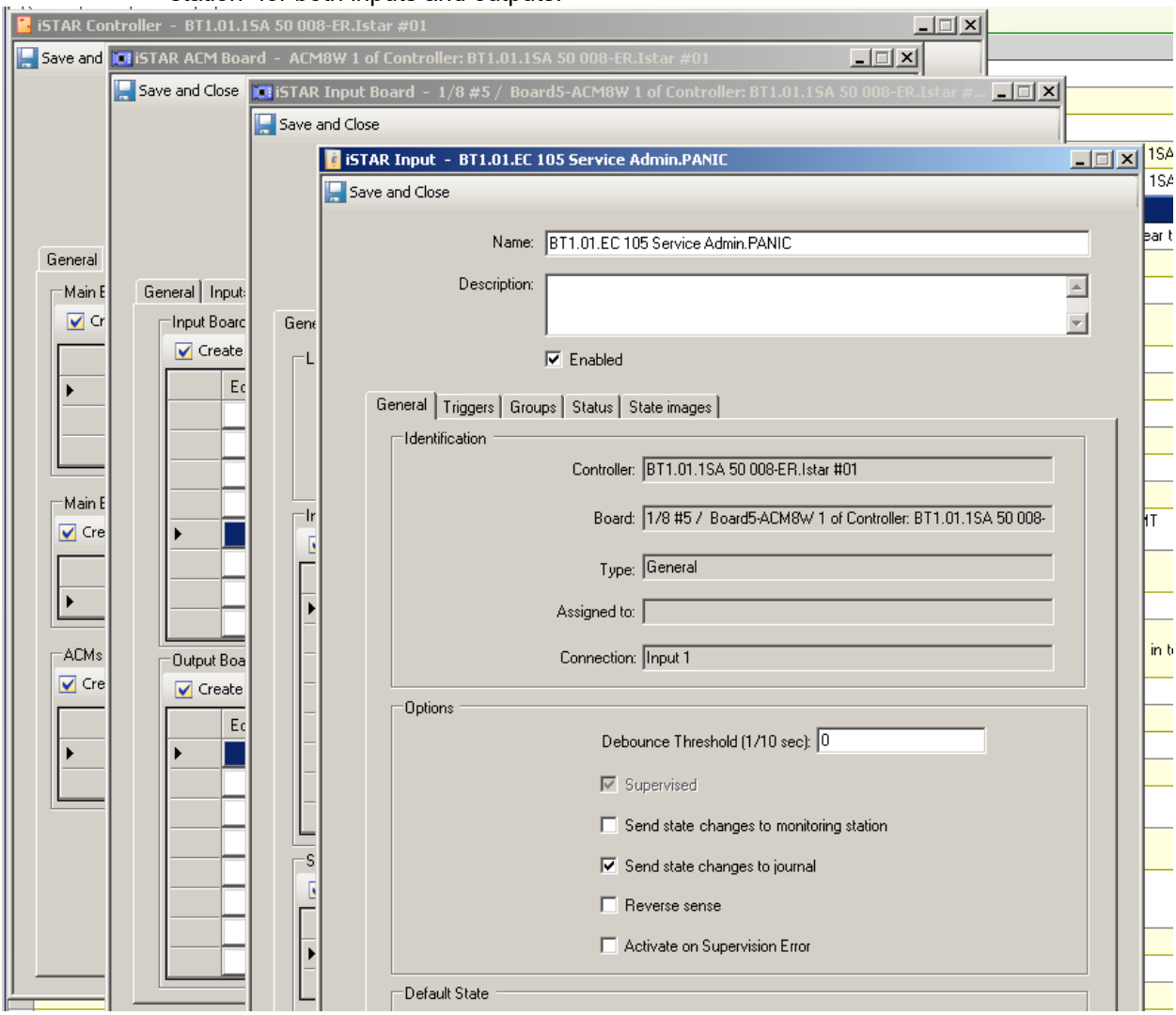
4. The following image shows the way in which C●CURE sorts the information making it easy to locate the information we would be looking for:



For programming iSTAR Clusters, replace the word “iSTAR” with the word “Cluster”.

INPUTS, OUTPUTS AND READERS

1. Check/enable, “Send State Changes to Journal” for both inputs and outputs, with the exception: **do not select for REX/RTE devices.**
2. Unless otherwise instructed, it is not necessary to “send State Changes to monitoring station” for both inputs and outputs.



A. The format for naming of INPUTS and OUTPUT is:

<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location and building # (two or three Letter Acronym)
FLR – Is the floor number on which the device is located
USER DEF – Is the a 12 character description where the device is located
SUFFIX – Is the type of device from the input/output list suffix list.

Current List of Acceptable Suffix Entries (inputs)

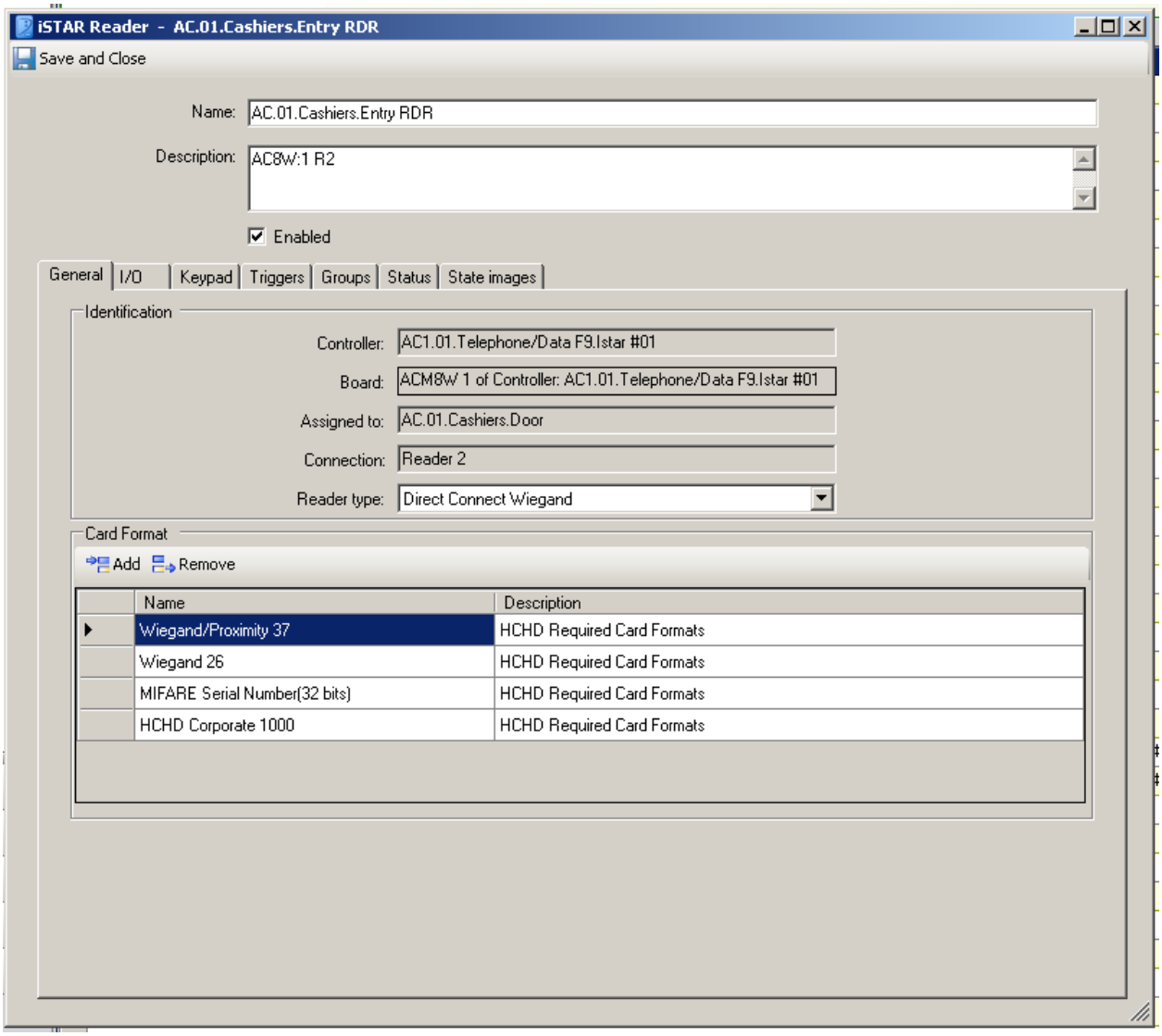
a. DSM = Door Switch Monitor
b. PANIC = panic or duress switch
c. RTE = Request to Exit
d. CONTACT = door contact
e. AC Fail = AC Failure
f. DC Fail = DC or Battery Fail

g. MOTION = Burglary Motion Detector
h. Glass Break = Glass Break Detector
i. Bond Sensor = Bond Sensor (usually associated with MAG locks)
j. Crash Bar = Emergency Exit Device
k. RDR Tamper = Reader Tamper
l. PNL Tamper = Panel Tamper
m. Fire Input = Monitoring of Fire Release Relay
n. Key Switch = Local External Lock Release
o. FLR Select = Floor Selection usually part of an Elevator Control System

2. Current List of Acceptable Suffix Entries (outputs)
   a. Lock Relay = Door Latch Relay
   b. Strobe = External Strobe
   c. Sounder = External Sounder
   d. FLR Control = Floor Control Relay

CARD READERS

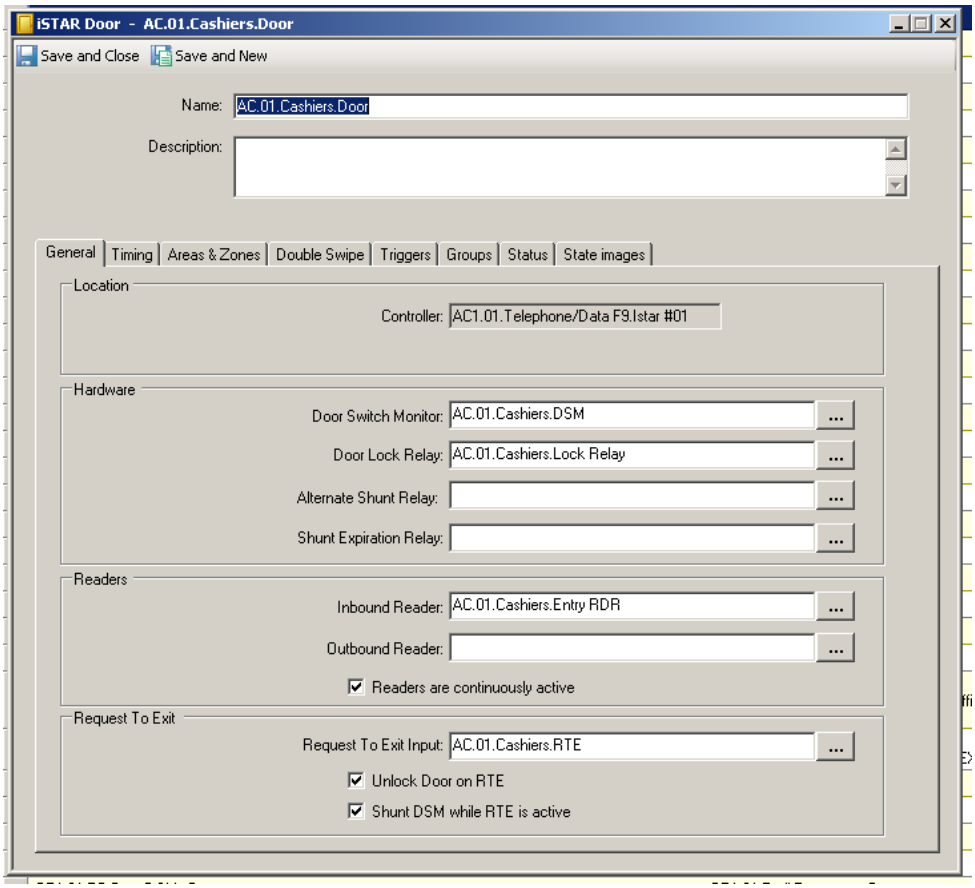
The following image shows the basic programming for each reader.
The format for the naming of READERS is:
<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location and building # (two or three Letter Acronym)
FLR – Is the floor number on which the reader is located
USER DEF – Is the an 18 character description where the device is located
SUFFIX – Is only needed if the readers are defined an “IN” and “OUT” readers



NOTE: All Harris Health System Card formats shown in the image must be included.
It is expected that programming cards be obtained from the DPS and used for testing of each reader after installation and configuration.

DOORS

1) The format for the naming of DOORS is:
<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location and building # (two or three Letter Acronym)
FLR – Is the floor number on which the device is located
USER DEF – Is the an 18 character description where the device is located
SUFFIX – Is the type of controlled access point and reader type (i.e. Door, Gate, BioReader, CtlReader, ElevC)
2) The user defined location name should be a short description of where the actual door is located to help anyone who may work on the system and to properly program events.
3) Use the "description" section for additional information to include:
   a. The date of activation and the Integrator installing the door
   b. The type of locking device used (i.e. maglock, electric strike)
   c. Any special configuration (i.e. door control interface using day/night event)
4) Trigger Events to be programmed for each door will include Forced and Held Open. See Events section



CLEARANCES

1. Access control clearances are defined and controlled by the DPS Administration office. New clearances must be approved to maintain security and consistency. Departmental clearances are linked to LDAP imports and high security clearances are controlled through the CCure Access Management system.
2. Adding controls to existing additional clearances or door groups must be approved by the owner. A programming template will be provided when needed.
    a. Doors approved for general access will be added to the “general access” door group for the site.
    b. Doors approved for departmental access will be added to the respective door group(s) for the area or areas.
3. DPS clearance naming conventions
    a. Request clearance names from the DPS Administration office

SCHEDULE NAMING

1. Schedule schedules trigger the events that perform access control and event monitoring. Configure a schedule as one or more time spans that represent a continuous unit of time during the number of days you specify. Schedules are used to define (1) When clearances are allowed and (2) When events are to be launched.
2. To help clarify who is the “owner” of a schedule, all schedule names that are unique to a set of devices or events must begin with the facility identifier (SETT, LB, HH, etc.). Existing generic schedules that begin with “ALL” may also be used but should not be changed or edited.
3. When an EVENT requires a unique schedule, the EVENT NAME should be recorded as a note.
4. SYNTAX: Facility.Days.Timeframe,Optional Notes
    a. Maximum field width 50
    b. See addendum for location Acronyms (i.e. SQ, BT)
    c. Day Scope Days included. From the list M, T, W, R, F, S, U. (i.e., e.g., M-F; MWR; U) for M-onday, T-uesday, W-ednesday, thu-R-sday, F-riday, S-aturday, s-U-nday
    d. Time Scope Times use a 24-hour clock. 24/7. “Harris Health System TIME” (0630-1830).

EVENTS

A. EVENT NAMING

1. Alarm Point Programming Events will be programmed using the Door, or Input names with a suffix that describes the type of EVENT. Example <LOC>.<FLR>.<USER DEF>.<SUFFIX> EVT.
2. The following type devices are required to have defined alarm events with the noted suffix descriptions:
    a. “.PANIC EVT” (for all Duress Buttons)
    b. “.GLASS BREAK EVT” (for all glassbreaks)
    c. “.TDL EVT” (for Time Delayed Lock activations)
    d. “.CONTACT EVT” (for all Door Contacts not associated to Readers)
    e. “.Door Forced EVT” (for all door Contacts associated with Readers)
    f. “.Door Held EVT” (for all door Contacts associated with Readers)
    g. “.MOTION EVT” (for all burglar motion detectors)
    h. “.PHONE EVT” (for all emergency phones)
    i. “.FIRE RELAY EVT” (for all Fire Notifiers)

3. Names for Alarm Masking Events should be preceded with a "." to provide proper sorting on the Monitoring Screen. Names for Unlock Events should be preceded with a "_".
4. The text to be written in the Configure/Event window under "Display this line when activated" category should correspond specifically with the title of the device.
    a. Example: If the device is titled "Panic", then the category "Display this line when activated" should also read "PANIC IS IN ALARM".
    b. The same holds true for all the other devices respectively. The category "Display this line when activated" should read "(INSERT DEVICE NAME) IS IN ALARM".
    c. In all the above noted devices, the category "Display this line when deactivated" should read "(INSERT DEVICE NAME) IS NORMAL".
5. Door Access Programming Events
    a. Access Events to be programmed for each door will be Force Open and Held Open
    b. The text to be written in the Configure/Event window under "Display this line when activated" category should correspond specifically with the title of the event.
    c. Example: If the event is titled Force Open, then the category
    d. "Display this line when activated" should also read "DOOR FORCED OPEN".
    e. The same holds true for Held Open and Comm Fail events. The category "Display this line when activated" should read "DOOR HELD OPEN"

    In all the above noted events, the category "Display this line when deactivated" should read "NORMAL

B. EVENT PROGRAMMING

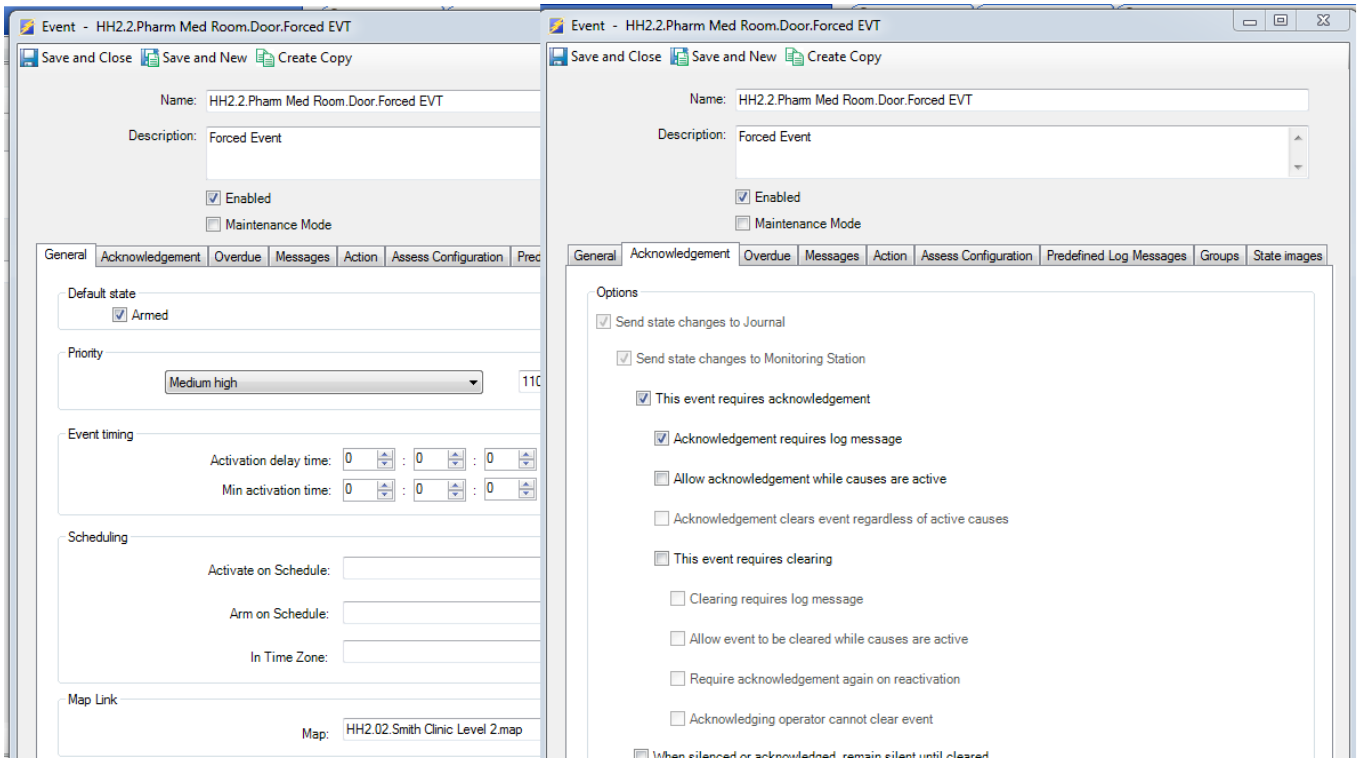
1. Events are generally setup based on their Priority Level.
    a. 200-Critical **(alarms requiring immediate law enforcement response)**
    b. 175-Very high **(Comm Fails, Fire relays)**
    c. 160-Very high **(Power fails)**
    d. 150-High **(Panic alarms)**
    e. 135-High **(Burglar devices, intrusion alarms, critical door forced alarms)**
    f. 110-Medium High **(Door forced alarms)**
    g. 100-Medium **(perimeter door contacts)**
    h. 75-Medium Low **(general alarm conditions)**
    i. 66-Medium Low **(door helds)**
    j. 25-Very Low **(masking and unlock commands)**
2. Enter the map link for any event related to a physical device (camera, panic, door, etc.).
3. Event options should include:
    a. "The event requires acknowledgement" should be checked for all events of Priority 100 or higher.
    b. "Acknowledgement requires log message" should be checked for all events of Priority 125 or higher.
    c. Do not check "acknowledgement clears event."
    d. Enter one of the standard "unacknowledged" events for all events of Priority 100 or higher.
4. Event actions should include:
    a. "Play sound" should be checked for all events of Priority 100 or higher (unless in intrusion zone). Please see existing examples for sound names.

b. “Display viewer” should activate any corresponding camera view for all events associated with physical devices for all events of Priority 125 or higher. All panic or duress alarm events should activate any associated camera that shows the panic location.

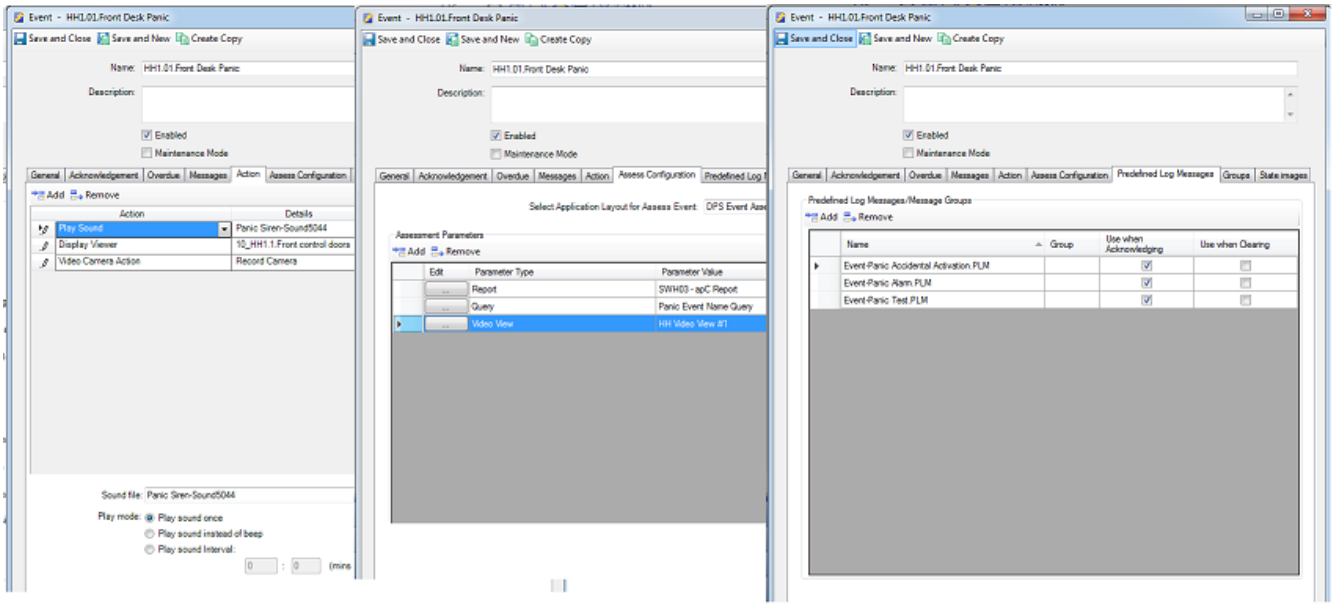
5. If a location utilizes space protection at set times and an intrusion zone will not be used, a masking event must be setup. Please see existing examples for setups.

6. **Special note for events associated with automatic door operators.** Events (such as “Day/night” events) that unlock an associated door via output activation should include an “unlock” trigger as an action so operators can quickly determine doors in an unlocked state. Please see existing examples for setups.

Standard Event Setup



Added event setup for panics and high security alarms (note assessment and event actions)



Items marked in BOLD are preferred and should be the default selection.

Selection Item Name	Selection Options
GENERAL	
Enable	**Checked**
Default State – Armed?	**Checked**
ACKNOWLEDGMENT	
Send state changes of this event to journal?	**Checked**
Send state changes of this event to monitoring station?	**Checked**
This event requires acknowledgment?	**Checked (priority 50 and above events)**
Acknowledgment requires log message?	**Checked (priority 100 and above events)**
Allow acknowledgment while causes are active?	Not Checked
Acknowledgment clears event regardless of active causes?	Not Checked
This event requires clearing	*NOTE: Clearing commands are used for events associated with lockdown buttons. See owner for additional information*
MESSAGES	
Display this line/Instructions	*NOTE: This information should be provided to include special information needed to facilitate the response. It is only required when that information is needed.*.

ACTION/ASSESS CONFIGURATION/PREDEFINED LOG MESSSAGES

NOTE: These items are normally used for high security events (priority 125 and above events). It is expected that the Assess Configuration tab be set and linked with actions for displaying the associated camera view and the recorded camera action. The basic assess configuration display includes the 1) map, 2) recent journal, 3) video view and 4) recorded video. Predefined log messages are provided for panic and intrusion device events

Sound to be assoc w/event activation:

_ Play sound once
_ Play sound instead of beep
_ **Play sound interval (enter 45 seconds)**
(all sound files needed are saved in the setup)

Other Available Event Actions (contact Owner if needed):

1. Lock, unlock, momentarily unlock, or secure a door or door group
2. Enable or disable door forced alarm, door held alarm, door open alarm, door lock tamper, door DSM tamper, door lock unsecured, or door RTE.
3. Activate, deactivate, latch, unlatch, arm, or disarm an event or event group
4. Activate, deactivate, or pulse an output or output group
5. Arm or disarm an input or input group
6. Activate or deactivate CCTV actions
7. Connect dialup iSTAR controllers
8. Connect dialup apCs

9. Back up iSTAR database
10. Control or uncontrol access for an elevator button (elevator and floor pair)
11. Enable or disable keypad commands
12. Disable PIN or require PIN
13. Set reader security level 0, 1, 2, 3, or 4
14. Arm, disarm, toggle, or force-arm intrusion zone (Intrusion zones on iSTAR controllers)
15. Display on keypad's reader intrusion zone mode status or off-normal points (Intrusion zones on iSTAR controllers)
16. Arm, disarm, toggle, or force-arm local intrusion zone (Intrusion zones on iSTAR controllers —reflexive action)
17. Display local intrusion zone mode status or off normal points on keypad's reader (Intrusion zones on iSTAR controllers — reflexive action)
18. Lock, unlock, or secure keypad's local door (on iSTAR controllers — reflexive action)
19. Initiate roll call report
20. Grace all cards
21. Activate BiD action
22. Send e-mail
23. Send page

Groups

1. The DPS primarily uses groups for access clearances (door groups) and for proper control of alarm and burglar devices (input and event groups). Other groups have been established for ease of testing and other uses. All devices programmed that correlate to the below noted groups must be placed in those groups at the time of setup. Groups to be built include:
    a. Input (Note: All inputs will be placed in an ALL INPUTS GROUP)
    b. Output
    c. Event
    d. Elevator
    e. Door
    f. Personnel
2. Setups that include burglary devices must have both an Input group and an Event group for those devices. These groups will be placed in their respective Alarm Masking or Intrusion Zone setups.
3. Doors designated as "general access" should be added to the locations "general access" door group. If not general access, always check if the door needs to be added to a pre-existing door group.
4. Controlled areas, such as pharmacies, business offices, etc., should have door groups established. For example: "BT Inpatient Pharmacy.DG". New doors added to these areas should be added to the respective groups.
5. Personnel groups must be setup for all areas using intrusion zones.
7. Event actions should include:

Intrusion Zones

1. If a location utilizes space protection, an intrusion zone must be setup. Some areas, such as Pharmacies, require their own intrusion zones.
2. Please contact the DPS for specific information on how control of the intrusion zone will be setup.
3. Please see existing examples for setups.

Maps

4. Every physical access control device that has an alarm event associated with it must be mapped. The associated event icon should be placed on the map, with the exception being for doors. Icons for the actual door, elevator, or gate should be displayed on the map.

CCTV Programming Standards

A. NOTE: Camera names should be programmed in the respective devices and then imported into CCure. Cameras names cannot match any other device. They will not import into CCure if the name is not unique.

B. The format for naming Cameras in CCURE is:
   1. <LOC>.<FLR>.<USER DEF> where:
   2. LOC – Is the facility location and building # (two or three Letter Acronym)
   3. FLR – Is the floor number on which the device is located
   4. USER DEF – Is the max 25 character description where the camera is located
   5. Example: HH1.01.Corridor to Receiving

C. The location description should be a good description of where the actual door is located to help anyone who may work on the system and to properly program events. Typically, only this location description will be used for the DVR programming.

DVR Programming Standards

A. DVR's names in CCURE should be programmed in the as follows: the Building Acronym, Room Number, brief description of the DVR.
   1. Example: HH1.01.VideoEdge1

B. DVRs will be programmed to include:
   1. <LOC>.<FLR>.<USER DEF>. where:
   2. LOC – Is the facility location and building # (two or three Letter Acronym)
   3. FLR – Is the floor number on which the panel is located
   4. USER DEF – Is the unique name of the DVR.

"

ATTACHMENT 2 – SPECIAL PROGRAMMING INSTRUCTIONS FOR CCURE ACCESS CONTROL EQUIPMENT

A. Each power supply power fail and low battery alarm must be wired in as an input and configured as an individual alarm event in the system.

B. Card Readers should be wired and programmed with LEDs to indicate conditions and functions as follows:
   1. Red LED in the normal, locked state.
   2. Green LED upon a valid card read and when the door is in the access (unlocked) condition.
   3. Flashing red LED upon invalid card read, forced door, and held open alarm conditions.
   4. Card reader LED indicators shall operate identically throughout all facilities.

C. CCure programming and setup of all integrated security controls and equipment.

   1. System CCure programming and setup of the DVRs/NVRS are to include, but not be limited to the following:
      a. Program NVRS for all supported events, such as a "communication loss", “excessive temperature”, etc.
      b. Import all associated IP video and define cameras or views needed to support required event call-ups.
      c. Show cameras on CCure location maps so that when alarms are generated on the ACMS Monitoring Station, an operator can double-click on the camera icon next to the event, and a display window will open.
      d. Program all exterior PTZ cameras (if utilized) to operate with on-screen controls from the CCure display window.
      e. Coordinate automatic camera selection requirements using the Harris Health System DPS CCURE programming instructions. Coordinate other details with DPS as necessary prior to programming.

   2. Provide all initial system programming and setup of the intercom, hands-free phone, and/or emergency phone are to include, but not be limited to the following:
      a. Initial setup for the interface with the ACMS.
      b. Alphanumeric identification of each Substation and Security Assistance Station, on each Master Station. Coordinate descriptors using the Harris Health System DPS CCURE programming instructions. Coordinate other details with DPS as necessary prior to programming.
      c. Automatic selection of CCTV Cameras adjacent to Substations or Security assistance Stations as applicable upon call in. Coordinate automatic CCTV Camera selection requirements using the Harris Health System DPS CCURE programming instructions. Coordinate other details with DPS as necessary prior to programming.

ATTACHMENT 3 – PROGRAMMING INSTRUCTIONS FOR VIDEOEDGE NVR EQUIPMENT

A. SYSTEM PRE-SETUP

1. Harris Health Network security requires all devices be registered before activation. Provide device mac address(es) at least two weeks before planned installation date
2. To receive a static IP address, provide device switchport information and equipment mac addresses at least two weeks before planned installation date. Submit information on DPS excel template.

B. SYSTEM SETUP

1. Once device is communicating and stable on network, change ALL default passwords. Obtain the current Harris Health DPS NVR passwords for the following
   a. Administrator
   b. Videodege (linux)
   c. Root (linux)
   d. Videoedge Backups
   e. Nvrgroupadmin
   f. softwareadmin
   g. support
2. Confirm with owner if user roles are needed for VictorWeb viewing
3. Confirm with owner if unit is to be added to Failover system. If required, program the information needed for failover on both the Videoedge unit and the associated Failover NVR's.
4. Confirm with owner if unit is to have centralized licensing. If required, apply to the new IP camera licenses to the Victor server and centralize the new NVR.
5. Enable the NTP Server and use IP address **10.50.26.10**

C. FAILOVER

1. Confirm that the Videodege (linux), Root (linux), and Nvrgroupadmin passwords match with the failover (secondary) unit being utilized.
2. Both remote settings need to be activated
3. SNMP community name needs to match with failover (secondary) unit being utilized.

D. CAMERAS

1. Once camera(s) are communicating and stable on network, change ALL default passwords. Obtain current Harris Health DPS camera password.
2. All Cameras should be programmed for full resolution at 15 FPS.
3. All cameras should be set for motion detection video analysis. If analytics are included, confirm settings with owner.
4. All cameras should be set for "Recording always with alarms" (will be changed at a later date)
5. All cameras should be set and tested for video alarms. Confirm with owner if schedule is to be used for alarms.

E. ADVANCED SETUP

1. Setup Device security passwords using current Harris Health DPS IP camera password in the following order. This will facilitate camera imports:
   a. 1. Axis-DPS
   b. 2. Illustra-DPS
   c. 3. Sony DPS
   d. 4-7 Others as needed
2. Setup mail server for IP Address: **170.57.134.21**
3. Contact owner to mail service email address(es). Default notifications are to include:
   a. Analog Hander reboot
   b. Archive
   c. Area Temperature
   d. Audio Malfunction
   e. Blur Detection
   f. Camera Dark Frame
   g. Camera Processing Malfunction
   h. Camera Video Loss
   i. Device Not Recording
   j. Failover
   k. Log Storage Space Low
   l. Security Alert
   m. Security Config Change
   n. Spot Temperature
   o. Storage
   p. Storage Activation
   q. Storage Config
   r. Storage Retention
   s. System
   t. System Reboot
   u. Text Stream

ATTACHMENT 4 – PROGRAMMING INSTRUCTIONS FOR DPS IP CAMERA EQUIPMENT

A. SYSTEM PRE-SETUP

1. Harris Health Network security requires all devices be registered before activation. Provide device mac address(es) at least two weeks before planned installation date
2. To receive a static IP address, provide device switchport information and equipment mac addresses at least two weeks before planned installation date. Submit information on DPS excel template.

B. SYSTEM SETUP

1. Once device is communicating and stable on network, change default password. Obtain current Harris Health DPS IP camera password.
2. Change settings so that camera cannot be viewed or access without password.
3. Confirm with owner for desired view and focal point.

ATTACHMENT 5 – PROGRAMMING INSTRUCTIONS FOR DPS VMS SYSTEM

A. SYSTEM SETUP

1. All NVR Systems are to be setup for access on the existing American Dynamics Victor Video Management System.
2. Upon request, setup saved views of project cameras per the owner's direction
3. Upon request, setup video motion alarms of project cameras per the owner's direction.

SECTION 28 13 00 - SECURITY AND CCTV SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. The conditions of the General Contractor (General, Supplementary and other Conditions) and the General Requirements are made part of this section. The complete installation shall conform to the requirements set forth by the National Electrical Code, all State and Local Building Codes as required by the "Authority Having Jurisdiction" and the requirements of the owner.

B. Harris Health, "the owner", has a system wide Security Control System (SCS) consisting of the Software House CCure Access Management System (ACMS) that provides door monitoring, intrusion alarm and access control functions and the American Dynamics Victor Video Management System (VMS) that provides CCTV control and monitoring functions. All security control and security video systems shall be an extension of these systems unless specially approved by the Harris Health Department of Public Safety.

1. Harris Health requires at a minimum that all exterior doors be equipped with card access or electronic door position monitoring.

C. Harris Health's Department of Public Safety provides the Owner's System Administrator, and is responsible for the operation and maintenance of the ACMS and VMS and will, with the Owner's Representative, work with the Design Professional to ensure design criteria are satisfied. Harris Health also maintains a separate Security Project Design Requirements document and it should also be referred to when planning for security controls. All equipment and materials provided shall be new and unused and of the most current model or revision. All components of this system shall be installed in a workmanlike manner, following security industry "best practices" and in strict adherence to the manufacturer's specifications and applicable codes. Wire and conduit shall be installed consistent with Harris Health Information Technology Department standards.

D. An approved Security System Contractor shall be utilized and shall be responsible for all costs associated with the installation of this equipment.

1.02 DEFINITIONS

A. Owner: Harris Health

B. Harris Health Contact: the designated owner's representative

C. General Contractor: The General Contractor is the firm contracting with the Owner to perform and manage the Work required for the construction of the facility. The General Contractor is responsible for coordinating all sub-contractor work and any Owner assigned specialty contractors.

D. Security Contractor: The Security Contractor is the firm contracting with the General Contractor to perform the Work required for the security installation and to provide maintenance for all devices in the project. (alternate: The Security Contractor shall be selected by the Owner as a Specialty Contractor).

E. Security Control System (SCS): All components of the Security access control, communication, and CCTV systems provided under this section.

F. Work: The Work is all equipment, labor, material and services necessary to produce the construction in accordance with the Contract Documents.

1.03 WORK INCLUDES

A. Furnish and install all equipment, accessories and materials in accordance with these specifications and drawings to provide a complete and operating Security and CCTV System.

B. The scope of work for the Electrical Contractor shall include, but not be limited to providing the following:

1. 120-volt power at designated security devices.

2. 120-volt power, grounding, and fire-resistant backboards located in the IDF rooms.

C. The scope of work for the Security System Subcontractor (the Security Contractor) shall include, but not be limited to providing the following:

1. Local control panels within the IDF.
2. Card readers.
3. Exit motion sensors.
4. Magnetic door locks.
5. Door monitor contacts.
6. Request-to-exit devices.
7. Remote door release devices
8. Sounders and key-switches.
9. Panic buttons
10. Intercom and telephone devices utilized for door and gate control
11. CCTV cameras
12. CCTV camera recording devices
13. Exterior hands-free Emergency Phone systems
14. Termination of all field wiring including the card readers and cameras.
15. Termination of communication field wiring within the IDF.
16. Testing and programming of local system.
17. Reprogramming of existing host computer.
18. Interface with ADA door operators where applicable.

D. Any material and/or equipment necessary for the proper operation of the access control system not specified or described herein shall be deemed part of this specification.

1.04 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are listed in the hardware requirements in section 2 of this document.

B. The following security contractor /integrators have been approved for the installation of the Software House ACMS and meet the qualifications listed in Section 1.1. Quality Assurance.

1. Terri Adams, Siemens Industry, Inc. Building Technologies Division, 8850 Fallbrook Houston, TX 77064 Phone: (346) 260-7195, Email: terri.adams@siemens.com.
2. Steve Greis, Nextgen Security, 600 Century Plaza Drive, Suite C130, Houston, 77073, (832) 706-4551, Email: steve.greis@nextgensecured.com
3. Craig Harris, Tech Systems, 3400 Corporate Way, Suite F, Duluth, GA 30096, Phone: 770-495-8700 Ext. 1707, Email: charris@techsystemsinc.com.
4. Marvin Machado, Walker Engineering, 7761 W. Little York Rd, Houston, Texas, 77040; 713-864-3801/832-421-2700; Email: mmachado@walkertx.com
5. Stephen Schoff, Security Control Systems, Inc., 10645 Richmond Avenue, Suite 180, Houston, TX 77042, Phone: 346-228-1084. Email: stephens@scstexas.com.

1.05 RELATED WORK SPECIFIED ELSEWHERE

A. Electrical General Provisions
B. Basic Materials and methods
C. Fire Stopping and firewall penetrations
D. Door, door frame and door hardware shall be coordinated with Architect and the General Contractor (alternate: Owner). All doors that are monitored or provided with access control devices shall be provided with mechanical panic hardware that has the ability to be manually locked in the event of failure by the Access Control System.

1.06 SCOPE OF WORK

A. Reserved for project-specific security specifications

1.07 PERMITS

A. The Security Contractor shall ensure compliance with and an understanding of all local codes and contract conditions and obtain all permits necessary pertaining to the Work.

B. The Security Contractor shall be responsible for submitting to the local authority having jurisdiction (AHJ) the electric lock/electronic lock procedure submittal for permitting as required. The Security Contractor shall only be responsible for lock permitting of electric locks controlled by the Security System.

C. All approved Permits and support drawings and documentation are to be provided to the DPS Contact as part of Record Documentation.

1.08 SUBMITTALS

The Security Contractor shall not order any equipment and shall not begin any work until the submittals have been approved in writing by Harris Health. The Security Contractor shall not perform any installation prior to the receipt of a written authority to proceed from Harris Health

A. Shop Drawings

Prior to assembling or installing the SCS, the Contractor shall provide complete shop drawings which include the following:

1. Architectural floor plans indicating all system device locations.
2. Full schematic wiring information for all devices. Wiring information shall include cable type, cable length, conductor routings, quantities, and point-to-point termination schedules. The Security Contractor shall verify and validate the Wiring Schedule provided with this document.
3. Complete access control system one-line block diagram.
4. Statement of the system sequence of operation.
5. Riser diagrams showing interconnections.
6. Detail drawings showing installation and mounting.
7. Fabrication drawings for console arrangements and equipment layout.
8. All drawings shall be fully dimensioned and prepared in DWG format using any CAD-based software capable of exporting the format (such as AutoCAD).

B. Product Data

Prior to assembling or installing the SCS, the Contractor shall provide the following:

1. Complete product data and technical specification data sheets that include manufacturer's
2. data for all material and equipment, including terminal devices, local processors, computer equipment, access cards, and any other equipment provided as part of the SMS. A system description, including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment shall operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:
   a. Central processor configuration and memory size.
   b. Description of site equipment and its configuration.
   c. Protocol description.
   d. Rigid disk system size and configuration.
   e. Backup/archive system size and configuration.
   f. Start-up operations.
   g. System expansion capability and method of implementation.
   h. System power requirements and UPS sizing.
   i. A description of the operating system and application software.

C. As-Built Drawings

1. At the conclusion of the project, the Contractor shall provide “as built” drawings. The “as built”
2. drawings shall be a continuation of the Contractor’s shop drawings as modified, augmented, and
3. reviewed during the installation, check out and acceptance phases of the project. All drawings
4. University of Utah C•CURE 9000 A&E SPECIFICATIONS 5
5. shall be fully dimensioned and prepared in DWG format using any CAD-based software capable
6. of exporting the format (such as AutoCAD).

D. Manuals

At the conclusion of the project, the Contractor shall provide copies of the manuals as described herein. Each manual’s contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each security system contractor installing equipment and systems and the nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The manuals shall include all modifications made during installation, checkout, and acceptance. The manuals shall contain the following:

1. Hardware Manuals

The hardware manuals shall describe all equipment furnished including:

a. General description and specifications.
b. Installation and check out procedures.
c. System layout drawings and schematics.
d. Manufacturers’ repair parts list indicating sources of supply.

2. Software Manuals

The software manuals shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:

a. Definition of terms and functions.
b. Use of system and applications software.
c. Initialization, start-up, and shut down.
d. Alarm reports.
e. Reports generation.
f. Database format and data entry requirements

3. Operator Manual

The operator manual shall fully explain all procedures and instructions for the operation of the system including:

a. Computers and peripherals.
b. System start-up and shut down procedures.
c. Use of system, command, and applications software.
d. Recovery and restart procedures.
e. Graphic alarm presentation.
f. Use of report generator and generation of reports.
g. Data entry.
h. Operator commands.
i. Alarm messages and reprinting formats.
j. System access requirements.

4. Maintenance Manual

The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

E. System Commissioning

Harris Health requires a complete system commissioning and point-to-point checkout process before a project is considered complete. Every single point on the system will need to be tested for both software and system-level verification before the warranty can begin. The security contractor must ensure every door, sensor and device is set up, calibrated, and operating properly as if any given device has a problem, it could cause the piece of equipment its associated with not to work properly. During construction, the security contractor is to record system progress and the results of their testing and verification process. Before project closeout, submit reports covering every single device and detailing the checkout process and status. All costs for point to point check out and commissioning must be included in contract price. No additional allowance will be granted to complete this process.

1.09 SUBMITTAL OF SAMPLE MATERIALS

A. The Security Contractor shall submit samples of all SCS and Wiring materials, if requested by the Harris Health Contact.

B. If and when requested, the Security Contractor shall submit samples of any specific SCS devices to the Harris Health Contact for approval. Samples might include card readers, cameras, communications devices, and other similar SCS equipment. In cases of Alternative Bids, the Security Contractor shall submit samples of all equipment items.

1.10 PROGRAMMING

A. The Security Contractor shall enter and program all SCS data needed to make the system operational. The Security Contractor shall utilize data from the Contract Documents and all pertinent information in the Security Contractor's possession required for complete installation of the database.

B. The Security Contractor shall coordinate and provide specific format requirements for any data request from the Harris Health Contact, providing at least one (1) week advance notice on required data. The Security Contractor shall request from the Harris Health Contact any data needed to provide a complete and operational SCS, using standard data request forms, for any data that cannot be easily transmitted using electronic data formats. For any data easily transmitted electronically, the Security Contractor shall specify format and data requirements.

C. It is expected that the Security Contractor follow all naming and programming standards currently in use by the Owner. Additional, required, programming instructions can be found in the attachment: “Harris Health Security CCURE Programming Instructions.”

D. It is expected that the Security Contractor follow both Harris Health policies and industry standard protocols when setting up device and/or software system userids and passwords. Manufacturer’s “hardening guides” and cybersecurity installation and setup guidelines are to be followed. No Harris Health security control, device, or system shall be accessible via the internet without the owner’s written approval. No Harris Health security control, device, or system shall be accessible via the owner’s intranet without password protection unless the owner’s has provided written approval.

1.11 QUALITY ASSURANCE

A. Manufacturer Qualifications

The manufacturers of all hardware and software components employed in the SMS shall be established vendors to the access control/security monitoring industry for no less than five (5) years and shall have successfully implemented at least 5 systems of similar size and complexity

B. Contractor / Integrator Qualifications

1. The security Contractor shall have been regularly engaged in the installation and maintenance of integrated access control and video management systems and have a proven track record with similar systems of the same size, scope, and complexity.
2. The Security Contractor shall have a minimum of five years' experience in the fabrication, assembly, and installation of systems of similar complexity as specified herein.
3. The Contractor shall have the specified systems in at least three projects of the type and complexity specified herein. This includes the requirement that the Contractor has installation experience of large healthcare installations (300 readers or above) in the Houston Metropolitan Area with the CCure Access Control System.
4. The Security Contractor shall have a service facility and organization with staffing capable of providing comprehensive maintenance and service for the specified systems within a 75-mile radius of downtown Houston.
5. The Security Contractor shall be a certified installer and properly licensed to install, modify, and service the specified systems. The Security Contractor shall supply information attesting to the fact that their firm is an authorized dealer and product integrator certified with the both the SCS and VMS.
6. The Security Contractor shall provide factory-certified technicians. Certified technicians shall install and supervise installation, commissioning, and maintenance of the Work. All installing personnel shall be licensed as required by local and/or state jurisdictions. Technicians shall have achieved the status of Advanced Integrator or higher certification from Tyco/Software House/American Dynamics approved training centers. The Security Contractor shall supply information attesting to the fact that their installation and service technicians are competent factory trained and certified personnel capable of maintaining the system and providing reasonable service time.
   (Photocopies of certification should be submitted with package response).
7. The Security Contractor shall ensure compliance with and have a thorough understanding of all local codes and contract conditions pertaining to the Work.
8. The Security Contractor shall have local in-house engineering and project management capabilities consistent with the requirements of the Work. The Security Contractor shall provide a team managed by a project manager responsible for submittals, installation, scheduling, manpower, testing, record documents, subcontractors, etc.
9. The Security Contractor shall
   a. Coordinate all work once awarded, with the named Harris Health Department of Public Safety (DPS) contact person and/or Project manager.
   b. Comply with city, state, and local regulations concerning licensing and operation of system.
   c. Assume the responsibility for the protection of all finishes in and adjacent to the work area and repair and restore all damage caused to any adjacent building and/or site by any action of the Vendor, its subcontractors or personnel of either in the progress of the work.
   d. Ensure employees and subcontractor meets employee identification requirements and any owner -required safety training.
   e. Upon request, schedule and provide training for operational and administrative staff. These classes shall include, but not limited to the overview of the systems installed, control and setup functions of the system, alarm acknowledgement and event investigation. The administrative staff training shall include system programming and

setup, reports and diagnostics of the system, enhanced operations features, password protection setup and network configuration, connection to network setup features if necessary.

10. By submitting a Bid Proposal, the Security Contractor certifies that it is qualified in all areas pertaining to the Work. In the event the Security Contractor becomes unable to complete the Work in accordance with the Security Contractor Documents, or the satisfaction of the Owner or its representatives due to a lack of understanding of the equipment, systems, or services required by the Contract Documents, the Security Contractor shall retain the services of the applicable manufacturer's representatives to expeditiously complete the Work in accordance with the construction schedule at no additional cost to the Owner.
11. Bidders shall submit documentation as required to demonstrate compliance with Contractor Qualifications. References shall include contact information for end users familiar with the installation and continued operation of the systems, and the Security Contractor's work. Provide a minimum of three (3) references whose systems are of similar complexity and have been installed and maintained by the security system integrator in the last five (5) years.
12. There shall be a local representative and factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for these systems.

C. Testing Agencies
1. The SMS shall be tested and listed by Underwriters Laboratories (UL) for UL/cUL 294 for Access Control System Units.
2. The SMS shall be tested and listed by Underwriters Laboratories (UL) for UL/cUL 1076 for Proprietary Burglar Alarm Units.
3. The SMS shall employ a FIPS 197-listed AES 256-bit encryption between the SMS Servers, Clients, and iSTAR Ultra/eX/Edge Controllers.

D. The SMS shall include full support for FIPS 201 initiative:
a. Ability to customize a system-wide Card Holder Unique Identification number (CHUID).
b. Ability to configure custom, extended card formats, including GSA 75-bit Wiegand
c. standard, and to download them to the card access panels.
d. Ability to use Hashed Message Authentication Codes (HMAC) for medium assurance profile.
e. Enhanced data fields per the FIPS 201 standard, including Agency Code, System Code, Credential Series and Credential Issue Code.
2. 5. The SMS hardware shall comply with the following regulatory requirements:
a. FCC Class A.
b. FCC Class B.
c. CE.
d. Canadian Radio Emissions requirements.
e. Restriction of Hazardous Substances Directive (RoHS) 2002/95/EC.
f. FIPS 140-2 encryption (certified for the iSTAR Ultra/Edge/eX controllers).
3. 6. The SMS shall support Americans with Disabilities Act (ADA) compliance in door and access operation.

E. Product Standards
1. All access control hardware and software shall be of a single manufacturer including controller panels, and input and output terminal modules.
2. All published specifications of the system manufacturer shall be considered as being a part of this specification, even though they have not been written in complete detail.
3. The base bid shall be based on the products specified. Any substituted product and/or system shall not be accepted without prior approval from the Owner within 10 days of bid date
4. Materials included in the completed security system installation shall be new and shall fully comply with the latest published specifications and versions of the manufacturer.
5. Unless otherwise specified, components included in the completed security system shall be standard, unmodified production models.

6. Equipment, components and materials provided by the Security Contractor shall meet or exceed the performance characteristics and technical specifications for referenced components.
7. The Security Contractor shall provide complete and detailed technical information for equipment, components and materials. The Owner or its representatives will reject proposed equipment in the event that submitted technical information is not sufficient to readily confirm that proposed equipment, components, and materials will meet or exceed the performance and technical specifications. The Owner or its representatives shall make the final decision as to whether proposed equipment, components and materials are acceptable. In no case shall acceptance by the Owner or its representatives of proposed equipment, components and materials relieve the Security Contractor of his/her responsibility to produce completed systems, which comply with this RFP.
8. Within the technical specifications for the system, certain manufacturers may be specified. These manufacturers are listed in alphabetical order for example purposes only (unless followed by “No Exceptions”). The Security Contractor may substitute manufacturers and models that may be more cost effective or readily available than those specified. Substitutions shall meet or exceed the minimum functional and technical specifications. Acceptance of such substitutions is at the discretion of the Owner and DPS Contact Person (if used).
9. The systems (including software, hardware and firmware) proposed for this project shall have been installed in at least two projects of similar size and nature and shall have been in beneficial use for at least six months prior to submission of the Bid Proposal. Provide a compliance statement from each manufacturer along with references as part of the Bid Proposal.

1.12 Licensing

1. Licensing shall be required for the SCS and VMS software and components.
2. The security contractor must provide licensing upgrades whenever any of the SCS design components exceeds 90% of the owners current SCS License limits for any of the following.
   a. Number of online readers.
   b. Number of online inputs.
   c. Number of online outputs.
   d. Number of card holders.
   e. Number of simultaneous clients.
   f. Number of simultaneous badging stations.
3. The security contractor must provide all licenses for added VMS devices and provide licensing upgrades whenever any of the VMS design components exceeds 90% of the owners current VMS License limits for any of the following.
   a. Number of online VMS devices.
   b. Number of simultaneous clients.

1.13 WARRANTY

The SMS shall be provided with a 14-month product warranty from date of shipment or 1 year from date of registration, whichever is shorter. The SMS Hardware shall be provided with a 5-year product warranty from date of manufacture. Software version upgrades shall be available for no charge during this warranty. The software media warranty shall be 90 days per the C•CURE software licensing agreement.

1. The Security Contractor shall warrant to Harris Health that it is the owner of the equipment and that the equipment will be free and clear of any lien or encumbrance on the final acceptance date.
2. The Security Contractor warrants that the materials and equipment furnished to Harris Health will be new and of recent manufacture unless otherwise specified in the Contract Documents.
3. During the warranty period, the Security Contractor's maintenance personnel shall initiate all SCS service and repair within four (4) hours from receipt of a report of a SCS malfunction. The Security Contractor shall restore the SCS to proper operating condition within eight (8) hours after receiving a report of system malfunction.

4. For the purpose of this document, SCS malfunctions may be defined as follows:
   a. Complete failure of the components connecting or controlling the system security equipment or interfacing with existing equipment.
   b. Complete or partial failure of the panel or workstation, resulting in the loss of monitoring or reporting capability.
   c. Complete failure of the security equipment, resulting in loss of all system capability.
   d. Failure of security equipment, resulting in loss of use of installed access control stations (Card Readers or cameras).
   e. All other malfunctions shall be considered minor failures.
5. Harris Health will call a designated Security Contractor-provided telephone number to effect Security Contractor notification of maintenance problems. Harris Health will make reasonable repeat attempts to make notification. Response time requirements shall be measured from the time of the first attempt by Harris Health to notify the Security Contractor.
6. The Security Contractor shall maintain an inventory of security equipment spare parts, materials, consumables, and any other system item in order to meet the specified warranty maintenance requirements and keep the security equipment in a continuous operational mode during the warranty period.
7. During the warranty period, maintenance service shall not be assigned or transferred by the Security Contractor to any agent or other Security Contractor.

PART 2 - PRODUCTS

2.01 GENERAL INFORMATION:

A. The SCS shall consist of the Software House C•CURE 9000 system, Software House C•CURE ID Badging Solution, and the Software House iSTAR Ultra family of field controllers. Hardware manufacturers shall be an ISO 9001:2000 registered company.

B. All security control cabling, including all horizontal cabling, for the security devices shown on the floor plan device drawings will be provided by the security contractor. All connectors and other cabling and wire are to be provided by the security contractor.

C. All network Data cable (Cat6A) and telecom cabling will be provided by the General Contractor (alternate: Owner) under the guidelines of the Harris Health Information Technology Department. Number and location of devices, such as POE IP Cameras and security control panels, requiring network data cable are to be identified to the General Contractor and approved by the owner. Installation of all devices requiring network data cable is to be coordinated with the Harris Health Information Technology Department.

D. All systems and added equipment shall be for a complete “Turnkey System” including power circuits required for servers and power supplies for the cameras or any other devices/components, interconnections, labor, and required design service. The entire system, including mounting, installing, system programming, connecting, calibrating, aligning, testing, and adjusting is to be the responsibility of one contractor.

2.02 SECURITY ACCESS CONTROL MANAGEMENT SYSTEM OPERATION REQUIRMENTS (ACMS)

A. The Access Control Management System (ACMS) consists of a fully integrated access control and alarm monitoring system consisting of fully redundant file servers, workstations, printers, software, Security Control Panels (SCPs), card readers, and alarm input and output devices.

B. The ACMS is controlled by the Software House CCure 9000 card access system. All additional controls and components shall be compatible and programmed to work with the existing Harris Health Software House CCure 9000 card access system.

C. This CCure 9000 card access system is established in a centralized manner in which the Department of Public Service (DPS) administrates and monitors the database/server/software configuration. The DPS issues all identification badges and access cards and approves and

assigns access levels per departmental request. All security control equipment must be installed and configured to support this centralized monitoring and control program.

D. All components of the ACMS that include programmable inputs for communication of power failures, low battery, and tamper alerts are to be setup to activate alarm event conditions to notify the security console alarm workstations.

E. The ACMS shall include, but not be limited to:

1. Alarm Workstations
   a. Designated alarm monitoring workstations (provided by owner) shall utilize ACMS client software to display alarm, access control, and CCTV events for the location. The security contractor must coordinate naming conventions for system programming and labeling with the owner. Primary alarm monitoring is conducted offsite.
   b. Software configured for on-site reporting should be properly partitioned to report only events or CCTV images that originate at the location. Access levels for on-site use of the ACMS monitoring software shall be programmed to provide both “guard station” and “supervisory” monitoring of card reader and remote control of doors.
   c. The ACMS monitoring software must be configured to allow the operator to switch between the software and other applications while the system software is running.
   d. The ACMS monitoring software must be programmed to allow the operator to monitor live video or video from cameras activated when an alarm condition occurs. Programming should allow the operator to watch live video, rewind a video clip to the point where an event occurred, or control the movement of any pan/tilt/Zoom cameras installed at the location.
   e. The ACMS monitoring workstation must be configured to display the date, time, and number of alarms waiting at all times. The workstations must display and record the alarm messages including the time, date, location, point number, event type, and point status for each transaction.
   f. The ACMS monitoring workstation must also monitor the status of the Fire Alarm system relays to provide for fail-safe lock release.
   g. Central alarm monitoring commands must always override any on-site workstations and the use of on-site workstations should not cause any appreciable reduction in system processing or response time.
   h. The security contractor shall ensure that all alarm and CCTV devices can be accessed and controlled through remote workstations via the owners existing CCURE 9000 security system.
   i. All CCTV and alarming devices must be set up as events according to the owner’s instructions and their locations properly mapped in the CCURE mapping interface.
   j. Setup of areas specified with a card reader with keypad is to include setup of special intrusion zones, personnel groups, and event(s) according to instructions provided by the owner.
   k. The CCure 9000 mapping interface is to be utilized for all workstation graphics. Workstation graphics must show the location of all alarm, card access, and camera points. Icons for each must visibly change appearance during alarm conditions. All workstation graphics must be setup so that they may be utilized when the Owner transitions to a CCure 9000 system in mid-2009. Proper function of the graphical interface is to be considered a warranty item.
   l. The Owner will provide ACMS workstations. Coordinate workstation requirements with the Owner
2. Security Control Panels (SCP): The SCPs shall:
   a. Support OSDP (Open Supervised Device Protocol), v2.1.6 or higher for directly connected readers. OSDP shall be supported with the iSTAR Ultra and qualified OSDP capable readers using OSDP Secure Channel AES128 encryption.
   b. Be installed in a hardwired configuration only with all readers and field devices home run to central location using composite access control cable. Provide 20% spare capacity on

all panels to support future growth. Non-OSDP reader installations, RM-4,IPACM, and/or wireless locksets must be specifically approved by Harris Health DPS.

c. Not have any inputs or outputs that not associated with a card reader door. Any inputs or outputs not associated with a card reader door will require the addition of I8 or R8 remote input/output modules to the panel to support the additional I/O requirements. These inputs and outputs may include but not be limited to, panic and lockdown switches, elevator controls, fire alarm inputs, door contacts, intrusion detectors, call buttons or other monitoring/control systems.
d. Collect alarm input point status.
e. Access control data:
   1) Multiplex the data.
   2) Transmit the data back to the system file server workstation.
f. Support a minimum of fifteen (15) card readers.
g. Support a minimum of fifteen (15) supervised inputs, in addition to those required for card access-controlled door monitoring and request to exit.
h. Incorporate Flash ROM to allow for efficient firmware update downloads from the system software and remotely from the system manufacturer.
i. Support secure Ethernet and RS-485 communications topologies.
j. Support Dynamic Host Configuration Protocol to simplify installation.
k. Receive and execute instructions issued automatically or manually from the system file server workstation.
l. Have memory and logic circuits required to ensure continued operation of connected devices without degradation of system security in the event that communications with the system file server is interrupted.
m. Communicate with the system server and system workstation over the owner's local or wide area network. The security contractor is to provide all equipment necessary to facilitate communications, i.e., terminal servers, short haul modems, fiber optic transmission devices, etc. All communications shall be fully supervised.
n. Have the equipped hardware capacity to connect with the listed card reader doors, door contacts, and motion detectors and shall have a minimum of 20% of reader ports, inputs, and outputs available for future controlled doors. The base hardware inputs and outputs on security control panels are not be used for other devices unless specifically approved by the owner.
o. Have the equipped hardware and software capacity to support up to 50,000 cardholders.

3. SCP Power Supplies shall be furnished and installed and shall:
   a. Be dedicated to the SCPs and shall not provide power for locks or any other low voltage device.
   b. Be UL listed and operate with a 120 VAC input voltage and provide filtered and conditioned output voltage required by the SCPs.
   c. Provide a minimum of twelve (12) hours of battery backup to provide continuous operation during power failure.
   d. Include a battery and charger to maintain the battery.
   e. Be housed in a locking steel enclosure designed for surface mounting. The housing shall include a tamper switch to sense the removal or opening of the enclosure cover. All SCPs, power supplies, and power distribution cabinets shall be keyed alike.
4. Alarm input and output modules
   a. Alarm input and output modules are to be provided for alarm, annunciating, and other control devices connected to the ACMS.
   b. Alarm input and output modules should be located adjacent to their respective SCP unless otherwise approved by the owner.
   c. All inputs on the system require true 2 resistor end of line supervision with (2) - 1K 1/8 watt 5% carbon film resistors.
   d. All alarm input and output modules are to be mounted in an appropriate enclosure.
5. Card Access Controlled Doors and Gates

a. Card Reader Controlled Doors and/or Gates shall have a card reader and all necessary components installed to allow the door(s) or gate(s) to be controlled by the system workstation(s) or be set on time schedule control of electric locking mechanism. Doors equipped with card readers shall be installed within ADA standards and specifications.
b. The Security Contractor shall provide owner-specified composite access control cable from the door/reader to the SCP location. Cabling for Harris Health Software House card reader installations is normally specified without the use of a Reader Interface Module. The need for and proposed mounting locations of Reader Interface Modules is to be approved by the owner. Other cabling needed for additional inputs/outputs and/or power needs should also be identified and provided by the Security Contractor. The Security Contractor may use the option to subcontract with the Harris Health's cable contractor to perform any required work.
c. Connect the card reader door components and provided locking hardware to new power supplies.
d. Provide one normally closed magnetic door position switch (concealed where possible and surface mount when necessary) for each leaf of card reader-controlled doors to monitor door propping/intrusion alarms and open/closed status.
e. Provide necessary relay(s) for interface with door equipped with electric door operators. Card access-controlled doors with electric door operators shall be configured so that they operate normally by activation switch or presence detector in "unlocked" mode. For entry in "locked" mode, only a valid card read shall be required to activate the operator(s). Relays should be properly timed so that there is no binding of the lock when the operators activate the system.
f. Card access-controlled doors also equipped with electromagnetic hold-open devices (MHO) must be interfaced with the ACMS so that the MHO's only operate when the door(s) is in a "locked" state.
g. Provide monitoring the card reader for invalid card use. The System shall annunciate each condition individually.
h. Provide configuration and setup for "nested anti-passback controls" into and from nested parking areas when required.
i. The System shall automatically relock the lock after the door closes after a valid card read access.

6. Electric Locking Mechanisms
   a. The security contractor should coordinate electric locking hardware for new card reader-controlled doors with the Architect and General Contractor prior to preparing pricing. Unless otherwise noted, the security contractor is to provide all electric locking devices and electromechanical releases. The security contractor is to provide relays necessary for interface with electrically operated or handicapped accessible doors or doors equipped with magnetic hold-opens.
   b. New electric lock mechanisms should be selected based on the following preference.
      1) Electromechanical mortise/cylindrical lock and power transfer hinge (for new doors).
      2) Panic devices with electric lever release/retraction and power transfer hinge (Electrified trim release with power transfer hinge preferred for non-operated doors)
      3) Electric strikes (for existing door hardware applications).
      4) Electromagnetic locks (for doors where other electric locking hardware cannot be used).
   c. Electric locks for high security or mental health areas should be rated "high security" or similar.
   d. Electric locks for use in mental health patient areas should be rated "anti-ligature" or similar.
   e. Delayed egress locks are to be used when required by Code.
   f. Door electric locking mechanism power will reside in the SCP location with an exception for panic hardware electric latch retraction devices that are to be connected to a power supply within 25' of the door.
7. Remote Releases for ACMS controlled doors

a. Remote release push buttons are to be desk mounted at designated desks to remotely release electric locks on card reader-controlled doors. Unless otherwise noted, all remote release button shall operate via in input into the ACMS. Each use of the remote-release pushbutton shall be recorded in ACMS history. The Door-release pushbutton use shall not cause an alarm on the system workstation. When a door release pushbutton is pressed, the ACMS shall unlock the door and shunt the door position switch for a user programmable time-period of one to sixty seconds. The ACMS shall unlock the door and shunt the door position switch no more than one second after the door release pushbutton is pressed. The door release pushbutton shall not affect the request to exit device operation for doors with free egress hardware.
b. Upon instruction for owner, define an ACMS schedule when the remote release button will be operational.
c. Door release buttons must appear visibly different from panic or duress devices

2.03 SECURITY SYSTEM HARDWARE REQUIRMENTS (ACMS)

A. Security Control Panels (SCP).
1. Software House iSTAR SCPs are to be utilized. The Security Contractor must get written approved from the designated Harris Health representative for the proper size of the Istar(s) to be utilized and the exact location(s) for all devices to be installed. If not otherwise specified, the Software House iSTAR Ultra G2 with an integrated PSX Power Solution is to be utilized (Panduit option to be utilized, see SCP Power supplies)
2. Mount all panels on a fire-rated plywood backboard that is securely anchored to the wall. The Security Contractor must confirm if the backboard requires painting.
3. Bundle cables inside the panels with Velcro, not tie wraps.
4. Label the cables using a label-maker
5. Create and attach a panel schedule to the new panel that includes the description and location for each installed point used within that panel:
6. Connect and configure the panel tamper switch as an alarm event.
7. Handwritten panel schedules will not be accepted.
8. Within the title block, the panel schedule shall identify the panel name, panel IP, panel MAC ID, and panel address.
9. A minimum of 2 keys shall be left with the Harris Health representative upon final inspection. Do not leave panels unsecured or keys onsite and unattended.
10. If RM4's are installed for doors, they shall be installed a maximum of 10 feet from their corresponding card reader and shall be mounted inside an enclosure on the secure side of the opening.

B. SCP Power Supplies
1. The Software House PSX Power System shall be provided for all ISTAR SCP's. The pre-wired Software House PSX Power Solution including LifeSafety Power NetLink Integration with PSX NL2 and NL4 network modules is to be provided to provide both SCP and door lock power and contained within the same enclosure. This system is to be integrated into CCure for monitoring and control of the power system.
2. The system is to be configured to view live power and battery parameters, perform remote servicing through the C-CURE 9000 PSX event window, report power faults, and perform remote battery load tests.

C. Card Readers
1. The Security Contractor shall provide and install Multi Technology card readers that shall be controlled by the ACMS. The Security Contractor shall install the card readers within Americans with Disabilities Act standards and specifications.
2. Card Reader, standard
a. Card readers shall read the Owner's existing HID 125kHz Corporate 1000 access cards, 13.56MHz ISO14443/ISO15693 card serial numbers.

b. Card readers shall read LEAF-enabled MIFARE DESFire EVS credentials using the owner's LEAF keyset.
c. Card readers shall also read NFC & BLE mobile credentials.
d. Card readers must effectively operate if mounted directly to a metal surface and have a minimum read range of 4 inches. Card Readers shall be provided with a manufacturer recommended UL Class 2 power supply and shall provide necessary output voltage to allow the card reader to operate at its maximum specified read range.

3. Acceptable Manufacturers
a. Wavelynx ET10-7WS-CHAH1 (mullion)
b. Wavelynx ET20-7WS-CHAH1 (single-gang)

D. Card Reader with keypad (pharmacy entrance doors)
1. Card readers shall read the Owner's existing HID 125kHz Corporate 1000 access cards and 13.56MHz ISO14443/ISO15693 card serial numbers.
2. Card readers shall read LEAF-enabled MIFARE DESFire EVS credentials using the owner's LEAF keyset.
3. Card readers shall also read NFC & BLE mobile credentials.
4. Card readers must effectively operate if mounted directly to a metal surface and have a minimum read range of 6 inches. Card Readers shall be provided with a manufacturer recommended UL Class 2 power supply and shall provide necessary output voltage to allow the card reader to operate at its maximum specified read range.
5. Installation is to include proper configuration of intrusion zone and personnel groups.
6. Acceptable Manufacturers
a. Wavelynx ET25-7WS-CHAH1 (single-gang w/ keypad)

E. Card Readers, parking-long range (with owner's approval)
1. Card readers shall read the Owner's existing HID 125kHz Corporate 1000 access cards.
2. Card readers must effectively operate if mounted directly to a metal surface and have a minimum read range of 8 inches. Card Readers shall be provided with a manufacturer recommended UL Class 2 power supply and shall provide necessary output voltage to allow the card reader to operate at its maximum specified read range.
3. Parking card readers are to be mounted on a pedestal-mounted acrylic spacer large enough to include the reader and a hands-free
4. Unless otherwise noted, the security contractor shall provide the mounting surface(s) and pedestal(s) for all parking card readers.
5. Acceptable Manufacturers
a. HID Maxiprox (with owner's approval)
b. Falcon S1R1235 metal stanchion
c. Falcon MCH5375-1CR MaxiProx acrylic spacer kit
d. Or approved equivalent

F. Electro-Mechanical Locksets
1. Electro-mechanical locks shall comply with requirements for size, finish, type, etc., as set forth for non-electric locks and shall conform to ANSI A156.23. Locks shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical locks shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty.
3. Electro-mechanical locks shall ben field-selectable to provide fail secure or fail-safe function. Unless otherwise indicated or required by Life Safety Code, electro-mechanical locks are to be configured as fail-secure and will operate as passage set when energized,
4. Electro-mechanical hardware shall be rated to operate with the specified reader composite cable and provided power supplies so that voltage drop does not exceed 5% of load's stated voltage.
5. Electro-mechanical hardware is to be furnished with power transfer devices, junction boxes, and other accessories needed for a complete, efficient installation. Installation of Electro-

mechanical hardware is to include coring of doors when required. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation.

6. Power Transfer Devices shall provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2" x 4 1/2" butt hinges or 3/4" offset pivots. When door is in closed position, transfer unit shall be concealed. Transfer units shall contain ten 24 AWG UL approved conductors with a rating of 10 Amps at 24 VDC (Class 1 low voltage)
7. Acceptable Manufacturers
   a. Stanley Best HW Series
   b. Stanley Best KW Series
   c. Or approved equivalent

G. Integrated Electro-Mechanical Locksets
1. Integrated Electro-Mechanical Locksets shall be Sargent/Corbin Russwin grade 1 mortise locks that includes the card reader, latch bolt position (DPS) monitor, and door-handle REX sensor integrated into the lock housing.
2. Integrated Electro-Mechanical Locksets shall comply with requirements for size, finish, type, etc., as set forth for non-electric locks and shall conform to ANSI A156.23. Locks shall be UL listed for labeled doors.
3. Integrated Electro-Mechanical Locksets shall provide fail-secure function and will operate as storeroom-function lockset when de-energized, unless otherwise indicated. All Integrated Electro-Mechanical Locksets shall include a key override (to be fitted with the owner's Best MX-8 core). High security applications shall include the deadbolt option
4. Integrated Electro-Mechanical Locksets must include a card reader that reads the Owner's existing HID 125kHz Corporate 1000 and existing MIFARE DESFire EV3 LEAF access cards.
5. Integrated Electro-Mechanical Locksets must be furnished with specified power transfer devices, junction boxes, and other accessories needed for a complete, efficient installation. Doors must be provided with either pre-installed ASSA ABLOY ElectroLynx cabling or a minimum 5/8"chase or raceway to allow installation of ElectroLynx retrofit cables with Molex connectors. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation.
6. Whether the installation used pre-installed or retrofit cable, all ElectroLynx cable sets are to be provided to provide connectivity from the ceiling termination point to the hinge and from the hinge to the door hardware.
7. Power Transfer Devices must consist of McKinney QC Concealed Circuit Electric Hinges with ElectroLynx 8 position and 4 position connectors.
8. Wireless Wi-Fi IP enabled locksets must meet Harris Health Information security requirements and require specific approval from the owner.
9. Acceptable Manufacturers
   a. Sargent or Corbin Russwin IP-enabled locksets
   b. McKinney QC Series Hinges
   c. Assa Abloy ElectroLynx Series cabling
   d. Or approved equivalent

H. Electro-Mechanical Exit Devices:
1. Electro-mechanical exit devices shall comply with requirements for size, finish, type, etc., as set forth for non-electric devices. Exit devices shall be UL listed for labeled doors.
2. Solenoids used in electro-mechanical exit devices shall meet UL requirements for cycle life, low operating temperature and shock and fire hazard qualifications; and be designed for intermittent and continuous duty.
3. Electro-mechanical exit devices are to be furnished with power transfer devices (armored cables loops are not to be utilized), junction boxes, and other accessories needed for a complete, efficient installation. Installation of electro-mechanical exit devices are to include a local power supply, when specified by the manufacturer.

4. Electro-mechanical exit devices shall provide fail safe function and will operates as panic hardware when de-energized
5. Electro-mechanical exit devices shall operate with latch retraction: Upon signal, unit's latch retracted (unlocks).
6. Power Transfer Devices shall provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2" x 4 1/2" butt hinges or 3/4" offset pivots. When door is in closed position, transfer unit shall be concealed. Transfer units shall contain ten 24 AWG UL approved conductors with a rating of 10 Amps at 24 VDC (Class 1 low voltage).
7. Power Supply Units for electro-mechanical exit devices shall be designed for the device utilized. Output power shall be field selectable for either 24 volts DC at 1 ampere or 12 volts DC at 2 amperes. The Power supply unit shall have a terminal block that shall accept 14-gauge stranded wire and shall be mounted in an enclosure not less than 10" x 10" x 4" deep, constructed of 19-gauge steel with a hinged cover. When a temperature control module (TCM) is recommended by the manufacturer, it is required that is be included with the installation.
8. Acceptable Manufacturers
    a. Von Duprin Quiet Electric Latch Retraction-QEL or approved "quiet, low amperage" equivalent

I. Access Control Interface for electrically operated or handicapped accessible doors
1. Interfaces for operated access control doors must provide adjustable timed relay control to allow proper integration of locking devices, electric door operators, and/or locks that latch upon fire alarm activation. This functionality is to include the following:
    a. Access control locked mode allows for door to unlock and then activation of door operator after valid card is presented to the card reader.
    b. Access control unlocked mode allows for activation of door operator when paddle is depressed or when door operator motion sensor detects presence.
    c. Delayed locking of door locks until both door leafs are closed
2. Interfaces for operated access control doors are to be installed in a surface mounted steel enclosure(s) mounted above the accessible ceiling in a surface mounted steel enclosure mounted on the secure side of the door. A SWH G2-RM4E/R8 or additional cabling should be included if required for proper function.
3. Acceptable Manufacturers
    a. BEA BR3-X Series
    b. SDC UR Series
    c. Or approved equivalent

J. Electric Strike
1. Electric strikes may be required for projection additions or completion.
2. Electric strikes must comply with BHMA Std. 501, Grade 1 requirements and UL 1034, Burglary-Resistant Electric Locking Mechanisms. [At fire-rated openings provide UL listed Fire Door Accessory, category 10B, for use with 3 hour "A" labeled doors.].
3. Electric strikes must be solenoid actuated, heavy-duty, tamper-resistant electric strikes constructed of corrosion-resistant metals, with stainless steel cases and springs. They are to be non-handed, field-reversible, and horizontally adjustable to compensate for door/frame misalignment. Electric strike function shall be Fail-Secure (unlocked when energized) with 24V solenoid operating voltage. The strike should accommodate internal switches for remote monitoring and control as required.
4. The Security Contractor must ensure that electric strikes are compatible with types and models of locksets or exit devices being installed. The electric strike must allow the lock's latch trigger to properly operate. Finish is to be stainless steel unless otherwise noted
5. Minimum Specifications
    a. Construction: Tamper resistant, heavy duty, stainless steel.
    b. Adjustment: Horizontal adjustment to compensate for door and frame misalignment.

c. Application: As required for each location to accommodate existing lock set (e.g., mortise, cylindrical, etc.).
d. Latch protection: Provide strike latch guard to prevent tampering with the latch bolt.

6. Acceptable Manufacturers
   a. HES 1006 series (mortise)
   b. HES 1600 series (deadbolt/cylindrical)
   c. HES MUNL (mortise, “quiet” applications)
   d. Or approved equivalent

K. Electromagnetic lock
1. Electromagnetic locks are to only be installed when required for proper door function. Electro–Magnetic Locks are to be considered prohibited without a written exception from the Harris Health Security Representative.
2. Where required, locks shall include filler plates, angle brackets or glass door brackets as required for door and frame assembly as recommended by manufacturer. Coordinate installation with General Contractor and Architect.
3. Minimum holding force for standard interior doors shall be 1,200 pounds. Minimum holding force for perimeter, mental health, and high security areas shall be 1,500 pounds
4. Shear locks are prohibited.
5. Installation shall be done to Code required by the AHJ. All magnetic locks shall release immediately upon or signal from the fire protective signaling system. The locks shall remain unlocked until the fire protective signaling system has been reset.
6. Acceptable Manufacturers
   a. Rutherford Controls (RCI) 8300 Series
   b. Schlage M490/492 Series (high security)
   c. Or approved equivalent

L. Delayed egress locking devices
1. Delayed egress locking devices are to be used when required by Code or to deter unauthorized egress.
2. Delayed egress locking devices on access doors into controlled areas must be approved by the Harris Health Security Representative.
3. Installation shall be done to Code required by the AHJ.
4. Desired function is as follows
   a. Pre-activation warning tone to sound whenever egress pressure is applied to door
   b. Activation alarm to sound at end of count down.
   c. Reset of activation alarm shall require key reset at door or, when controlled by access control, by console operator.
5. Acceptable Manufacturers
   a. Schlage M490DEP (magnetic lock)
   b. Vonduprin CHEXIT
   Or approved equivalent

M. REX Devices
1. Provide UL Listed REX devices in accordance with local codes to detect authorized exits through card reader-controlled doors including, but not limited to.
   a. REX motion sensors.
   b. REX buttons for doors with electromagnetic locks.
2. Wire the REX devices to the REX input of the SCP.
3. For doors with electromagnetic locks, additionally wire REX devices to directly interrupt power to the lock in accordance with local life safety codes.
4. For doors equipped with electric locking mechanisms that are free exiting at all times (e.g., electromechanical mortise/cylindrical locks, electric strikes, etc.), the REX motion sensor shall only shunt the intrusion alarm output and shall not unlock the lock. Use of graphics shall not affect the request-to-exit motion sensor operation for doors with free egress hardware.
5. Locate and adjust REX motion sensor to minimize improper activation (e.g., objects pushed beneath or between doors, corridor traffic, etc.).

6. Provide all signs and/or labels as required to meet local codes and be accepted by local life safety officials.

N. REX Motion Sensor
1. Minimum Specifications
   a. Detection technology: Passive infrared.
   b. Detection pattern: Adjustable to provide coverage of immediate door area.
   c. Output contacts: Two configurable with adjustable activation time (connect one contact to SCP REX Input and one contact to interrupt lock power for electromagnetic locks).
   d. Power requirements: 12-24 VDC.
   e. Mounting: Surface mount to wall, ceiling, or door mullion.
2. Acceptable Manufacturers
   a. Bosch/Detection Systems Inc. Model DS160.
   b. Or approved equivalent.

O. REX Button
1. Provide REX buttons for unlocking card reader-controlled doors with electromagnetic locks.
2. Activation of the REX button shall release the lock and shall shunt the intrusion alarm output.
3. The REX button shall contain an adjustable-time unlock relay for door unlock and shall be intrinsically fail-safe in order to release the door(s) in the event of a failure of the exit control circuitry within the SCP.
4. Wire the REX button as follows:
   a. One normally open momentary pushbutton contact wired to activate the timed unlock relay.
   b. One normally closed momentary pushbutton contact wired in series with lock power for fail safe lock release.
   c. One normally open momentary pushbutton contact wired to the SCP request to exit input.
   d. One user adjustable (1 to 60 seconds) hold open relay normally closed contact wired in series with lock power to lock control.
5. The REX button shall be labeled to meet local codes and accepted by local life safety officials. Provide instructional signage as required to comply with local codes and life safety requirements.
6. Provide wall mount or mullion mount styles as required.
7. Acceptable Manufacturer
   a. Designed Security, Inc.
   b. Locknetics.
   c. Security Door Controls.
   d. Or approved equivalent.

P. Key Switch Override
1. When approved by owner, provide wall-mounted key switch override to provide function of 1) overriding card access functions OR 2) providing lock and unlock function of connected electronic lock.
2. Key switch to be mounted per reader mounting specifications and, when used to override the card reader, should be mounted adjacent to the reader.
3. Key switch overrides must be provided with a small format 7pin IC core mortise cylinder.
4. Acceptable Manufacturers
   a. Camden CM-1130 Key Switch, SPDT N.O. and N.C. Maintained

Q. Tamper Switch
1. Provide normally closed tamper switches to monitor the secure status of all SCPs, power supplies, power distribution enclosure units, and interface cabinets.
2. Minimum Specifications
3. Type: Plunger.
   a. Configuration: Normally closed when the cabinet door is closed.
   b. Mounting: Fastened within cabinet with no access to fasteners when cabinet is closed.

4. Acceptable Manufacturers
    a. Honeywell.
    b. Flair.
    c. GE Security.
    d. Or approved equivalent.

R. Door Position Switches
1. Provide supervised, normally closed single and double pole double throw, door position switches to monitor the open/closed status of card-access controlled doors and other specified doors, gates, and hatches. Provide concealed door position switches unless otherwise specified or required.
2. Concealed Door Position Switch
    a. Minimum Specifications
        1) Gap: One inch between the magnet and switch.
        2) Configuration: Normally closed when the door is closed.
        3) Mounting: 3/4-inch diameter hole in door and frame.
3. Surface Mount Door Position Switch
    a. Minimum Specifications
        1) Gap: Two inches between the magnet and switch.
        2) Configuration: Normally closed when the door is closed.
        3) Construction: Heavy duty aluminum housing.
        4) Mounting: Surface to door and frame.
    b. Provide armored cable from the switch location to the associated junction box in order to conceal and protect the wire.
4. Overhead Door Position Switch
5. Minimum Specifications
    a. Gap: Three inches between the magnet and switch.
    b. Configuration: Normally closed when the door is closed.
    c. Construction: Heavy duty.
    d. Mounting: Floor.
6. Provide armored cable from the switch location to the associated junction box in order to conceal and protect the wire.
7. Acceptable Manufacturers
    a. GE Security (Sentrol).
    b. Flair.
    c. George Risk Industries (GRI).
    d. Or approved equivalent.

S. Duress (Panic) Button
    a. Provide duress buttons flush mounted on walls or surface mounted below desks and counter tops. Verify duress button types, locations, and mounting requirements with the Owner.
    b. Unless otherwise noted, duress buttons are to be non-latching “under-counter” types (use latching types when buttons are installed in series), surface mounted below counter tops or in the knee space of desks in an accessible location. Verify the exact location with the Owner. Exposed cable shall be armored and securely fastened to prevent tampering.
    c. Wall mounted panic buttons shall be a non-latching type and must be visibly marked with the wording “panic” or similar.
    d. Panic button shall have a separate raceway from IT data cabling to the mounting surface. Coordinate requirements with the Architect and General Contractor. Panic alarm devices are to be installed in a point-to-point configuration: one device to one input. Zoning or series-connectivity of any intrusion sensor shall require the approval of the owner.
    e. Configure ACMS system to annunciate duress alarms as the highest priority alarms with associated camera display(s).
    f. Acceptable Manufacturers

1) United Security Products HUB-DL-M (desk/counter button)
2) STI SS2204ZA-EN (wall mount, “EMERGENCY-PUSH FOR HELP”)
3) Alarm Controls Model PBM-1-1 (wall mount)

T. Lockdown or other event Control Button
1. Provide flush mounted wall mount lockdown or other event control buttons to provide event activation through the SCS. Verify button types and colors, locations, and mounting requirements with the Owner.
2. Control buttons should be momentary, must be visibly marked with the function wording (i.e., “Lockdown”) and activate an alarm event on the ACMS. “Stopper” coverers are preferred.
3. Acceptable Manufacturers
   a. Dortronics 5216-MP23/BxE6 (requires engraving)
   b. STI SS2324LD-EN (lockdown button, white)

U. Fireman’s Unlock Control Button
1. Provide flush-mounted wall mount control buttons to provide override of electric locking systems.
2. Fireman’s unlock control buttons are provided only when required by Code or local AHJ. Verify function, button types and colors, locations, and mounting requirements with the Owner.
3. Control buttons must be visibly marked with the function wording “EMERGENCY UNLOCK” or wording required by Code. Provide special engraving, wording, and additional signage as required.
4. All fireman’s Unlock buttons must also activate an alarm event on the ACMS unless specifically approved by the owner.
5. “Break-Glass” types or “Stopper” covers for wall mounted buttons are preferred.
6. Acceptable Manufacturers
   a. SDC 491 Emergency Door Release with siren
   b. S4A EB-20 Access Control Emergency Door Opening Button Fire Switch
   c. RCI 904P Emergency Pull Station (requires additional signage)

V. Door Control Panel/Door Release Push Button
1. The Security contractor shall provide, install or reconnect door control panels and/or door release push buttons as require on designated desks or counters.
2. As design of the system may require single or multiple, momentary or latching systems, The Security Contractor must obtain approval from the Harris Health Security Representative of the solution to be utilized. Door release panels controlling multiple doors must be properly labeled.
3. The Door-release pushbutton use shall be designed to activate inputs in the ACMS to perform as follows:
   a. When a door release pushbutton is pressed, the ACMS shall unlock the door and shunt the door position switch for a user programmable time-period of one to sixty seconds.
   b. The ACMS shall unlock the door and shunt the door position switch no more than one second after the door release pushbutton is pressed. The door release pushbutton shall not affect the request to exit device operation for doors with free egress hardware.
   c. The door release pushbutton shall not cause an alarm on the system workstation.
4. Door release buttons must appear visibly different from any emergency activation switches including panic, duress, lockdown, or HVAC shutdown devices
5. Acceptable Manufacturers:
   a. Assa Abloy TS-18 (single, under counter)
   b. Securitron PB3N (single, wall)
   c. RCI 909S MO (single, wall or desk)
   d. Alarm Controls DTC series (multiple, desktop)

W. Emergency Door Release for ACMS controlled doors
1. Only when required by code, and with Owner’s approval, the Security contractor may add an emergency door release adjacent to and for access-controlled doors.

2. In addition to any direct unlocking requirements, the emergency door-release button used shall be designed to activate inputs in the ACMS to activate a notification event that describes the emergency unlock function.
3. Emergency Door Release switches shall also be covered with a clear “Stopper” cover of the type used for fire alarm pull stations. A local alarm is to be provided either by the lifting of the stopper cover or upon activation of the emergency door release button.
4. Acceptable Manufacturers:
   a. SDC 492/492WP
   b. SS2 481 EX EN

X. Gate Control Panel
   a. Provide a gate control panel capable of supporting at least six zones/gates. Verify type, location, and mounting requirements with the Owner. Include control cable to all perimeter parking gates and connect to gate controller provided by others.
   b. Verify with the General Contractor gates to be controlled by the lock control panel.
   c. Gate control panel functions should be “open”, “closed” and momentary.
   d. Acceptable Manufacturers
      1) Securitron
      2) Or approved equivalent

Y. Intrusion Sensors
   a. Glassbreak, motion, and/or combination detectors should be installed in locations to provide optimum intrusion protection. The security contractor is empowered to select the proper device or devices to protect the facility. Device selections are to be made on ensuring rapid early detection of human targets without triggering false alarms. Whenever possible, devices should be ceiling mounted and capable of providing 360º of coverage
   b. Intrusion sensor devices are to be installed in a point-to-point configuration: one device to one input. Zoning or series-connectivity of any intrusion sensor shall require the approval of the owner.
   c. The security contractor is empowered to select the proper device or devices to protect the facility. Coordinate device applications, locations, and requested additional devices with the Owner to provide protection as required.
   d. Dual Technology Curtain Motion Sensor
      1) Minimum Specifications
         a) Detection technology: Combination passive infrared/ microwave.
         b) Detection pattern: 35 feet X 30 feet.
         c) Alarm output: Normally closed contact.
         d) Power requirements: 12-24 VDC.
         e) Mounting: Surface wall mount.
         f) Acceptable Manufacturers
            (1) Bosch DS series
            (2) or approved equivalent
   e. Dual Technology 360-degree Motion Sensor
      1) Minimum Specifications
         a) Detection technology: Combination passive infrared/ microwave.
         b) Detection pattern: Three 360-degree fields.
         c) Alarm output: Normally closed and normally open contact.
         d) Power requirements: 12-24 VDC.
         e) Mounting: Ceiling or wall mount.
         f) Acceptable Manufacturers
            (1) Bosch DS series

(2) or approved equivalent

f. Glassbreak sensor, 360 degree

1) 1) Minimum Specifications

a) Detection technology: glassbreak.

b) Detection pattern: 360-degree fields with up to 25' radius from sensor to glass.

c) Power requirements: 9 to 16VDC

d) Acceptable Manufacturers

(1) Bosch DS series

(2) Or approved equivalent.

Z. Video Intercom Systems

1. Provide a color video intercom system(s) for communication between designated areas.
2. The intercom systems must support a master to door station distance of at least 400’.
3. Intercom master stations should be configured to communicate with their respective door and parking gate entry substation(s) stations.
4. The door entry substation must provide a viewing angle of 60" degrees vertically and 80" horizontally.
5. Intercoms associated with card reader-controlled doors shall use the ACMS to unlock the door. Direct connections to the REX devices should not be used.
6. When required, provide integrated intercom systems capable of multiple, interoperable, master and door stations.
7. Intercom subdoor stations shall be flush mounted, unless otherwise noted on the Drawings.
8. Intercom systems shall be microprocessor controlled and shall incorporate modular components. All circuitry and components shall be arranged on slide-in printed circuit boards using SMD-Technology. Each module shall have its own microprocessor and a fault in one module shall not affect the function of the whole system. The modules shall have diagnostic LED'S for maintenance and fault detection.
9. Acceptable Manufacturers
   a. Axis A8105 with flush mount)/Axis I8016-LVE-Exterior (IP, single or multiple station systems for locations with IP phones or control by PC workstation)- standard
   b. Aiphone JO Series (single door to master systems – analog alternate)
   c. Aiphone KB Series (single door to master systems – analog alternate when privacy handset required)
   d. Aiphone IX Series (IP, multiple station systems requiring master stations-approval required)
   e. Or approved equivalent

AA. Hands Free Telephone

1. The hands-free telephone shall be specifically designed for outdoor applications and shall include the following functions:
   a. A single button call switch.
   b. An LED to identify “call placed” and “call answered” conditions.
   c. Automatic dialing of a primary telephone number when the call button is pressed. The telephone shall automatically dial a secondary telephone number when the primary number is busy or unanswered.
   d. Non-volatile memory requiring no battery backup.
   e. Operating temperature range of –15 to 130 degrees Fahrenheit.
   f. Vandal resistant construction.
   g. Remote programmability.
   h. Adjustable microphone sensitivity to adjust for field conditions.
   i. Auxiliary Output(s) for remotely activation via receiver’s telephone keypad of a siren, light, CCTV camera, or door/gate unlock.
2. Provide auxiliary call button contacts or off-hook detector for each telephone and interface the contacts with the System to log call events in history and provide automatic camera call up when a call is placed from the telephone.

3. Interface the telephone with the Owner's telephone system.
4. The security contractor shall coordinate all power and conduit needs for emergency phones.
5. Acceptable Manufacturers
   a. IP Communications (video intercom) - standard
      1) Axis I8016-LVE
   b. Analog Communications
      1) Talkaphone Model ETP-401CV with auxiliary output(s).
      2) Or approved equivalent.

BB. Emergency Phones
1. Emergency Phones shall consist of outdoor-rated, vandal resistant and ADA-compliant hands-free speakerphones mounted in either a phone tower or wall mount. Emergency phones shall be VOIP units with an SIP camera integrated into the unit.
2. The Emergency Phone unit shall be totally hands-free on both sides after connection is initiated at site or by attendant.
3. Unless otherwise noted, emergency phones units shall include an SIP capable IP camera that includes a labeling of location. For approved analog phones, a voice location identifier prompt that transmits a recorded message as soon as call is answered. The location identifier message and duration shall be programmable from remote location.
4. Emergency phones shall typically be setup to call an owner-specified IP display phone. When specified, emergency phones shall be configured to be monitored and controlled by a provided base station software package. Configuration is to include calling location and site-specific instructions. The configuration is to also include setup for automatic tests of the phones and phone lines.
5. Analog Emergency Phones will be installed with a dedicated communication line and must be capable of operating on standard phone lines or analog PBX extensions
6. Mounts must also be outdoor-rated, constructed of stainless steel and available in brushed finish or painted blue with wording on the side(s). Coordinate color and wording requirements with the owner.
7. All mounts must have an integrated or adjacent blue light strobe (of at least 1.5 million candle power). When the Emergency Phone is not in use, the blue light shall remain lit and visible from a distance. When the button is pressed, the strobe shall flash brightly and continue to flash for the duration of the communication.
8. The security contractor shall coordinate all power and conduit needs for emergency phones. Power and data must be provided on separate conduit.
9. The security contractor shall provide a 24" x 24" concrete foundation where required. The security contractor may also coordinate with the general contractor for the installation of J-bolts in lieu of providing a foundation.
10. Acceptable Manufacturers
    a. IP Communications - standard
       1) Emergency Phone: CB 2-f with LS1000 with axis camera option
       2) Wall mount: Code Blue CB 2-e with LS1000 with axis camera option
       3) Tower Mount: Code Blue CB-1-s with LS1000 with axis camera option (preferred), Code Blue CB-RT with LS1000 with axis camera option (alternate)

    b. Analog communications-Requires approval
       1) Emergency Phone: Talk-A-Phone Model ETP-400
       2) Wall mount: Talk-A-Phone Model ETP-WM/E
       3) Tower Mount: Talk-A-Phone Model ETP-MT

CC. Off-hook Detector
1. Provide an off-hook detector, powered through the analog telephone line, for each analog hands-free and emergency telephone.
2. The off-hook detector shall activate an internal relay during a call/conversation and shall automatically reset when the telephone call terminates.

3. Connect and program the System and off-hook detector to provide for automatic camera call-up when the associated telephone is in use.
4. Locate off-hook detector within a lockable cabinet in the telephone cable termination closet. Coordinate location with the Owner and provide cable from the off-hook detector cabinet to the nearest SCP input module location.
5. Acceptable Manufacturers
   a. Viking Electronics LDB series.
   b. Or approved equivalent.

DD. Power Supplies
   a. Provide power supplies for all System equipment.
   b. Provide battery chargers for all power supplies with DC power outputs.
   c. Connect and configure the panel tamper switch to the SCP as an alarm event.
   d. Minimum Specifications
      1) Type: UL Listed Class II power limited.
      2) Input: 120 V AC plug in within locked cabinet.
      3) Power Output: Regulated and filtered DC. Output current rating of 150% of the actual connected load.
      4) Provide linear output power supplies for equipment as recommended by the device manufacturer.
      5) Alarm Outputs: Individual low battery and power fail.
      6) Battery Backup: 4 hours of rechargeable backup for the fully loaded DC power supply, regardless of the connected load.
      7) Battery Support: Battery charger to maintain battery.
      8) Battery: Sealed gel type
      9) Enclosure: Key lockable wall mounted steel housing with tamper switch. Enclosure shall be not less than 10” x 10” x 4” deep
      10) Enclosure Keying: Key all cabinets alike and on the same key as all security system power supplies and power distribution cabinets.
   e. Additional SCP Power Supply Requirements
      1) The SCP power supply shall be dedicated to SCPs and devices powered through connection to the SCPs (e.g., card readers, motion sensors, etc.). SCP power supplies shall not provide power for locks.
      2) Provide a minimum of 12 hours battery backup.
      3) Provide SCP power supply monitoring as follows:
         a) Monitor primary input voltage such that the System shall annunciate primary voltage failures.
         b) Monitor secondary (low voltage) output voltage such that the System shall annunciate secondary voltage failures.
         c) Monitor batteries such that the System shall annunciate low battery voltage conditions.
   f. Additional Electric Locking Mechanism Power Supply Requirements
      1) Provide power supplies for all electric locking mechanisms.
      2) Fail secure electric locking mechanisms shall continue to operate normally upon loss of building power.
      3) Fail safe locking devices shall unlock automatically under the following conditions:
         a) Building fire alarm.
         b) Failure of the power supply.
         c) Loss of power to the SCP.
      4) Provide power distribution boards with independently fused outputs and relays. Power distribution boards for fail safe locks shall include a fire override relay.

Interface the relay with the fire alarm system such that a dry contact from the fire alarm system shall remove power to fail safe devices during a fire alarm.

5) Power supply power fails, fire alarm relay activations, and low battery alarms must be wired in as inputs and configured as individual alarm events in the ACMS system.

g. Additional Device Power Supply Requirements
   1) Provide device power supplies for all other devices requiring power (e.g., card readers, motion sensors, etc.)
   2) Provide power distribution boards with independently fused outputs.
   3) Power supplies for devices monitored by remote alarm input modules may be collocated with the alarm input module

h. Acceptable Manufacturers
   1) PSX Power Solutions (Dual voltage for SCP and door lock power preferred)
   2) Alarm-Saf PS12408 Series
   3) Altronix/AL600 Series
   4) Power-One/SPL Series
   5) Or approved equivalent

EE. Interfaces
1. Digital Video recording unit(s)
   a. ACMS alarms are to be interfaced through an existing CCure 9000 ACMS with the provided digital video recording solution to provide the following:
      1) Linking associated video cameras to System alarms and events.
      2) Playback of recorded video associated with System events on System workstations.
      3) Call up of live camera video on the System workstations through the workstation Graphics.
      4) Monitoring video loss and video motion detection alarms through the System workstations.
2. Fire Alarm System
   a. Interface with the fire alarm systems at each facility to provide for release of fail-safe electric locking mechanisms as required by local life safety codes.
   b. Provide secondary monitoring of fire alarm system alarm conditions for each facility through the System.
   c. The General Contractor will provide fire alarm system interfaces at the SCP locations. Coordinate with the General Contractor as necessary to provide fire alarm interfaces.
3. Cable provided by others
   a. The Security contractor must confirm that horizontal Cat6A data cable for LAN or WAN devices will be provided by others.
   b. The Security contractor must confirm that Telecom (voice) cable for hands-free and/or emergency telephone devices will be provided by others.
   c. All conduit is to be provided by the Security Contractor and other General contractor. Coordinate all cabling and conduit requirements with the General Contractor.
   d. The Security contractor shall coordinate specific cable requirements for cable provided by others with the Owner.
   e. The Security Contractor shall provide all patch cables, connectors, and all other equipment necessary to connect to the owner-provided cable.
      Approved Product: Systimax Cat6A, yellow jacket, 36” standard length (do not substitute).

4. Owner-Provided Data and Voice Communication Networks
   a. Interface Security System equipment to the local area and wide area networks provided by the Owner.
   b. Interface hands-free telephones and off-hook detectors to telephone circuits provided by the Owner.
   c. Coordinate network port locations, quantities, IP addresses, network settings, and other information as necessary with the Owner.
   d. Provide patch cables and all other hardware and software necessary to connect Security System equipment to the Owner's networks.

5. Power
   a. Interface to 120 VAC power provided by the General Contractor.
   b. Coordinate circuit locations, sources, quantities, loads, receptacle, and other requirements with the General Contractor.
   c. Provide connections, conduit, and additional hardware necessary to connect Security System Equipment to the 120 VAC power.

2.04 PARKING GATE CONTROLS

A. Unless otherwise specified, parking gate card readers, phones, and intercoms will be provided by the Security contractor.

B. Unless otherwise specified, parking gate controls will be provided by others under SECTION 11210 – PARKING CONTROL EQUIPMENT

C. Controlled parking entrances will consist of a SCS card access-controlled gate entry and free egress parking gate exit. A hand free telephone with remote release option is also to be provided at the entry parking gate adjacent to the card reader.

D. Controlled parking gate controls shall include, but shall not be limited to the following:
   1. Two (2) Barrier Gates, white, with aluminum barrier booms – Magnetic Parking Pro Series, MHTM Microdrive or equivalent;
   2. Four (4) Loop Detectors-Cut, Wrap and seal Protector, Safety and Exit;
   3. One (1) Card Reader Pedestal with box and sun shield for reader and intercom mounting - Falcon S1R1235 metal stanchion with Falcon MCH5375-1CR MaxiProx acrylic spacer kit or equivalent;
   4. Steel Pipe Bollard/Protection, minimum two (2);
   5. One (1) long range proximity card reader;
   6. One (1) hands free telephone
   7. The general contractor is to provide power and conduit to the parking gate locations. The security contractor is to provide all cabling and any necessary conduit to complete the installation.
   8. The gate arm shall have a fail-to-open option. This selectable option shall provide an automatic open of gate arm when power is lost. A 15 second delay selection for this option is preferred.
   9. The gate arm shall have a down strike safety feature. This feature provides that should any object be struck by the gate arm during its descent, the arm shall immediately reverse and return to the UP position without damage, and remain up from 2 to 60 seconds, until automatically reset by variable control. The sensory function shall be initiated by sensing the internal mechanical action. The external mounting of tubes, wiring, and electrical devices on the gate arm shall not be acceptable
   10. Power Supplies, additional cabling, and all parts necessary to complete the work.
   11. Complete Installation and Programming of all equipment.

2.05 PERIMETER GATE CONTROLS

A. Controlled perimeter entrances will consist of an SCS card access-controlled gate entry and others controlled via a gate control panel in the security office. The SCS card access-controlled entry to include a hand free telephone with remote release option.

B. The card access-controlled perimeter gate shall include, but shall not be limited to the following:
   1. Connect to gate control.
   2. Four (4) Loop Detectors-Cut, Wrap and seal Protector, Safety and Exit;
   3. One (1) Card Reader Pedestal with box and sun shield for reader and intercom mounting - Falcon S1R1235 metal stanchion with Falcon MCH5375-1CR MaxiProx acrylic spacer kit or equivalent;
   4. Steel Pipe Bollard/Protection, minimum two (2);
   5. One (1) long range proximity card reader
   6. One (1) hands free telephone
   7. The general contractor is to provide power and conduit to the perimeter gate locations. The security contractor is to provide all cabling and any necessary conduit to complete the installation.
   8. Power Supplies, additional cabling, and all parts necessary to complete the work.
   9. Complete Installation and Programming of all equipment.

C. Controlled perimeter gates shall include, but shall not be limited to the following:
   1. Connection from security gate control panel to gate control.
   2. The general contractor is to provide power and conduit to the perimeter gate locations. The security contractor is to provide all cabling and any necessary conduit to complete the installation.
   3. Power Supplies, additional cabling, and all parts necessary to complete the work.
   4. Complete Installation and Programming of all equipment.

2.06 CCTV SYSTEM OPERATION REQUIRMENTS (CCTV)

A. The CCTV camera system shall consist of an independent video network of digital IP addressable color CCTV cameras, camera lenses, camera housings, and an on-site network video recording system (NVRS), All NVRS systems are to be connected and controlled by the owners existing American Dynamics Victor Video Management System (VMS). In addition, NVRS systems must have the ability to interface with and be directly monitored and controlled by the owner's separate Software House CCure ACMS.

B. The design of the CCTV System shall be that all CCTV devices can be controlled from one or more Microsoft Windows-based workstations (provided by Owner) using VMS software and by the Owner's ACMS via CCure software interface. Control and access into the CCTV system through the owners LAN shall be accomplished through the digital video recorders via dual NIC cards.

C. Exterior and parking structure cameras are to include advanced analytics to include object detection and perimeter protection. If provided exterior and parking structure cameras do not include compatible edge analytics, Videoedge NVR analytics licenses are to be provided for these cameras

D. The configurations listed are minimum guidelines and the responsive bidder will be required to specify digital recording hardware that meets or exceeds these requirements. The responsive bidder must also verify that their respective CCTV management software will operate on a server with these specifications. If the camera system requires digital recorders with more performance, storage or throughput, it is the bidder's responsibility to provide adequate hardware to support their system.

E. The Security Contractor with the owner shall field verify to ensure high quality, glare-free, desired field of view of each camera, and clear pictures at the video monitors.

F. The Security Contractor will provide all network POE patch cables, connectors, power supplies, and materials as required. An approved patch cable must be provided with each IP camera utilized.
G. All IP CCTV cameras shall include an option to activate video transmission based on detection of motion, tampering, or other activity.

2.07 CCTV SYSTEM HARDWARE REQUIRMENTS

A. CCTV Cameras, standard applications
1. Interior IP (Megapixel) CCTV Cameras shall be the mini-dome type and meet the following technical requirements:
a. 2.0 Megapixel CCD sensor and lens with remote zoom and focus
b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal range if not otherwise specified).
c. Automatic Day/Night IR function and iris control
d. Full motion progressive scan recording in full 1280x1024.
e. Integrated Power over Ethernet
f. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
g. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
h. Preferred Product: Axis P3265-LV,
2. Exterior building-perimeter IP CCTV Cameras shall be the mini-dome type and meet the following technical requirements:
a. 2.0 Megapixel CCD sensor and lens with remote zoom and focus
b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal if not otherwise specified).
c. Automatic Day/Night IR function and iris control
d. Full motion progressive scan recording in full 1280x1024.
e. Integrated Power over Ethernet
f. Exterior, minimum IP66 rating.
g. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
h. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
i. Preferred Product: Axis P3265-LVE
3. Parking Garage IP CCTV Cameras may be a standard or mini-dome type and meet the following technical requirements:
a. 2.0 Megapixel CCD sensor and lens with remote zoom and focus.
b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal if not otherwise specified).
c. Automatic Day/Night IR function and iris control
d. Full motion progressive scan recording in full 1280x1024.
e. Integrated Power over Ethernet
f. Exterior, minimum IP66 rating.
g. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
h. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
i. Preferred Product: Axis P3265-LVE
j. Alternate Product (license plate/entry): Axis Q1785-LE
4. Exterior Parking Surveillance IP CCTV Cameras shall consist of parapet domes or pendent wall mounts to monitor parking areas. A single exterior IP varifocal camera dome shall cover at least a 90° FOV and meet the following technical requirements:
a. 5.0 Megapixel CCD sensor and lens with remote zoom and focus

b. Megapixel lens shall be variable focal meets field of view specifications provided by the owner (minimum 40º-90º Horizontal range if not otherwise specified).
c. Automatic Day/Night IR function and iris control
d. Full motion progressive scan recording in full 1280x1024.
e. Integrated Power over Ethernet
f. Exterior, minimum IP66 rating.
g. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
h. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
i. Preferred Product: : Axis P3267-LVE

5. Exterior Parking Multidirectional Surveillance IP CCTV Cameras shall consist of a parapet dome or mount that combine multiple cameras on a single mounting. A single exterior IP camera dome shall cover a selected range from 180°to 360° FOV and meet the following technical requirements:
   a. (4) 3.7 Megapixel CCD sensor and lens with remote zoom and focus
   b. Automatic Day/Night IR function and iris control
   c. Full motion progressive scan recording in full 1280x1024.
   d. Integrated Power over Ethernet
   e. Exterior, minimum IP66 rating.
   f. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication
   g. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
   h. Preferred Product: : Axis P3719-PLE
   i. Alternate Product (PTZ/360) Axis Q6100-E with AXIS Q6010-E
6. Camera Mounting Hardware
   a. All cameras specified should include housing enclosures as required by the application and manufacture.
   b. Interior enclosures shall be provided when needed and shall meet the specifications of the camera manufacturer. All CCTV cameras shall include proper mounting hardware for both suspended ceiling and/or wall mount applications
   c. Exterior enclosures shall meet the specifications of the camera manufacturer and shall include proper mounting hardware for parapet or wall mount applications. Roof edge mounts higher than 20’ above grade that do not allow the camera to be retracted for servicing are generally not acceptable and require specific approval. Roof edge “flipover” mounts are preferred.
   d. Provide approved patch cable to connect IP camera to owner's networks.
   e. Approved Product: Systimax Cat6A, yellow jacket, 36" standard length (DO NOT SUBSTITUTE).

B. Special application IP CCTV Cameras
   1. Identification view interior IP CCTV Cameras
      a. Identification view interior IP CCTV Cameras shall meet the Interior IP camera specification but may be mounted in a discreet-type wall or ceiling camera housing with a lens selection to facilitate the desired identification view. Identification view cameras should be mounted at a height or distance so that the camera angle is not greater than 30 degrees to the subject.
   2. Interior/non parking application IP Multi-view CCTV Cameras
      a. Quad-head and fisheye multi-view cameras are generally **not** acceptable and require special approval.
      b. Interior IP Multi-view CCTV Cameras shall meet interior IP camera specifications but include independently adjustable varifocal cameras. Exterior IP Multi-view CCTV Cameras not used for parking surveillance shall meet exterior building-perimeter IP camera specifications.
      c. Preferred Product: Axis P4705-PLVE

3. Thermal cameras
    a. When requested, thermal cameras are to be mounted using exterior camera standards. Preferred Product: AXIS Q1942-E Thermal Network Camera
4. Patient monitoring interior IP CCTV Cameras
    a. IR-Illuminated 1.3 Megapixel CCD sensor and lens
    b. Megapixel lens shall be variable focal meets field of view specifications required for the application.
    c. Automatic Day/Night IR function and iris control. Full motion progressive scan recording in full 1280x1024
    d. Integrated Power over Ethernet
    e. Network security using multiple user access levels, IP address filtering, HTTPS encryption, and IEEE 802.1x authentication. Video can be compressed using MPEG-4 or better standard and streamed over the IP network.
    f. Preferred Product: AXIS M1075
5. Patient monitoring interior IP CCTV Cameras for psychiatric and seclusion areas shall meet the interior IP camera specification but must be mounted in an anti-ligature type high security dome or wedge ceiling camera housing with a lens selection to facilitate the desired identification view.
    a. Preferred Product: Axis Q9216-SLV
6. Elevator interior IP CCTV Cameras shall meet the interior IP camera specification but must be mounted in a vandal resistance mounting capable of viewing the entire elevator cab.
    a. Preferred Product: Axis P9106-V
7. License Plate Recognition (LPR) IP CCTV Cameras shall be specifically approved for LPR recognition. LPR cameras are to be used with the DPS Victor Video Management system in addition to any required parking control equipment. VMS analytic LRC licenses are to be included.
    a. Preferred Product: Axis Q1785-LE, (Up to 20ft)
    b. Alternate: Illustra Flex 3MP Bullet, 2.8mm (Up to 13ft), 12mm (13 to 42ft)
8. Camera Mounting Hardware
    a. Interior enclosures shall be provided when needed and shall meet the specifications of the camera manufacturer. All CCTV cameras shall include proper mounting hardware for both suspended ceiling and/or wall mount applications
    b. Exterior enclosures shall be provided and shall meet the specifications of the camera manufacturer and shall include proper mounting hardware for parapet or wall mount applications

C. Rack mounted Keyboard, Mouse, Monitor
    1. Provide a rack mounted LCD monitor, keyboards, mouse in rack mounted KVM configuration capable of supporting the provided equipment and at least two (2) additional NVR units. All necessary connecting cables are to be included to properly install and connect all NVR's located at the respective location.

D. Rack mounted UPS
    1. Include a rack mounted UPS (universal power supply). The UPS is to be 200VA or greater and should be specified to protect up the utilized NVRS against power fluctuations or outages of up to 30* minutes. In case of power failure, the NVRS shall be configured to recover fully from a power loss; system settings will recover to the user-defined settings without the aid of an operator. *Note: NVRS on generator power only require protection for outages of up to five (5) minutes.
    2. Preferred Product: APC Smart-UPS series

E. Network Video recording System(s) (NVRS)
    1. The Security Contractor shall provide Network Video Recorders meeting or exceeding the minimum specifications of this document.

2. The NVRS shall be a turn-key, software-based open platform solution that functions as an appliance server. It shall be provided as a bundled server solution with all required hardware and software provided.
3. The NVRS bundled server solution must be suitable for rack mount installations within a standard 19-inch IT server rack.
4. The NVRS bundled server solution must include an Intel Quad-Core CPU, dual Gigabit NICs, and internal hard drive storage. Fibre RAID expansion storage units are to be included as required for defined storage needs.
5. Each server comprising the NVRS system shall be specified to provide performance that meets or exceeds all requirements noted in this section with CPU performance exceeding that required for 30 cameras of the type specified for the project utilizing H.264 recording. The system should be designed so that no more than 40 cameras are recorded on any single bundled server solution
6. The NVRS expansion storage should allow for the recording of video for periods of up to at least 31 days. Storage based on the recording of the project's specified cameras at rated resolutions using the following:
   a. Use 40% motion at 8 FPS for Clinic and office occupancy applications
   b. Use 80% motion at 8 FPS for hospital/pavilion applications
   c. All storage calculations are to be based on H.264 recording. The owner will confirm recording codecs to be setup for actual use.
7. The NVRS unit(s) shall be provided with recording licenses to support the project's specified camera count plus a 10% allowance. Total, licensed, recorded channels provided should exceed system design requirement by 10%. The system should be designed so that no more than 64 cameras are recorded on any single bundled server solution.
8. The unit shall combine multiplexing, sensor/motion detection, video, and audio. The unit must operate in server-client architecture as a network appliance and simultaneously support viewing, recording, and playback of video.
9. The Network Video Recorder shall be TCP/IP and HTTP compliant, enabling administrators to provide better corporate deployment, and provide a standard format for server management.
10. The Security Contractor shall provide all configuration set-ups, and programming, as necessary to connect cameras and program the NVRS to record images based on Motion recording determined by selecting grids such that movement in the selected grids will trigger the NVRS to create a video file. The motion grid shall include a sensitivity adjustment scale to allow the user to dial down the sensitivity to eliminate false triggers from factors such as light changes, tree branch movement due to winds, animal's etc. This sensitivity adjustment shall be definable by camera.
11. The digital video recording unit(s) shall perform all viewing, playback, and video storage functions simultaneously. Video shall be displayed on a standard PC monitor, and configuration shall be performed with a standard mouse and keyboard. The digital video recording unit(s) shall be configured using an interface application and shall record video continuously, only during alarm events, or only while activity is present. Each camera shall be able to record in different modes and on different schedules or using the same schedule and configuration.
12. Local and remote interfaces shall allow easy search and retrieval of video. User defined parameters shall allow searches based on the time and date the video was captured; whether alarm, motion, or scene loss events occurred; and which camera captured the video. The interfaces shall also permit full video storage management, hardware control, alarm configuration, and export of video and individual frames.
13. The Network Video Recorder software shall be designed to provide both redundancy and high availability as standard built-in features. The Network Video Recorder software shall include configuration support for up to two levels of automatic storage fail-over. In the event that the designated primary storage encounters a problem, the system shall automatically switch to a designated level one storage device to provide continuous recording. In the event that a problem occurs with level one storage device, the system shall automatically switch to an

alternative designated level two storage device. Storage fail-over drives are to be included and must be setup on the Network Video Recorder.

14. The Network Video Recorder software must include driver support for IP fixed cameras, IP pan-tilt-zoom cameras, IP MegaPixel cameras, and analog cameras using IP encoders that are from a variety of manufacturers. It is expected that the NVRS support all cameras utilized with MJPEG, MPEG4, and H.264 recording options.
15. Remote connections are available over standard network connections.
16. The digital video recording unit(s) shall be on a rack-mount chassis.
17. Dual network interface connectivity and functionality is required and is to be provided.
18. Preferred Products:
    a. American Dynamics VideoEdge NVR bundled server
    b. American Dynamics Victor software

F. Network Video Recorder – alternate (NVR)
1. When approved by the Owner, provide American Dynamics Exacq A-series IP network video recorder configured to support all applicable NVRS specifications
2. When other departmental access to the alternate NVR is required, the web browser GUI is to be setup with a unique login and password for access.
3. Approved Product: American Dynamics American Dynamics Exacq A-series with +8 EVIP licenses.

G. Video Analytics
1. All NVR devices shall include motion detection analytics.
2. When required by the owner, the following analytic licenses are to be provided and configured
    a. Video intelligence
        1) Crowd Formation
        2) Direction
        3) Dwell
        4) Enter
        5) Exit
        6) Linger/Loiter
        7) Perimeter
        8) Object Abandoned/Removed
        9) Object Detection
        10) Queue Analysis
    b. Color Filtering
    c. Heat Mapping
    d. Point of Sale (POS)
    e. License Plate Recognition
    f. Facial Biometrics
3. Unless approved by the owner, all analytics are to be provided for and controlled by the American Dynamics VideoEdge NVR's.

H. Advanced Camera/Video Analytics
1. Confirm with owner regarding any specialized camera analytics needed for camera systems, Specific cameras, camera accessories, NVRs, and/or added VMS may be needed. If not supported by Videoedge/Victor, it is expected that any approved standalone video analytics systems interface directly with the owners CCure ACMS to provide video alarm functionality.
2. The following analytic systems are to be provided and configured upon request
    a. Sound intelligence. Requires Axis cameras and microphone support
    b. Object Detection, persons and/or vehicles. Requires specialty Illustra cameras for use with Videoedge

I. Management Software and Interface
1. It is intended that the DVRS manufacturer's video client software be utilized. A single client software system for access to all DVRS' is required. This software must include "policy manager/site manager" features for user and userid management, connection and bandwidth

monitoring and control status, and bandwidth management to support all DVRU's from a single location. .

2. Client Software is to be setup on all designated security monitoring workstations to provide "virtual matrix" functionality required by the site at which the video is being monitored.
3. Client software shall monitor video loss, device health, and, when designated, video motion detection alarms.
4. In addition, all Digital Video recording unit(s) must be interfaced with the Owner's ACMS for CCure 9000. The interface must be configured to provide at least the following:
   a. Linking associated video cameras to System alarms, events, and maps.
   b. Playback of recorded video associated with designated system events through the ACMS client software workstations.
   c. Call up of live camera video on the ACMS client software workstations through the workstation Graphics either manually or automatically during alarm or programmed video alarm events.
5. The Security Contractor shall be responsible for verifying software currently in use by the owner and, when required, for providing, installing, and configuring the latest software version for all systems required to provide full interface functionality.
6. Preferred Products:
   a. American Dynamics Victor software (do no substitute)

J. Other software
   1. The Security Contractor shall install and configure the IP camera monitoring software on workstations as directed by the owner.

K. Owner-Provided Data Networks
   1. Interface the CCTV System equipment to the independent, local area, and wide area networks provided by the Owner.
   2. Coordinate network port locations, quantities, IP addresses, network settings, and other information as necessary with the Owner.
   3. Provide patch cables and all other hardware and software necessary to connect Security System equipment to the Owner's networks.
      Approved Product: Systimax Cat6A, yellow jacket, 36" standard length (DO NOT SUBSTITUTE).

2.08 CONSOLE AND EQUIPMENT RACKS

A. Functional Requirements
   1. Two-post Ladder racks in IDF rooms will be provided by the Owner
   2. If required, provide Harris Health IT-specified four-post racks or cabinets to accommodate equipment.
   3. Provide all other consoles, rack shelving, cabinets, turrets, writing surfaces, panels and equipment as required to accommodate equipment. If owner provided racks are to be utilized, mounts and shelving must allow for centered mounting.
   4. All racks, rack shelving, and cabinets to be mounted in MDF or IDF rooms must be approved by the Harris Health Information Technology Department.

B. Acceptable Manufacturers
   1. Winsted Prestige Series (basis of design).
   2. Emcor Flat Panel 2 (FP2) Series.
   3. Or approved equivalent.

2.09 WIRE AND CABLE

A. All cabling must be installed in accordance with Harris Health Division 27 standards. Exceptions must be approved by Harris Health IT Department. All cabling is to be rated for environment it is to be installed within (i.e., plenum, riser, outdoor, indoor, indoor/outdoor)

B. All cabling needed for security equipment is to be provided by the Security Contractor. Security cabling includes, but is not limited to the following:
   1. Wire and cable infrastructure between SCP location and reader-controlled doors. Cable distance will not exceed 400 feet.
   2. Wire and cable infrastructure between SCP or Alarm Input Module locations and door position switch, duress button, intrusion, and other security device locations.
   3. All patch cables, connectors, and all other equipment as required for security devices.

C. All cabling between card readers and security control panels shall support OSDP (Open Supervised Device Protocol) compliant communications.

D. The Security Contractor should coordinate any other specific cabling needs with the General Contractor. This includes specific cable requirements for POE Cameras, data cable for LAN or WAN devices, and telecom cable for hands-free and/or emergency telephone devices. Cabling needs not identified to the General Contractor at the bid phase of the project will become the responsibility of the Security Contractor.

E. Any conduit needed for security equipment is to be identified to the General Contractor by the Security Contractor. Conduit needs not identified at the bid phase of the project will become the responsibility of the Security Contractor.

F. All exterior and/or parking garage cabling will be contained in conduit. Data and power cabling shall not share a conduit. Cabling used in underground conduit shall be burial grade. The security contractor will provide all conduit needed for security equipment for both cabling provided by the owner and the security contractor.

G. Wire and cable infrastructure between the IDF/SCP location and Emergency Telephones and Hands-free telephones will include.
   1. One Cat6A Cable.
   2. Cables will be coiled at the location of the device.

H. Wire and cable infrastructure to CCTV cameras locations will include.
   1. One POE Cat6A Cable.
   2. Cables will be coiled at the location of the device.

I. The Security Contractor shall provide all other wire and cable infrastructure necessary for SCS and CCTV devices.

J. The Security Contractor shall provide cables, patch cables, connectors, terminal strips, and all other hardware necessary to connect to cables, networks, and other infrastructure.

K. Minimum Requirements
   1. Wire and cable shall be Underwriter’s Laboratories (UL) approved for its intended application, shall meet all national, state and local code requirements for its application, and shall meet or exceed manufacturers' recommendations for the components connected.
   2. Provide yellow jackets for all cables.
   3. Provide plenum-rated cable as required by code.
   4. Wire and cable shall meet individual system or subsystem manufacturer specifications.
   5. Insulated wire and cable shall conform to the minimum requirements of Insulated Cable Engineers Association (ICEA) Standards.
   6. Wire and cable shall comply with the applicable requirements of the National Electrical Code (NEC), latest edition, in regards to cable construction and usage.

7. Copper wire conductors shall provide conductivity in accordance with the standardization rules of the Institute of Electrical and Electronics Engineers, Inc. (IEEE). The conductor and each strand shall be round and free of kinks and defects.
8. Provide shielded cables carrying where necessary for interference-free signals.
9. Insulation shall be rated for a minimum of 300 V.
10. Color coding shall be accomplished by using solidly colored insulation. Grounding conductors, where insulated, shall be colored solid green or identified with green color as required by the National Electric Code (NEC).
11. Patch Cables
    a. Provide pre-manufactured patch cables (cable, connectors, boots, etc.) as required to connect System equipment to the cable infrastructure.
    b. Patch cables shall be certified for their specific use to meet or exceed applicable industry specifications (e.g., EIA/TIA, ETL, UL, CSA, etc.).
    c. Provide cable lengths as necessary to neatly route cables through cable management systems and other cable organization systems.
    d. Provide connectors as required for proper termination. Provide boots for connectors where applicable to prevent snagging.
    e. Provide yellow jackets for all patch cables.
    Approved Product: Systimax Cat6A, yellow jacket, 36” standard length (DO NOT SUBSTITUTE).

L. Minimum Wire Types and Sizes
1. Low Voltage Power Cable
    a. One pair, 18 AWG minimum, twisted, stranded, insulated, and jacketed.
    b. Increase conductor gauge to be consistent with circuit current ratings and manufacturer's recommendations.
    c. Yellow cable jacket
2. Composite Cable for Card Reader Doors
    a. OSDP Compliant FRPVC Bare copper conductor 4-component composite cable; each component is shielded and jacketed. Diameters and weights may vary among manufacturers.
    Shielded
        1) Component 1: 18-4 C Lock Power
        2) Component 2: 22-2C Door Contact
        3) Component 3: 22-4C Rex Spare
        4) Component 4: 22-3P Card Reader
    b. Yellow cable jacket
3. Card Reader Cable
    a. OSDP Compliant 6-conductor, 22 AWG, stranded, individually shielded twisted pairs, insulated and jacketed.
    b. Yellow cable jacket
4. RS485 Cable
    a. OSDP Compliant 2 pair, 22 AWG, stranded, individually shielded twisted pairs, insulated and jacketed.
    b. Yellow cable jacket
5. Alarm Point Monitoring Cable
    a. 2-conductor, 22 AWG, stranded, shielded, insulated and jacketed.
    b. Yellow cable jacket
6. Control Point Cable (Non-Power)
    a. One pair, 22 AWG, twisted, stranded, insulated and jacketed
    b. Yellow cable jacket

7. Control Point Cable (Low Voltage Power)
    a. One pair, 18 AWG, twisted stranded, insulated, and jacketed.
    b. Yellow cable jacket
8. Local Area Network (LAN) Cable
    a. Category 6A (four pair).
    b. Yellow cable jacket
9. Acceptable Manufacturers
    a. Belden.
    b. Southwest Wire.
    c. West Penn Wire.
    d. Or approved equivalent.
10. Cat 6A Data Cable
    a. Refer to Harris Health Division 27 IT Cabling specifications.
11. Telecom Cable
    a. Refer to Harris Health Division 27 IT Cabling specifications.

2.10 LIGHTNING AND SURGE PROTECTION

A. With the exception of fiber optic cables, all cables and conductors that act as control, communication, or signal lines shall include surge protection.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate with the General Contractor and Architect to ensure that adequate conduit is provided and that equipment back-boxes are adequate for system installation.
B. Coordinate with the General Contractor and Architect to ensure that adequate power has been provided and properly located for the security system equipment.
C. Coordinate with the General Contractor and Architect to ensure that doors and doorframes are properly prepared for electric locking hardware and door position switches.
D. Coordinate and verify the location of each piece of rack-mounted equipment with the General Contractor and Owner.
E. Coordinate and verify the availability of existing SCP and NVR infrastructure and licensing with the General Contractor and Owner.
F. Coordinate and verify the mounting location and desired field of view for each CCTV camera with the General Contractor and Owner.
G. Coordinate finishes and colors of all equipment with the General Contractor and Owner.
H. Coordinate custom ACMS and NVRS programming and report requirements with the Owner to include:
    1. Naming convention for System programming and labeling.
    2. System programming information.
    3. Custom report requirements. Submit report templates to the Owner for review and acceptance.
    4. Initial database partitioning and setup prior to initial programming and cardholder data entry.
I. It is the responsibility of security contractor to generate an exceptions list prior to bidding or installation that itemizes exceptions taken with door hardware schedules, components or designs being used which may hamper their ability to provide a secure and compliant access control product.

J. A final pre-installation review may be required to include a final device location walkthrough with the general contractor, DPS representative, and project manager prior to acceptance of any access control or CCTV work.

3.02 INSTALLATION

A. General
1. Coordinate equipment installation requirements prior to installation.
2. Make equipment connections in accordance with the approved submittal drawings and manufacturer specifications.
3. Verify acceptance of each type of specified request-to-exit hardware for each application with local life safety code officials. Verify fail-safe and fail-secure lock requirements with the General Contractor and Architect
4. Provide tamper proof fasteners for all equipment in public areas. Fastener finish shall match equipment finish.
5. Seal exterior devices to protect against weather conditions including heat, cold, moisture, dust, and sand.

B. Site Observation
1. Continuously verify that the site conditions are in agreement with the Contract Documents. Submit a report to the Owner documenting changes to the site or conditions that affect the performance of the System. For those changes or conditions, which affect system installation or performance, provide (with the report) specification sheets, or written functional requirements to support the findings, and a cost estimate to correct the deficiency. No deficiency shall be corrected without written permission from the Owner.
2. Specific mounting locations, exact wire and cable runs, and conduit routing have not been specified or delineated on the Security Device Drawings. Coordinate all aspects of the Work with the General Contractor and Owner.
3. The Owner will conduct random site observation visits during the project and prepare reports noting observations. Correct deficiencies noted on the site visit reports. All work shall comply with the Contract Documents, applicable codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.

C. Equipment
1. Provide equipment as specified herein. Additional specific installation requirements are as follows:
    a. SCP Locations
        1) Wire each power supply power fail and low battery alarm contact as an individual alarm input to the System.
    b. Card Readers
        1) Wire and program card reader LEDs to indicate conditions and functions as follows:
            a) Red LED in the normal, locked state.
            b) Green LED upon a valid card read and when the door is in the access (unlocked) condition.
            c) Flashing red LED upon invalid card read, forced door, and held open alarm conditions.
            d) Card reader LED indicators shall operate identically throughout all facilities.
2. Field-verify specific equipment locations to provide the best fit and function. Verify locations with the Owner or its representatives as necessary.
3. Install equipment in accordance with manufacturer specifications.
4. Install equipment to allow adequate clearance for testing and maintenance.
5. Locate end of line devices within the device housing.

6. Provide tamper resistant screws and fasteners for equipment and pull boxes located in accessible and/or public areas.
7. Remove dirt, packaging, wiring scraps, and other debris from equipment, boxes, and cabinets at the end of each work day.
8. Wherever possible, remove contractor and manufacturer equipment logos from security field devices.

D. System Programming and Data Entry

1. Provide all initial system programming and setup of the ACMS including, but not limited to the following:
   a. ACMS Card Reader Information: Coordinate all card reader values and text, including descriptors, alarm messages, CCTV Camera call up, map call up and identification with the Owner.
   b. Input and Output Points: Coordinate all input and output priorities and text, including descriptors, alarm messages, CCTV Camera call up, and map call up and identification with the Owner.
   c. Initial System Users and Levels of Access: This shall include the designation of an Owner's representative at the "Super User" level immediately upon ACMS initialization.
   d. Initial CCTV Camera call-up and alarm information for interface with the DVRs/NVRs.
   e. Initial CCTV Camera call-up and alarm information for interface with intercom, hands-free phone, or emergency phone Systems.
   f. Alarm monitoring and automatic shutdown information for the UPS interface.
2. Provide all initial system programming and setup of the DVRs/NVRS including, but not limited to the following:
   a. On-screen alphanumeric identification of each CCTV Camera, on each Monitor and DVRs/NVRS workstation. Coordinate descriptors with the Owner prior to programming.
   b. Setup DVRs/NVRS for interface with ACMS events, such as a "door held open or door forced alarm" generated on the ACMS Monitoring Station so that an operator can double-click on the camera icon next to the event, and a camera window will open.
   c. Program all exterior PTZ cameras (if utilized) to perform automatic continuous tours.
   d. Provide automatic selection of a CCTV Camera adjacent to a Card Reader upon an invalid card use. Coordinate automatic camera selection requirements with the Owner prior to system programming.
3. Provide all initial system programming and setup of the intercom, hands-free phone, and/or emergency phone Systems including, but not limited to the following:
   a. Initial setup for the interface with the ACMS.
   b. Alphanumeric identification of each Substation and Security Assistance Station, on each Master Station. Coordinate descriptors with the Owner prior to programming.
   c. Automatic selection of CCTV Cameras adjacent to Substations or Security
   d. Assistance Stations as applicable upon call in. Coordinate automatic CCTV Camera selection requirements with the Owner prior to programming.
4. Enter all data needed to make the System operational. Deliver the data to the Owner on data entry forms, utilizing data from the Contract Documents, Contractor's field surveys and all other pertinent information in the Security Contractor's possession required for complete installation of the database. Identify and request from the Owner any additional data needed to make the Security System fully operational and integrated. The completed forms shall be delivered to the Owner for review and approval prior to the Security Contractor's scheduled need date as noted as a milestone in the Security Contractor’s schedule.

3.03 WIRING TECHNIQUES

A. Provide all wire and cable not provided by the Owner or others and as necessary to make the System operational.

B. Provide code compliant fire proofing techniques for all penetrations of fire rated partitions and slabs, where the penetrations are made by or used for installation of the System.
C. Coordinate the routing of wire and cable requiring isolation from power, radio frequency (RF), electromagnetic interference (EMI), telephone, etc. with the Owner.
D. Run all wire and cable continuous from device location to the final point of termination. No mid-run cable splices shall be allowed.
E. Wire and cable within SCPs, power distribution cabinets and other security enclosures shall be neatly installed, completely terminated, pulled tight with slack removed and routed in such a way as to allow direct, unimpeded access to the equipment within the enclosure. All wire and cable shall be bundled and tied. Ties shall be similar to T&B TyRap cable ties.
F. Visually inspect all wire and cable for faulty insulation prior to installation.
G. Provide grommets and strain relief material where necessary to avoid abrasion of wire and excess tension on wire and cable.
H. Make connections with solderless devices, mechanically and electrically secured in accordance with the manufacturers' recommendations. Solderless devices shall provide a hermetic seal and test probe access such that the circuit may be checked without breaking the connection. Wire nuts shall not be an acceptable means of connecting wire and cable.
I. Grounding
   1. Ground all equipment in accordance with manufacturers' recommendations. The Security Contractor shall be responsible for any damage to equipment or communications problems that may occur due to improper grounding.
   2. Provide all necessary hardware and cable to properly ground security equipment.

3.04 LABELED FRAMES AND DOORS

A. In no instance shall any UL labeled door or frame be drilled, cut, penetrated, or modified in any way without written approval from the Owner.
B. The Security Contractor shall be responsible for replacing any labeled door or frame that is modified without written approval from the Owner and General Contractor.

3.05 LABELING

A. Wire and cables shall be marked as follows:
   1. Mark all wire and cable in common at both ends.
   2. Install markers to be readable from left to right or top to bottom.
   3. Wire numbers shall be computer printed.
   4. Hand written labels shall not be acceptable.
   5. Labels shall be installed when wire and cables are installed.
   6. Labeling shall agree with Record Documentation.
B. Mark all connectors with common designations for mating connectors. The connector designations shall be indicated on the record drawings.
C. Permanently mark all terminals. Terminal and cable markings shall agree with markings shown on record drawings.
D. Coil all spare conductors in device back box or panel wire way. Neatly bundle and tag conductors.
E. Label all equipment including but not limited to SCPs (label shall denote SCP address), DVRs/NVRS (example NVR #I, etc.) and Cameras. Coordinate names, fonts, styles, and devices to be labeled with Owner prior to labeling. Provide computer-generated labels. Hand written labels will not be accepted.

3.06 TRAINING

A. ACMS System

1. Provide a minimum of 16 hours of ACMS System operator training, and 16 hours of CCTV administrative training, either on or off site on a complete and fully operational system parallel and equal to the system being provided, to representatives of the Owner.
2. Operator training shall include, but not be limited to the following:
   a. Graphical User interface (GUI) operation
   b. Manual retrieval of achieved events
3. Administrative training shall include, but not be limited to the following:
   a. GUI operation and configuration variables
   b. Addition and deletion of cardholder credentials

B. NVRS System
1. Provide a minimum of 16 hours of DVR/NVR operator training, and 16 hours of DVR/NVR administrative training, either on or off site on a complete and fully operational system parallel and equal to the system being provided, to representatives of the Owner.
2. Operator training shall include, but not be limited to the following:
   a. Graphical User interface (GUI) operation
   b. Manual and automatic camera call-up procedures
3. Record, label, and catalog all training on flash drive, CD or DVD disk. Provide the CD's to the Owner for future in-house training sessions and reviews. Furnish all temporary equipment necessary for recording training sessions.

C. The Security Contractor shall be on call during the Warranty to answer any questions the Owner may have. Maintain time sheets verifying the total hours of training provided.

D. The Owner reserves the right to use any excess training hours, not used by the time of system completion, for future training as requested by the Owner until the total number of training hours has been completed.

E. The Owner reserves the right to forgo training and request a credit for project training costs.

3.07 SURGE PROTECTION

A. Provide protection against spikes, surges, noise, and other line problems for all system equipment and components.

B. Protect all exterior video, control, power, signal cables and conductors against power surges. Video surge protectors shall not attenuate or reduce video and sync signals under normal conditions. Each surge protector shall be UL Listed.

3.08 POWER REQUIREMENTS

A. 120/208/480 VAC power dedicated to security will be provided by the General Contractor for the Security System. Coordinate circuit locations with the General Contractor.

B. Connect to the AC power and provide duplex receptacles within locked power supply cabinets. Provide UL listed power supplies and transformers with plug type connectors to distribute low voltage power to the system components as required. Plug transformers into duplex receptacles within locked cabinets only.

3.09 SYSTEM PROGRAMMING

A. Submit system-programming forms to the Owner with the prefabrication submittals. Include dates that the Owner must have the forms completed in order to maintain the construction schedules.

B. Program the security systems as necessary.

3.10 SUBSTANTIAL COMPLETION

A. In order to qualify for the Owner's consideration of Substantial Completion, the Work must, at a minimum, meet the following requirements:

1. All alarm points, access control points, CCTV cameras, DVR/NVR equipment, and intercom/phone substations shall be installed/connected to head end system and fully operational.
2. All security equipment shall be connected to UPS power.
3. All DVR/NVR equipment shall be connected to the dedicated security UPS power.
4. All sub-system interfaces must be complete and operational.
5. All required operator training shall have been provided to the Owner and its representatives.

B. Substantial Completion shall not be construed as final acceptance of the Work.

3.11 SYSTEM ACCEPTANCE

A. Final acceptance testing of the Work will be conducted by the DPS Contact Person. Prior to any final acceptance testing, the Security Contractor shall submit two sets of preliminary (draft) Record Drawings to the DPS Contact Person. The preliminary Record Drawings are to be used by the DPS Contact Person to conduct the system final test.

B. Submit a paragraph-by-paragraph completion matrix indicating completion or delinquency for each item included in the Specification and all subsequent addenda and bulletins as part of the Work. Indicate completion of the requirement by the word "Completed" following each paragraph number. Indicate delinquency for the requirement by the words "To Be Completed" following the applicable paragraph number. Should work on any item be under way, but not yet fully complete, indicate the extent (or lack thereof) of completion to date, and the proposed date of completion.

C. Conduct a complete test of the entire Security System and provide the DPS Contact Person with a written report on the results of that test. During the course of this test, place the integrated Security System in service, and calibrate and test all equipment.

D. Following completion of the initial testing and correction of any noted deficiencies, conduct a five-day burn-in test. The intent of the burn-in test shall be to prove the Security System by placing it in near real operating conditions. During this period the Security System shall be fully functional and programmed such that all points, interfaces, controls, reports, messages, prompts, etc. can be exercised and validated. Record and correct any system anomaly, deficiency, or failure noted during this period. Scheduling of the final acceptance test shall be based on a review of the results of this burn-in test.

E. Deliver a report describing the results of functional tests, burn-in tests, diagnostics, calibrations, corrections, and repairs including written certification to the DPS Contact Person that the installed complete Security System has been calibrated, tested, and is fully functional as specified herein.

F. Prior to the final acceptance test, coordinate with the DPS Contact Person for security related construction clean up and patch work requirements. Security equipment closets and similar areas should be free of accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, remove all waste materials, rubbish, the Security Contractor's and it's subcontractors' tools, construction equipment, machinery and all surplus materials.

G. Upon written notification from the Security Contractor that the Security System is completely installed, integrated and operational, and the burn-in testing completed, the DPS Contact Person will conduct a final acceptance test of the entire system.

H. During the course of the final acceptance test by the DPS Contact Person, the Security Contractor shall be responsible for demonstrating that, without exception, the completed and integrated system complies with the contract requirements. All physical and functional requirements of the project shall be demonstrated and shown. This demonstration will begin by comparing "as built" conditions of the Security System to requirements outlined in the Specification, item by item. Following the Specification compliance review, all Security System head-end equipment will be evaluated.

I. In order to sufficiently demonstrate the Security System's functionality, the console operator on duty and their superior may be requested to perform certain daily operations inherent to the Security System.
   1. 1. These operations may include, but not be limited to the following:

a. Manually locking and unlocking of doors within the ACMS.
b. Verifying the status of current alarm/control points within the ACMS.
c. Responding to alarms
d. Adding/deleting personnel from the cardholder database
e. CCTV Camera call-up on various monitors
f. Manipulation of PTZ cameras
g. Changing settings on various pieces of equipment (i.e. DVR/NVR System, DVR/NVR Client Software).
h. Adding a CCTV Camera to the DVR/NVR Client Software.
i. Changing the frame rate of a camera recording on a DVRNVR.
j. Correct CCTV Camera call-up on certain alarms within the ACMS
k. NVRS motion detection or lack of no motion detection automatic notification sent over network to a software routine in the ACMS to be able to automatically activate events based on the alarms received from the NVRS.
l. CCTV PTZ control via the ACMS and/or DVR/NVR Client Software.

2. As all of these operations depend heavily on the training outlined within the Specification, the Security Contractor shall have completed all of the required training prior to initiation of the final acceptance test.

J. The functionality of the various interfaces between systems will be tested. This testing will include, but not be limited to the following:
1. Generation of alarms from related systems activation or failure (i.e. loss of communications, fire relay activation, etc.)
2. Fire alarm system fail safe lock release
3. Control of any externally controlled devices and database system(s).

K. Following the Security System head-end equipment and console review, the installation of all field devices will be inspected. This field inspection will weigh heavily on the general neatness and quality of installations, complete functionality of each individual device, and mounting, back box and conduit requirements compliance.

L. All equipment shall be on and fully operational during any and all testing procedures. Provide all personnel, equipment, and supplies necessary to perform all site testing. Provide a minimum of two employees familiar with the system for the final acceptance test. One employee shall be responsible for monitoring and verifying alarms while the other will be required to demonstrate the function of each device. Supply at least two two-way radios for use during the test. A manufacturer's representative may be present on site to answer any questions that may be beyond the technical capability of the Security Contractor's employees, if the Security Contractor so elects or by specific request of the DPS Contact Person or Owner, at no charge to the DPS Contact Person or Owner.

M. Upon successful completion of the final acceptance test (or subsequent punch list retest) the DPS Contact Person will issue a letter of final acceptance. The DPS Contact Person retains the right to suspend and terminate testing at any time when the system fails to perform as specified. In the event it becomes necessary to suspend the test, the Security Contractor shall work diligently to complete/repair all outstanding items to the condition specified in the Specification and as indicated on the Security Device Drawings. The Security Contractor shall supply the DPS Contact Person with a detailed completion schedule outlining phase-by-phase completion dates and a tentative date for a subsequent punch list retest. During the final acceptance test, no adjustments, repairs or modifications to the system will be conducted without the permission of the Owner.

3.12 RECORD DOCUMENTATION

A. Record Documentation shall include all information required in the Pre-fabrication Submittals but revised to reflect "as installed" conditions.

B. General Description and Requirements:
1. Submit Record Documentation in accordance with the DPS Contact Person's construction schedule.

2. Record Documentation shall consist of Record Drawings and Operation and Maintenance Manuals.
3. Provide a letter of transmittal with Record Documentation identifying the name of the Project, Security Contractor's name, date submitted for review, and a list of items transmitted.
4. Prior to the final acceptance of the Work, submit two draft sets of the Record Drawings portion of Record Documentation to the DPS Contact Person. The draft copy shall be used during the final acceptance testing by the DPS Contact Person.

C. Record Drawings
1. Update all record documentation to reflect changes or modifications made during final acceptance testing as required and provide electronic copies both in CAD and PDF formats. Submittals are be.
2. Produce all Record ('as-built') Drawings both in CAD and PDF formats. CAD drawings are to be prepared using the latest version of AutoCAD... Record Drawings shall, at a minimum, include the following:
   a. Floor plan drawings indicating device locations, with device legends indicating manufacturers and model numbers for each device.
   b. Floor plan drawings indicating wire routing. Wire routing shall be delineated in straight-line runs and be tagged with cable identification and terminal strip numbers to coincide with the installation.
   c. Mounting details for all equipment and hardware.
   d. Functional block diagrams for each subsystem.
   e. Wiring details showing rack elevations, equipment wiring and terminations, and inter-rack wiring.
   f. Wiring diagrams for all custom circuitry including interfaces to various control output controlled devices, i.e. overhead doors, fire alarm system interface, etc.
   g. Wiring diagrams for networking of NVR and ACMS.
   h. Wiring diagrams for each data-gathering panel (SCP). Wiring diagrams shall be identical to those laminated and located with each SCP.
   i. Typical point-to-point wiring diagrams for each piece of equipment and groups of equipment within the system.
   j. Layout details for each riser location, including security panels, power supplies, junction boxes, conduit, and any other security related equipment.

D. Operation and Maintenance Manuals
1. Provide electronic copies of Operational and Maintenance Manuals both in PDF formats. Provide on transportable media when required
2. Operation and Maintenance Manuals shall apply to all security related devices, equipment and software modules.
3. Operation and Maintenance Manuals shall be formatted as follows:
   a. Bind each manual in a hard-back loose-leaf binder.
   b. Identify each manual's contents on the cover.
   c. Provide a table of contents and tabulated sheets for each manual. Place tab sheets at the beginning of each chapter or section and at the beginning of each appendix if applicable.
   d. Any hardware manual demonstrating more than one model number of devices on any one page shall be clearly marked as to delineate which model has been implemented in the Work.
4. Operation and Maintenance Manuals shall include, at a minimum, the following:
   a. Operational description of each subsystem.
   b. Detailed programming descriptions for each subsystem, including step-by-step procedures with illustrations identifying how computer screens will appear after each entry.
   c. Explanations of subsystem interrelationships. Explanations shall include operations of each subsystem and operations unique to the interfaces between each of the subsystems and possible conflicts that may occur with the interfaces. Each explanation shall be identified, tagged, bound and indexed into a single binder.

d. Electrical schematics for each piece of equipment specified.
e. Power-up and power-down procedures for each subsystem.
f. Description of all diagnostic procedures.
g. A menu tree for each subsystem. The tree shall provide a graphical flow of commands within the menu system.
h. Setup procedures for each component of the subsystems.
i. A list of manufacturers, their local representatives and subcontractors that have performed Work on the Project. The list shall include contact names, phone numbers and addresses for each.
j. Installation and service manuals for each piece of equipment.
k. Maintenance schedules for all installed components. Schedules shall include inspections and preventative maintenance schedules, and documentation of all repaired or replaced equipment.

5. Operation and Maintenance Manuals shall include a separate section for each software program incorporated into the Project. The software section shall include, at a minimum, the following information:
   a. Definitions of all software related terms and functions.
   b. Description of required sequences.
   c. Directory of all disk files.
   d. Description of all communications protocols, including data formats, command characters, and a sample of each type of data transfer.
   e. Instructions for manufacturer supplied report generation with illustrations showing what reports should look like and screen-by-screen illustrations for each entry made.
   f. Instructions for custom report generation.
   g. Database format and data entry requirements.

E. Procedure for Resubmitting
1. Make corrections or changes in Record Drawings as required by the DPS Contact Person and resubmit when the DPS Contact Person's stamp requires re-submittal.
2. Clearly identify changes made other than those specifically requested by the DPS Contact Person when resubmitting Record Drawings. Changes shall be clouded or similarly highlighted as coordinated with the DPS Contact Person. Only changes that have been specifically requested by the DPS Contact Person or have been clouded by the Security Contractor will be reviewed on re-submittals.
3. Any drawing sheets added to the re-submittal shall be clearly identified and clouded, and shall not change the sheet numbering scheme for previously issued Record Drawings.
4. The Security Contractor shall be responsible for any delays caused by the re-submittal process.

ATTACHMENTS – ADDITIONAL INFORMATION FOR EQUIPMENT AND PROGRAMMING

ATTACHMENT 1 – VMS APPLICATIONS USED AT HARRIS HEALTH

1.01 Cameras Systems in use at Harris Health effective 01/01/2025

FUNCTIONALITY	VMS SYSTEM	RECORDER	COMMENTS
DPS Security Cameras	Victor	Videoedge*	
Pharmacy Vent Hood Cameras	N/A	Exacq	Pharmacy access only using Exacq webview
Pharmacy Pyxis Cameras	Victor	Exacq*	
Wall Display Cameras	Axis Video decoder	N/A	Requires Axis camera
Axis Video Intercoms	Axis camera station	N/A	Typically, intercom to Cisco phone. Camera station licensing required for multiple access. Requires Axis Video Intercom
Staff viewing of DPS Security Cameras	Axis camera station	N/A	Typically, single via web browser. Camera station licensing required for multiple cam access.
Patient View Camera			Not is DPS Scope

* Also monitored via CCure ACMS system and CCure IQ

Camera Analytics in use at Harris Health effective 01/01/2025

FUNCTIONALITY	SYSTEM	RECORDER	COMMENTS
Sound Aggression monitoring via camera	Sound Aggression/Victor/ Videoedge	Videoedge	Requires Axis camera with microphone. Confirm locations with owner
Object Detection	Victor	Videoedge	Requires current generation cameras
Object Detection-Persons or Vehicles	Victor	Videoedge	Requires specific model Illustra or Axis Camera. Confirm use/need with owner
Perimeter Detection	Victor	Videoedge	Requires specific model Illustra or Axis Camera. Confirm use/need with owner
Loitering/Linger Detection	Victor	Videoedge	Requires specific model Illustra or Axis Camera. Confirm use/need with owner
License Plate Reader	Victor	Videoedge	Requires specific model Illustra or Axis Camera and licensing. Confirm use/need with owner. See specifications
Facial Recognition	Victor	Videoedge	Requires current generation cameras and licensing. Confirm use/need with owner. See specifications

Other Analytics: Color Filtering Crowd Formation Direction Dwell Enter Exit Linger Object Perimeter Abandoned/Removed Queue Analysis Tripwire			Requires Illustra Gen4 Camera or Videoedge intelligence licensing. Confirm use/need with owner

ATTACHMENT 2 - PROGRAMMING INSTRUCTIONS FOR CCURE

GENERAL INFO

A. NOTE: The following information is provided to assist in adding and updating C*CURE9000 hardware device configuration and programming. This document intends to provide programming for Harris Health C*CURE9000 software to ensure a consistent environment based on the following methodology
   - Naming conventions for iSTARs, INPUTS, OUTPUTS READERS and DOORS include references to make it be easier for our support staff to troubleshoot.
   - Naming conventions for CLEARANCES are designed to allow for easy assignment with minimal need to reference lookup data.
   - Naming conventions for EVENTS and DOOR GROUPS are designed primarily to allow for quick referencing for monitoring.

B. DPS Administration must always be notified in advance of planned installations or programming of any nature.

C. A Harris Health-provided vendor account is required to access Harris Health computers and the Harris Health CCure 9000 system. Vendors should ensure that this access is properly setup before beginning work assignments at Harris Health. This account must be renewed daily.

D. A database partition is currently used at Harris Health for Harris Health and Community Health Center locations. Please contact DPS Administration if additional is needed for Community Health Center installations.

E. The DPS ACMS is currently partitioned between HCHD and CHC operations. DPS alarm monitoring is generally divided into three basic groups (Ben Taub, LBJ, and ACS-Administration). The security vendor should ensure all programming and monitoring privileges match the designated monitoring group for the site's control devices and confirm which partitions are to be used and if any are to be added..

F. Unless otherwise noted in this document, you shall always check/enable "Send State Changes to Journal", in order to provide database logging capability should there be a problem with a device. If there is a problem with a device, a database "Journal Replay" can be used to locate problems

G. Unless otherwise noted in this document, all devices should be programmed to activate a CCURE event in the case of network communications failures, power loss, and/or supervisory conditions. Existing CCURE events based on monitoring groups may be used for this purpose.

H. The Standard Naming format that is used throughout this document is based on the following:

   <LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
   LOC – Is the facility location code and building number (two or three Letter Acronym)
   FLR – Is the floor number on which the panel is located
   <USER DEF> – Is the general room or location of the device controlled or monitored
   <SUFFIX> – is an abbreviation (from a defined list) for the device that defines the function.

I. Submit programming names for security control devices on a standard Software House CCure installation template for owners review and approval at least two weeks before activation. Confirm door groups and clearance setup before activation of controls.

1. iSTAR PANEL CONFIGURATION NOTES

A. Please obtain all IP addresses from DPS Administration before beginning installations. The device mac address(es) must be provided. To receive a static IP address, provide device switchport information and equipment mac addresses at least two weeks before planned installation date. Submit information on DPS excel template.

1. Once the IP address has been programmed. Please contact the Harris Health Network Operation Center (NOC) to ensure communications has been established.

2. All IP addresses must be “static” (non-DHCP).

3. Trigger Events to be programmed for each Istar will include the defined locations “Comm failure” event to activate in the event the Online status is offline for the iSTAR and all IP components of the iSTAR (i.e. IP-ACMs). See Events section

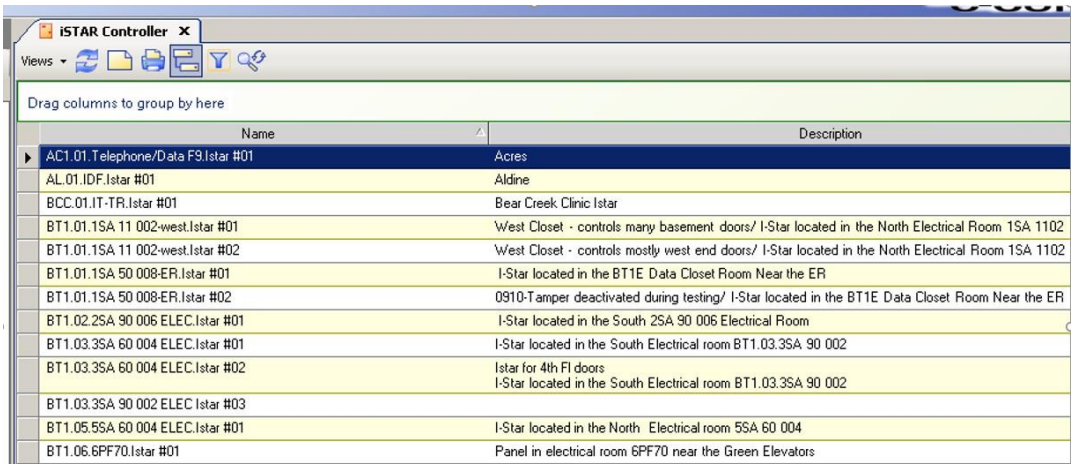
2. iSTAR PANEL NAMING

A. The format that was developed for the Harris Health implementation of the C*CURE9000 system is:
<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location (two or three Letter Acronym)
FLR – Is the floor number on which the panel is located
USER DEF – Is the room number in which the panel is located
SUFFIX – is the type of panel and sequentially numbered panel of the building

1. Current List of Acceptable SUFFIX Entries
    a. iStar (Istar pro)
    b. iStarEx
    c. iStarU…
2. Example: If a Clinic (SETT) has only one iSTAR panel, it would be identified as:
“SETT.01.012 ISTAR #1”.

3. Example: If a hospital building has three iSTAR panels on the 1st floor, in the same room, they would be identified as:
“LB1.01.112 ISTAR #1”
“LB1.01.112 ISTAR #2”
“LB1.01.112 ISTAR #3”

4. The following image shows the way in which C●CURE sorts the information making it easy to locate the information we would be looking for:

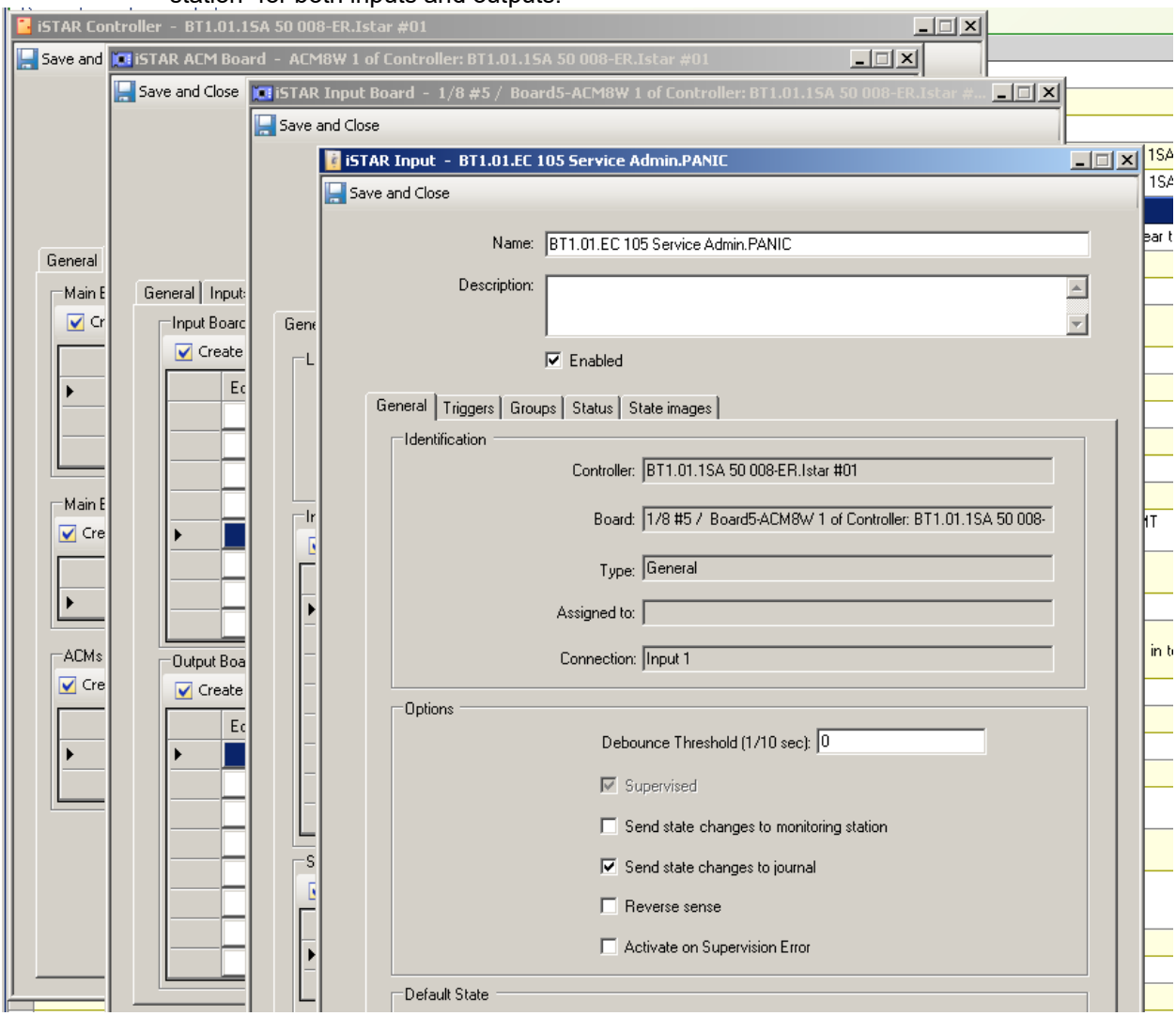


Name	Description
AC1.01.Telephone/Data F9.Istar #01	Acres
AL.01.IDF.Istar #01	Aldine
BCC.01.IT-TR.Istar #01	Bear Creek Clinic Istar
BT1.01.1SA 11 002-west.Istar #01	West Closet - controls many basement doors/ I-Star located in the North Electrical Room 1SA 1102
BT1.01.1SA 11 002-west.Istar #02	West Closet - controls mostly west end doors/ I-Star located in the North Electrical Room 1SA 1102
BT1.01.1SA 50 008-ER.Istar #01	I-Star located in the BT1E Data Closet Room Near the ER
BT1.01.1SA 50 008-ER.Istar #02	0910-Tamper deactivated during testing/ I-Star located in the BT1E Data Closet Room Near the ER
BT1.02.2SA 90 006 ELEC.Istar #01	I-Star located in the South 2SA 90 006 Electrical Room
BT1.03.3SA 60 004 ELEC.Istar #01	I-Star located in the South Electrical room BT1.03.3SA 90 002
BT1.03.3SA 60 004 ELEC.Istar #02	Istar for 4th Fl doors I-Star located in the South Electrical room BT1.03.3SA 90 002
BT1.03.3SA 90 002 ELEC Istar #03	
BT1.05.5SA 60 004 ELEC.Istar #01	I-Star located in the North Electrical room 5SA 60 004
BT1.06.6PF70.Istar #01	Panel in electrical room 6PF70 near the Green Elevators

For programming iSTAR Clusters, replace the word “iSTAR” with the word “Cluster”.

1.01 INPUTS, OUTPUTS AND READERS

1. Check/enable, “Send State Changes to Journal” for both inputs and outputs, with the exception: **do not select for REX/RTE devices.**
2. Unless otherwise instructed, it is not necessary to “send State Changes to monitoring station” for both inputs and outputs.



A. The format for naming of INPUTS and OUTPUT is:
<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location and building # (two or three Letter Acronym)
FLR – Is the floor number on which the device is located
USER DEF – Is the 12 character description where the device is located
SUFFIX – Is the type of device from the input/output list suffix list.

Current List of Acceptable Suffix Entries (inputs)

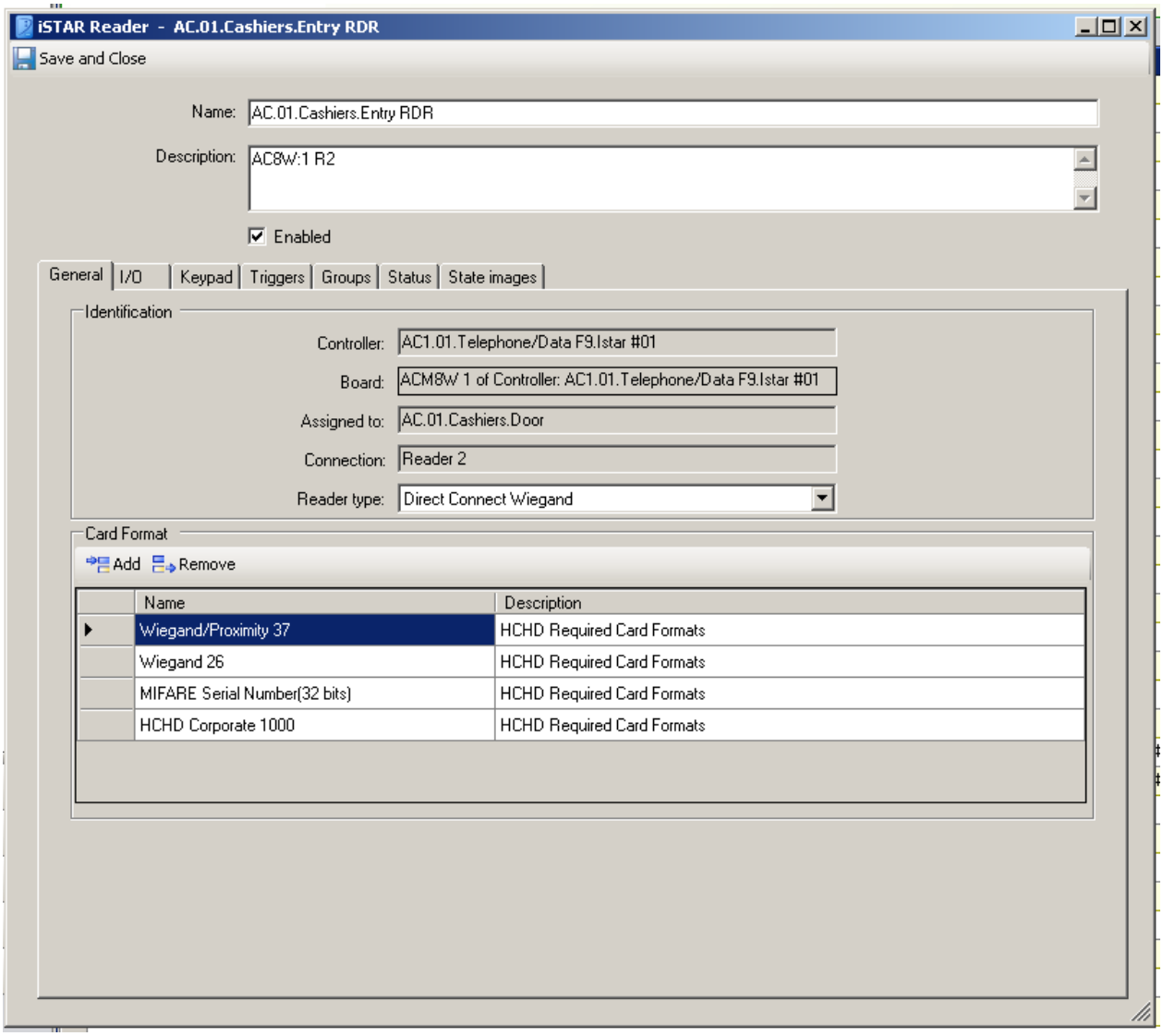
a. DSM = Door Switch Monitor
b. PANIC = panic or duress switch
c. RTE = Request to Exit
d. CONTACT = door contact
e. AC Fail = AC Failure
f. DC Fail = DC or Battery Fail

g. MOTION = Burglary Motion Detector
h. Glass Break = Glass Break Detector
i. Bond Sensor = Bond Sensor (usually associated with MAG locks)
j. Crash Bar = Emergency Exit Device
k. RDR Tamper = Reader Tamper
l. PNL Tamper = Panel Tamper
m. Fire Input = Monitoring of Fire Release Relay
n. Key Switch = Local External Lock Release
o. FLR Select = Floor Selection usually part of an Elevator Control System

2. Current List of Acceptable Suffix Entries (outputs)
   a. Lock Relay = Door Latch Relay
   b. Strobe = External Strobe
   c. Sounder = External Sounder
   d. FLR Control = Floor Control Relay

CARD READERS

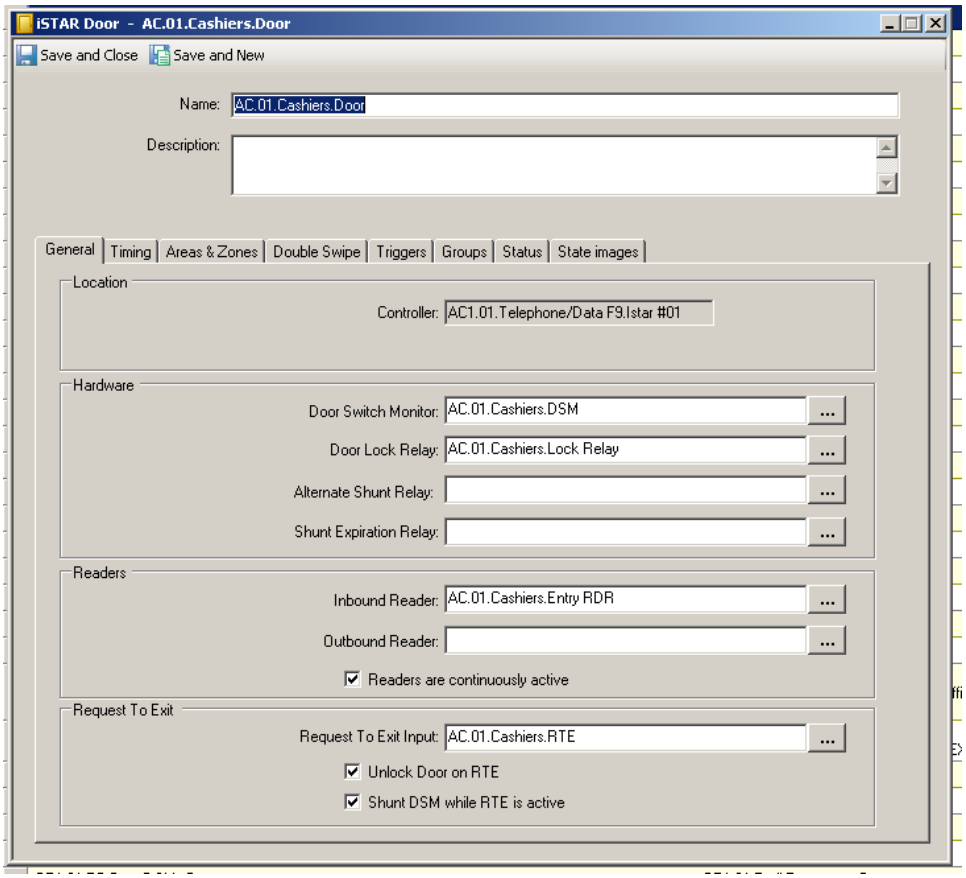
1. The following image shows the basic programming for each reader.
   The format for the naming of READERS is:
   <LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
   LOC – Is the facility location and building # (two or three Letter Acronym)
   FLR – Is the floor number on which the reader is located
   USER DEF – Is the 18 character description where the device is located
   SUFFIX – Is only needed if the readers are defined an “IN” and “OUT” readers



NOTE: All Harris Health Card formats shown in the image must be included.
It is expected that programming cards be obtained from the DPS and used for testing of each reader after installation and configuration.

1.01 DOORS

1) The format for the naming of DOORS is:
<LOC>.<FLR>.<USER DEF>.<SUFFIX> where:
LOC – Is the facility location and building # (two or three Letter Acronym)
FLR – Is the floor number on which the device is located
USER DEF – Is the 18 character description where the device is located
SUFFIX – Is the type of controlled access point and reader type (i.e. Door, Gate, BioReader, CtlReader, ElevC)
2) The user defined location name should be a short description of where the actual door is located to help anyone who may work on the system and to properly program events.
3) Use the "description" section for additional information to include:
   a. The date of activation and the Integrator installing the door
   b. The type of locking device used (i.e. maglock, electric strike)
   c. Any special configuration (i.e. door control interface using day/night event)
4) Trigger Events to be programmed for each door will include Forced and Held Open. See Events section



1.01 CLEARANCES

1. Access control clearances are defined and controlled by the DPS Administration office. New clearances must be approved to maintain security and consistency. Departmental clearances are linked to LDAP imports and high security clearances are controlled through the CCure Access Management system.
2. Adding controls to existing additional clearances or door groups must be approved by the owner. A programming template will be provided when needed.
    a. Doors approved for general access will be added to the “general access” door group for the site.
    b. Doors approved for departmental access will be added to the respective door group(s) for the area or areas.

3. DPS clearance naming conventions
    a. Request clearance names from the DPS Administration office

1.01 SCHEDULE NAMING

1. Schedule schedules trigger the events that perform access control and event monitoring. Configure a schedule as one or more time spans that represent a continuous unit of time during the number of days you specify. Schedules are used to define (1) When clearances are allowed and (2) When events are to be launched.
2. To help clarify who is the “owner” of a schedule, all schedule names that are unique to a set of devices or events must begin with the facility identifier (SETT, LB, HH, etc.). Existing generic schedules that begin with “ALL” may also be used but should not be changed or edited.
3. When an EVENT requires a unique schedule, the EVENT NAME should be recorded as a note.
4. SYNTAX: Facility.Days.Timeframe,Optional Notes
    a. Maximum field width 50
    b. See addendum for location Acronyms (i.e. SQ, BT)
    c. Day Scope Days included. From the list M, T, W, R, F, S, U. (i.e., e.g., M-F; MWR; U) for M-onday, T-uesday, W-ednesday, thu-R-sday, F-riday, S-aturday, s-U-nday
    d. Time Scope Times use a 24-hour clock. 24/7. “Harris Health TIME” (0630-1830).

1.01 EVENTS

A. EVENT NAMING

1. Alarm Point Programming Events will be programmed using the Door, or Input names with a suffix that describes the type of EVENT. Example <LOC>.<FLR>.<USER DEF>.<SUFFIX> EVT.
2. The following type devices are required to have defined alarm events with the noted suffix descriptions:
    a. “.PANIC EVT” (for all Duress Buttons)
    b. “.GLASS BREAK EVT” (for all glassbreaks)
    c. “.TDL EVT” (for Time Delayed Lock activations)
    d. “.CONTACT EVT” (for all Door Contacts not associated to Readers)
    e. “.Door Forced EVT” (for all door Contacts associated with Readers)
    f. “.Door Held EVT” (for all door Contacts associated with Readers)
    g. “.MOTION EVT” (for all burglar motion detectors)
    h. “.PHONE EVT” (for all emergency phones)
    i. “.FIRE RELAY EVT” (for all Fire Notifiers)

3. Names for Alarm Masking Events should be preceded with a "." to provide proper sorting on the Monitoring Screen. Names for Unlock Events should be preceded with a "_".
4. The text to be written in the Configure/Event window under "Display this line when activated" category should correspond specifically with the title of the device.
    a. Example: If the device is titled "Panic", then the category "Display this line when activated" should also read "PANIC IS IN ALARM".
    b. The same holds true for all the other devices respectively. The category "Display this line when activated" should read "(INSERT DEVICE NAME) IS IN ALARM".
    c. In all the above noted devices, the category "Display this line when deactivated" should read "(INSERT DEVICE NAME) IS NORMAL".
5. Door Access Programming Events
    a. Access Events to be programmed for each door will be Force Open and Held Open
    b. The text to be written in the Configure/Event window under "Display this line when activated" category should correspond specifically with the title of the event.
    c. Example: If the event is titled Force Open, then the category
    d. "Display this line when activated" should also read "DOOR FORCED OPEN".
    e. The same holds true for Held Open and Comm Fail events. The category "Display this line when activated" should read "DOOR HELD OPEN"

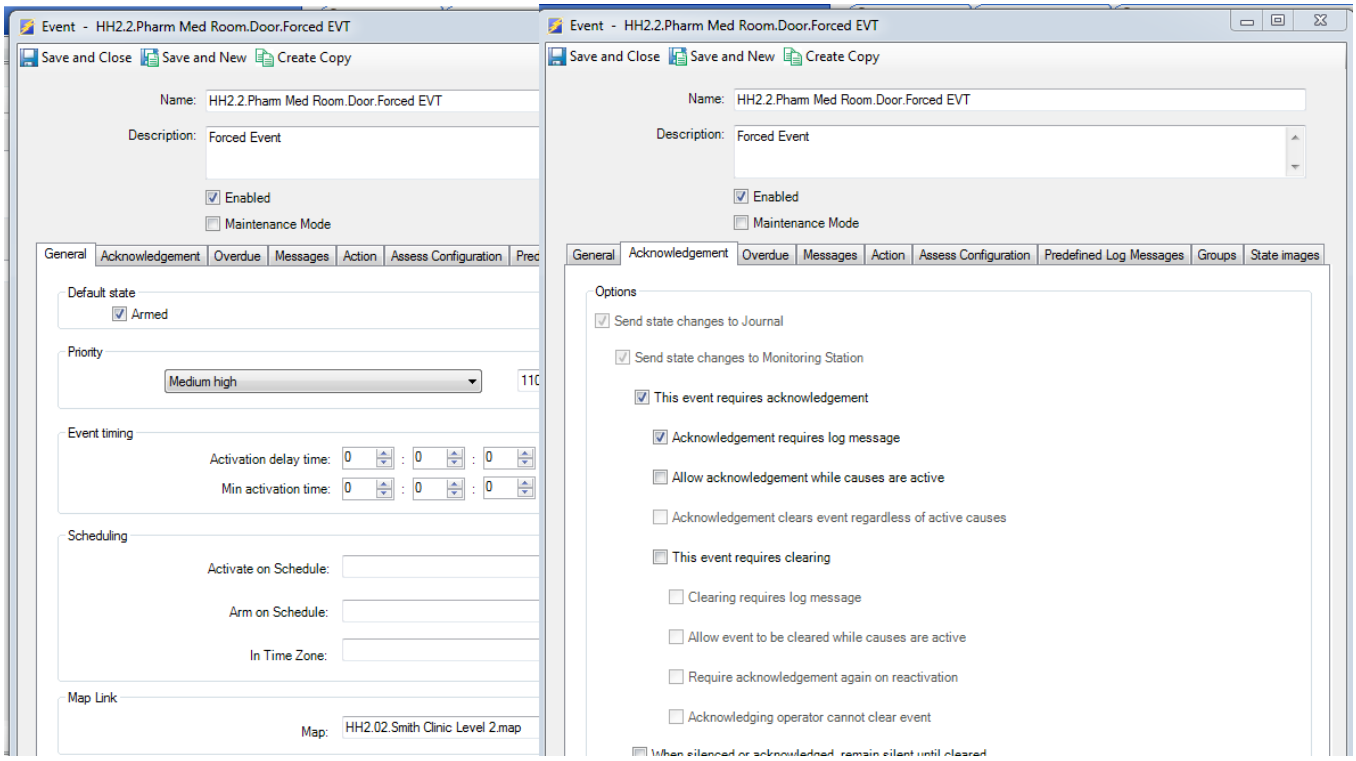
    In all the above noted events, the category "Display this line when deactivated" should read "NORMAL

B. EVENT PROGRAMMING

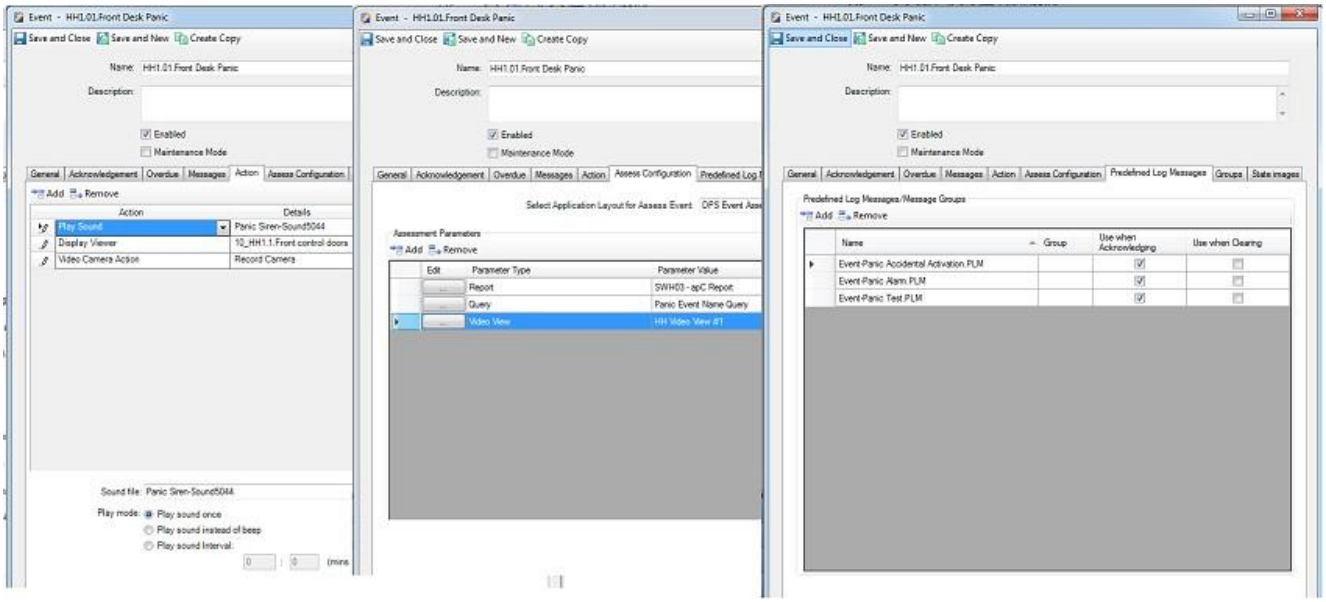
1. Events are generally setup based on their Priority Level.
    a. 200-Critical (alarms requiring immediate law enforcement response)
    b. 175-Very high **(Comm Fails, Fire relays)**
    c. 160-Very high **(Power fails)**
    d. 150-High **(Panic alarms)**
    e. 135-High (Burglar devices, intrusion alarms, critical door forced alarms)
    f. 110-Medium High **(Door forced alarms)**
    g. 100-Medium **(perimeter door contacts)**
    h. 75-Medium Low **(general alarm conditions)**
    i. 66-Medium Low **(door helds)**
    j. 25-Very Low **(masking and unlock commands)**
2. Enter the map link for any event related to a physical device (camera, panic, door, etc.).
3. Event options should include:
    a. "The event requires acknowledgement" should be checked for all events of Priority 100 or higher.
    b. "Acknowledgement requires log message" should be checked for all events of Priority 125 or higher.
    c. Do not check "acknowledgement clears event."
    d. Enter one of the standard "unacknowledged" events for all events of Priority 100 or higher.
4. Event actions should include:
    a. "Play sound" should be checked for all events of Priority 100 or higher (unless in intrusion zone). Please see existing examples for sound names.

   b. “Display viewer” should activate any corresponding camera view for all events associated with physical devices for all events of Priority 125 or higher. All panic or duress alarm events should activate any associated camera that shows the panic location.
5. If a location utilizes space protection at set times and an intrusion zone will not be used, a masking event must be setup. Please see existing examples for setups.
6. **Special note for events associated with automatic door operators.** Events (such as “Day/night” events) that unlock an associated door via output activation should include an “unlock” trigger as an action so operators can quickly determine doors in an unlocked state. Please see existing examples for setups.

1. Standard Event Setup



Added event setup for panics and high security alarms (note assessment and event actions)



Items marked in BOLD are preferred and should be the default selection.

Selection Item Name	Selection Options
GENERAL	
Enable	**Checked**
Default State – Armed?	**Checked**
ACKNOWLEDGMENT	
Send state changes of this event to journal?	**Checked**
Send state changes of this event to monitoring station?	**Checked**
This event requires acknowledgment?	**Checked (priority 50 and above events)**
Acknowledgment requires log message?	**Checked (priority 100 and above events)**
Allow acknowledgment while causes are active?	Not Checked
Acknowledgment clears event regardless of active causes?	Not Checked
This event requires clearing	*NOTE: Clearing commands are used for events associated with lockdown buttons. See owner for additional information*
1.01 MESSAGES	
Display this line/Instructions	*NOTE: This information should be provided to include special information needed to facilitate the response. It is only required when that information is needed.*.

1.01 ACTION/ASSESS CONFIGURATION/PREDEFINED LOG MESSSAGES

NOTE: These items are normally used for high security events (priority 125 and above events). It is expected that the Assess Configuration tab be set and linked with actions for displaying the associated camera view and the recorded camera action. The basic assess configuration display includes the 1) map, 2) recent journal, 3) video view and 4) recorded video. Predefined log messages are provided for panic and intrusion device events

Sound to be assoc w/event activation:

_ Play sound once

_ Play sound instead of beep

1. _ Play sound interval (enter 45 seconds)
   (all sound files needed are saved in the setup)

2. Other Available Event Actions (contact Owner if needed):
   1. Lock, unlock, momentarily unlock, or secure a door or door group
   2. Enable or disable door forced alarm, door held alarm, door open alarm, door lock tamper, door DSM tamper, door lock unsecured, or door RTE.
   3. Activate, deactivate, latch, unlatch, arm, or disarm an event or event group
   4. Activate, deactivate, or pulse an output or output group
   5. Arm or disarm an input or input group
   6. Activate or deactivate CCTV actions
   7. Connect dialup iSTAR controllers
   8. Connect dialup apCs

9. Back up iSTAR database
10. Control or uncontrol access for an elevator button (elevator and floor pair)
11. Enable or disable keypad commands
12. Disable PIN or require PIN
13. Set reader security level 0, 1, 2, 3, or 4
14. Arm, disarm, toggle, or force-arm intrusion zone (Intrusion zones on iSTAR controllers)
15. Display on keypad's reader intrusion zone mode status or off-normal points (Intrusion zones on iSTAR controllers)
16. Arm, disarm, toggle, or force-arm local intrusion zone (Intrusion zones on iSTAR controllers —reflexive action)
17. Display local intrusion zone mode status or off normal points on keypad's reader (Intrusion zones on iSTAR controllers — reflexive action)
18. Lock, unlock, or secure keypad's local door (on iSTAR controllers — reflexive action)
19. Initiate roll call report
20. Grace all cards
21. Activate BiD action
22. Send e-mail
23. Send page

3. Groups

1. The DPS primarily uses groups for access clearances (door groups) and for proper control of alarm and burglar devices (input and event groups). Other groups have been established for ease of testing and other uses. All devices programmed that correlate to the below noted groups must be placed in those groups at the time of setup. Groups to be built include:
    a. Input (Note: All inputs will be placed in an ALL INPUTS GROUP)
    b. Output
    c. Event
    d. Elevator
    e. Door
    f. Personnel
2. Setups that include burglary devices must have both an Input group and an Event group for those devices. These groups will be placed in their respective Alarm Masking or Intrusion Zone setups.

3. Doors designated as "general access" should be added to the locations "general access" door group. If not general access, always check if the door needs to be added to a pre-existing door group.
4. Controlled areas, such as pharmacies, business offices, etc., should have door groups established. For example: "BT Inpatient Pharmacy.DG". New doors added to these areas should be added to the respective groups.
5. Personnel groups must be setup for all areas using intrusion zones.
7. Event actions should include:

4. Intrusion Zones

1. If a location utilizes space protection, an intrusion zone must be setup. Some areas, such as Pharmacies, require their own intrusion zones.
2. Please contact the DPS for specific information on how control of the intrusion zone will be setup.
3. Please see existing examples for setups.

5. M
4. aEvery physical access control device that has an alarm event associated with it must be pmapped. The associated event icon should be placed on the map, with the exception being sfor doors. Icons for the actual door, elevator, or gate should be displayed on the map.

6. CCTV Programming Standards

A. NOTE: Camera names should be programmed in the respective devices and then imported into CCure. Cameras names cannot match any other device. They will not import into CCure if the name is not unique.
   B. The format for naming Cameras in CCURE is:
      1. <LOC>.<FLR>.<USER DEF> where:
      2. LOC – Is the facility location and building # (two or three Letter Acronym)
      3. FLR – Is the floor number on which the device is located
      4. USER DEF – Is the max 25 character description where the camera is located
      5. Example: HH1.01.Corridor to Receiving
   C. The location description should be a good description of where the actual door is located to help anyone who may work on the system and to properly program events. Typically, only this location description will be used for the DVR programming.

7. DVR Programming Standards

A. DVR's names in CCURE should be programmed in the as follows: the Building Acronym, Room Number, brief description of the DVR.
      1. Example: HH1.01.VideoEdge1
   B. DVRs will be programmed to include:
      1. <LOC>.<FLR>.<USER DEF>. where:
      2. LOC – Is the facility location and building # (two or three Letter Acronym)
      3. FLR – Is the floor number on which the panel is located
      4. USER DEF – Is the unique name of the DVR.

"

1.01 ATTACHMENT 3 – SPECIAL PROGRAMMING INSTRUCTIONS FOR CCURE ACCESS CONTROL EQUIPMENT

A. Each power supply power fail, fire alarm relay activation, and low battery alarm must be wired in as an input and configured as an individual alarm event in the system.
B. Card Readers should be wired and programmed with LEDs to indicate conditions and functions as follows:
    1. Red LED in the normal, locked state.
    2. Green LED upon a valid card read and when the door is in the access (unlocked) condition.
    3. Flashing red LED upon invalid card read, forced door, and held open alarm conditions.
    4. Card reader LED indicators shall operate identically throughout all facilities.
C. CCure programming and setup of all integrated security controls and equipment.
    1. System CCure programming and setup of the DVRs/NVRS are to include, but not be limited to the following:
        a. Program NVRS for all supported events, such as a "communication loss", “excessive temperature”, etc.
        b. Import all associated IP video and define cameras or views needed to support required event call-ups.
        c. Show cameras on CCure location maps so that when alarms are generated on the ACMS Monitoring Station, an operator can double-click on the camera icon next to the event, and a display window will open.
        d. Program all exterior PTZ cameras (if utilized) to operate with on-screen controls from the CCure display window.
        e. Coordinate automatic camera selection requirements using the Harris Health DPS CCURE programming instructions. Coordinate other details with DPS as necessary prior to programming.
    2. Provide all initial system programming and setup of the intercom, hands-free phone, and/or emergency phone are to include, but not be limited to the following:
        a. Initial setup for the interface with the ACMS.
        b. Alphanumeric identification of each Substation and Security Assistance Station, on each Master Station. Coordinate descriptors using the Harris Health DPS CCURE programming instructions. Coordinate other details with DPS as necessary prior to programming.
        c. Automatic selection of CCTV Cameras adjacent to Substations or Security assistance Stations as applicable upon call in. Coordinate automatic CCTV Camera selection requirements using the Harris Health DPS CCURE programming instructions. Coordinate other details with DPS as necessary prior to programming.

1.01 ATTACHMENT 4 – PROGRAMMING INSTRUCTIONS FOR VIDEOEDGE NVR EQUIPMENT

A. SYSTEM PRE-SETUP
1. Harris Health Network security requires all devices be registered before activation. Provide device mac address(es) at least two weeks before planned installation date
2. To receive a static IP address, provide device switchport information and equipment mac addresses at least two weeks before planned installation date. Submit information on DPS excel template.

B. SYSTEM SETUP
1. Once device is communicating and stable on network, change ALL default passwords. Obtain the current Harris Health DPS NVR passwords for the following
   a. Administrator
   b. Videodege (linux)
   c. Root (linux)
   d. Videoedge Backups
   e. Nvrgroupadmin
   f. softwareadmin
   g. support
2. Confirm with owner if user roles are needed for VictorWeb viewing
3. Confirm with owner if unit is to be added to Failover system. If required, program the information needed for failover on both the Videoedge unit and the associated Failover NVR's.
4. Confirm with owner if unit is to have centralized licensing. If required, apply to the new IP camera licenses to the Victor server and centralize the new NVR.
5. Enable the NTP Server and use IP address **10.50.26.10**

C. FAILOVER
1. Confirm that the Videodege (linux), Root (linux), and Nvrgroupadmin passwords match with the failover (secondary) unit being utilized.
2. Both remote settings need to be activated
3. SNMP community name needs to match with failover (secondary) unit being utilized.

D. CAMERAS
1. Once camera(s) are communicating and stable on network, change ALL default passwords. Obtain current Harris Health DPS camera password.
2. All Cameras should be programmed for full resolution at 15 FPS.
3. All cameras should be set for motion detection video analysis. If analytics are included, confirm settings with owner.
4. All cameras should be set for "Recording always with alarms" (will be changed at a later date)
5. All cameras should be set and tested for video alarms. Confirm with owner if schedule is to be used for alarms.

E. ADVANCED SETUP
1. Setup Device security passwords using current Harris Health DPS IP camera password in the following order. This will facilitate camera imports:
   a. 1. Axis-DPS
   b. 2. Illustra-DPS
   c. 3. Sony DPS
   d. 4-7 Others as needed
2. Setup mail server for IP Address: 170.57.134.21
3. Contact owner to mail service email address(es). Default notifications are to include:
   a. Analog Hander reboot
   b. Archive
   c. Area Temperature
   d. Audio Malfunction
   e. Blur Detection
   f. Camera Dark Frame
   g. Camera Processing Malfunction
   h. Camera Video Loss
   i. Device Not Recording
   j. Failover
   k. Log Storage Space Low
   l. Security Alert
   m. Security Config Change
   n. Spot Temperature
   o. Storage
   p. Storage Activation
   q. Storage Config
   r. Storage Retention
   s. System
   t. System Reboot
   u. Text Stream

1.01 ATTACHMENT 5 – PROGRAMMING INSTRUCTIONS FOR DPS IP CAMERA EQUIPMENT

A. SYSTEM PRE-SETUP
1. Harris Health Network security requires all devices be registered before activation. Provide device mac address(es) at least two weeks before planned installation date
2. To receive a static IP address, provide device switchport information and equipment mac addresses at least two weeks before planned installation date. Submit information on DPS excel template.

B. SYSTEM SETUP
1. Once device is communicating and stable on network, change default password. Obtain current Harris Health DPS IP camera password.
2. Change settings so that camera cannot be viewed or access without password.
3. Confirm with owner for desired view and focal point.

1.01 ATTACHMENT 6 – PROGRAMMING INSTRUCTIONS FOR DPS VMS SYSTEM

A. SYSTEM SETUP
   1. All NVR Systems are to be setup for access on the existing American Dynamics Victor Video Management System.
   2. Upon request, setup saved views of project cameras per the owner's direction
   3. Upon request, setup video motion alarms of project cameras per the owner's direction.

END OF SECTION 28 13 00

SECTION 28 46 00 - FIRE ALARM AND SMOKE DETECTION - NEW

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Final planning and design of an NFPA 72 compliant microprocessor-based addressable fire alarm and detection system. The installing contractor shall be responsible for providing the final planning and design of the system in accordance with the Texas Board of Engineers Policy Advisory Opinion titled “Planning of Fire Alarm Systems” approved on April 22, 2004. The contractor shall fully familiarize themselves with that document and comply with its requirements in every respect. The information given on the contract documents is intended to fulfill the minimum information requirements of the policy advisory, including the applicable prescriptive codes and standards and the specific building use and/or occupancy classification. The Contract Documents, in addition to the meeting the minimum requirements of the policy advisory, include additional requirements regarding the function, performance and operation of the devices and system to be used in planning system. Any device placement locations and quantities depicted on the plans are intended to be used only for initial guidance in the contractor’s final planning and design. The contractor shall provide additional devices and revise locations as required to provide a design and installation fully complying with both applicable codes and additional contract requirements including but not limited to:
1.

B. Furnishing, installing and testing of the system to provide a complete and working system.

1.2 REFERENCES

A. Referenced Publications:

1. NFPA 1, Uniform Fire Code
2. NFPA 13, Standard for the Installation of Sprinkler Systems
3. NFPA 14, Standard for the Installation of Standpipe and Hose Systems
4. NFPA 70, National Electrical Code
5. NFPA 72, National Fire Alarm Code
6. NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems
7. NFPA 101, Life Safety Code
8. IBC – International Building Code
9. IFC – International Fire Code
10. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems
11. UL Standard 268A, Smoke Detectors for Duct Application
12. UL Standard 346, Waterflow Indicators for Fire Protective Signaling Systems
13. UL Standard 521, Heat Detectors for Fire Protective Signaling Systems
14. UL Standard 864, Control Units for Fire Protective Signaling Systems
15. UL Standard 1424, Cables for Power-Limited Fire Protective Signaling Systems
16. UL Standard 1480, Speakers for Fire Protective Signaling Systems
17. UL Standard 1481, Power Supplies for Fire Protective Signaling Systems
18. UL Standard 1711, Amplifiers for Fire Protective Signaling Systems
19. UL Standard 1971, Signaling Devices for the Hearing Impaired
20. TAS-Texas Accessibility Standards

1.3 SYSTEM DESCRIPTION

A. Provide a complete and working digital, addressable, closed-circuit, automatic and manual fire detection/alarm system to perform detection, monitoring, and alarm functions for the building.

B. All system product lines must be comprised of components capable of providing the following features when specifically required in the project documents:

1. Private alarm notification.
2. Positive alarm sequence.
3. Voice alarm notification.
4. Smoke control/fan shutdown.
5. Door hold-open release.
6. Release locks on normally locked egress doors.
7. Release of clean agent and/or pre-action sprinkler systems.
8. Monitoring of fire suppression systems.
9. Multiple channel voice

C. Provide audible alarming throughout the building in accordance with NFPA 72.

D. Provide visual alarming to TAS requirements throughout the building.

E. The equipment furnished shall be listed and approved by a testing laboratory that has been approved by the State of Texas Commission on Fire Safety. This listing shall be for all functions required by this specification.

F. All systems must comply with applicable paragraphs of the National Electric Code.

1.4 SUBMITTALS

Prior to installation, the following documents shall be provided to Owner for reference and/or approval:

A. Specification Review: Provide a complete item by item, line by line specification review indicating compliance with the specifications and note any deviations from the specification with reason for deviation.

B. Shop Drawings: Include manufacturer's name, model numbers, ratings, power requirements, equipment layout, conduit, device arrangement, and complete point to point wiring diagrams along with other required information including but not limited to:

1. General Drawing Notes
2. Electrical back box requirements
3. Control Equipment Schedules
4. Panel Schematics showing all connections, between modules within panels, to all modules from field wiring with zones identified.
5. Riser Diagrams indicating circuits, type of devices, number of devices, number of conductors, conduit size, junction boxes, and zones.
6. Scaled floor plans with layout of all devices with point numbers for initiating and notification devices, wiring connections, zoning, wire sizes and routing.

    a. Wattage setting for each speaker labeled adjacent to the speaker
    b. Candela rating for each strobe labeled adjacent to the strobe

7. Detailed Legend
8. Fire safety and related symbols shown on Drawings and diagrams shall comply with NFPA 170.
9. Detailed input/output matrix.

C. Product Data: Provide electrical characteristics, connection requirements and compatibility listing showing that components are compatible with each other including but not limited to:

1. Full equipment list including model numbers and quantities
2. Complete system operation
3. Highlighted Data Sheets on Devices and Products

    a. Fire Alarm Control Panel
    b. Wiring
    c. Batteries
    d. Detectors
    e. Manual Stations
    f. Audible Signaling Devices
    g. Visual Signaling Devices
    h. Control Devices

4. Wiring diagrams of all equipment
5. Installation instructions for all equipment
6. Equipment testing procedures
7. Equipment maintenance manuals
8. Wire data sheets.

D. System Calculations – Complete calculations shall be provided which show the electrical load on the following system components:

1. Each system power supply, including stand alone booster supplies.
2. Standby Battery Calculations plus a 20 percent derating factor.
3. Voltage drop calculations for each type of circuit. (Identify all mathematical formulas, variables and constants.)
4. dB loss calculations for speaker circuits.
5. Speaker circuit loading and amplifier loading.
6. Strobe circuit loading.
7. Each auxiliary control circuit that draws power from any system power supply.

E. Software and Database Information:

1. Proposed point numbers.
2. Labels of all addressable devices.
3. English action messages.
4. Add Programming rules, Equations, with comments listed.

F. The submittal package shall be signed by State of Texas Alarm Planning Superintendent (NICET III) or signed and sealed by a Professional Engineer (P.E.) registered in the State of Texas.

G. The Contractor shall provide a signed "Fire Alarm Certification and Description" for each system, consisting of completed copies of the appropriate pages from NFPA 72, at the final Acceptance Test.

H. Provide staff installation superintendents who are licensed by the State Fire Marshal's office for such purpose and under whose supervision installation, final connections, and testing will be performed.

1.5 QUALIFICATIONS

A. Installer Qualifications:

1. Authorized and designated representative of fire alarm manufacturer to sell, install, and service proposed manufacturer's equipment. Verify equipment supplier has technical factory training specifically for the system proposed.
2. Licensed by State Fire Marshal to sell, install and service fire alarm systems.
3. Actively engaged in business of selling, installing, and servicing fire alarm systems for at least five years with minimum of ten such installations completed and operating properly.
4. Equipment furnished shall be of current manufacture.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP)

A. Acceptable Manufacturers/Models:

1. Honeywell Notifier Onyx.
2. Edwards EST.
3. Siemens.
4. Simplex Grinnell.

B. All fire alarm control panels must be intelligent, addressable Central Processing Unit (CPU) based and meets the latest edition of UL 864.

C. All FACPs must be capable of providing circuit integrity monitoring for all Signaling Line Circuits at a level of Class A, Style 6, as defined in NFPA 72.

D. All FACPs must be capable of providing circuit integrity monitoring of Initiating Device Circuits (IDC's) at a level of Class B as defined in NFPA 72.

E. All FACPs must be capable of providing circuit integrity monitoring of Notification Appliance Circuits (NACs) at a level of Class B as defined in NFPA 72.

F. Panels shall have provisions for smoke detector "Alarm Verification" for Signaling Line Circuits must be provided.

G. Manufactured terminal boxes labeled “FIRE ALARM TERMINAL BOX” Space Age TC series or equal.

H. With each installed field device affix a label to indicate the devices full address on its signaling line circuit.

I. Mark each cable or wire to designated terminal with labeling tool.

J. All FACPs must provide twenty percent (20%) excess power supply, input circuit, and output circuit capacity at final acceptance to allow for future expansion by the Owner.

K. Zone labeling must be textual by alpha-numeric display at the FACP and remote annunciator to allow “first response” by persons not trained in fire alarm technology.

L. Textual (alpha-numeric) language must be conventional, concise, clear and accurate to facilitate rapid response.

M. All FACPs must provide a control to silence the Public Alarm to allow for maintenance and testing, and to reduce disruption.

N. All FACPs must provide a control to override the smoke control/fan shutdown feature to allow for maintenance and testing. Program panel to allow functions to be disabled by floor or by group as required by Owner.

O. All FACPs must be connected to a Primary and Secondary Power source. The secondary power supply must be sized to provide 5 minutes of operation in alarm conditions after 24 hours of system operation in standby power. Where voice evacuation systems are utilized, 15 minutes of alarm shall be provided.

P. All FACPs must provide a separate digital address for each initiating device to facilitate rapid response and maintenance and testing.

Q. All FACPs must provide a separate digital address for each individual flow switch.

R. All programming must be permanent and non-volatile to reduce outage time due to failure.

S. All FACPs must be listed and approved as the smoke detector sensitivity test set to reduce maintenance costs.

T. All FACPs must be capable of providing drift compensation. Drift compensation is considered equal to adjustability at the detector.

U. All FACPs must be field programmable, using internal or connected components, for all changes, alterations, modifications, additions, deletions and hardware and software upgrades.

V. All messages shall be recorded in a female voice.

W. All FACPs must be capable, using internal or connected components, of generating comprehensive reports for sensitivity, verification counts, address registers.

X. Where a clean agent fire suppression system and/or pre-action sprinkler system is specified for the project, the FACP must be UL listed for releasing service the pre-action and/or clean agent system specified in Section 21 20 00. Initiating devices shall be connected to a UL listed releasing panel. All initiating, output and releasing circuits shall reside in one fire alarm control panel.

Y. A fault isolation device shall be provided electrically between each building level. This device shall be capable of automatically isolating wire-to-wire faults on each SLC to the building level involved. The device shall be powered by the SLC loop. The device shall provide visual indication at the device of a short circuit (isolate) condition. The device shall reset to the normal mode upon elimination of the wire-to-wire short. All fault isolation devices shall be physically located within the marshaling box for that floor.

2.2 REMOTE MONITOR

A. All systems must be capable of interconnection to the monitoring service selected by Owner via a dial-up modem to monitor:

1. Alarm
2. Waterflow
3. Supervisory
4. Trouble

2.3 DISTRIBUTED POWER SUPPLIES

A. Distributed power supplies for powering Notification Appliance Circuits, beam smoke detectors, and control relays may be used.

B. All distributed power supply inputs must be controlled by addressable interface devices located on the same floor levels as the power supply and controlled by the SLC serving the area to facilitate maintenance.

C. The distributed power supplies must be sized to provide 5 minutes of operation in alarm after 24 hours of system operation in standby power. Where voice evacuation systems are utilized, 15 minutes of alarm must be provided after operation in standby power.

2.4 MANUAL PULL STATIONS

A. All manual pull stations must be of the "double-action" type with local alarm to reduce unintentional or vandal alarms. Pull stations required to break glass to activate are not acceptable. Provide pull stations that utilize the same key as FACP for resetting.

B. Each manual pull station must have a unique digital address on the SLC.

C. Where separate addressable monitor modules are used for monitoring conventional type manual pull stations, the modules are required to be installed within the manual pull station back box.

2.5 HEAT DETECTORS

A. All heat detectors shall be fixed temperature, rate-of-rise, or combination fixed temperature and rate-of-rise, spot type.

B. Each addressable heat detector must have a unique address on the SLC.

C. Non-resetting detectors must give visual indication of "ALARM" condition to facilitate rapid response.

D. Where separate addressable monitor modules are used for monitoring conventional type heat detectors, the modules are required to be installed within the heat detector junction box.

2.6 SMOKE DETECTORS

A. All spot type smoke detectors shall be photoelectric or combination photoelectric and ionization type.

B. Each smoke detector, whether spot-type, or projected-beam type, must have a unique digital address on the SLC.

C. All smoke detectors must be field measurable and adjustable for sensitivity.

D. All smoke detectors, except projected beam type, must be powered from the SLC.

E. The FACP must function as the smoke detector sensitivity test set and must be approved and listed for that service.

F. All smoke detectors must meet or exceed the requirements of Underwriters Laboratory Standard 268, as amended, and must be listed and approved for use with the FACP provided.

2.7 DUCT-MOUNTED SMOKE DETECTORS

A. It is the joint responsibility of the Fire Alarm and the Mechanical Contractors to assure that all supply and return air is sampled as required per NFPA 90A. Label duct work and direction of air flow and identify the proper locations for duct detectors. Provide only addressable system duct detectors, factory installed duct detectors within the air handling unit are not acceptable.

B. For duct detectors mounted above ceiling and/or in locations not visible from the floor, provide remote LED indicator recessed flush with ceiling and at rooftop unit control cabinet. Installation locations to be reviewed with the AHJ.

2.8 WATERFLOW SWITCHES

A. Fire detection/alarm systems must be interconnected to the fire sprinkler systems by waterflow switches must be set for a 60 second delay (retard) prior to the “ALARM.”

B. Each waterflow switch must be monitored for a unique digital address on the SLC.

C. It is the responsibility of the Sprinkler Contractor to locate the waterflow switches to assure indication of water flow within the building and at each level of the building to reduce water damage.

2.9 SUPERVISORY (TAMPER) SWITCHES

A. Connect tamper switches installed on all sprinkler or standpipe system valves to the fire alarm system to indicate closing or opening of the valves.

2.10 AUDIBLE APPLIANCES

A. Fire alarm system audible notification appliances are required to be provided by speakers in all buildings. The fire alarm speakers will also be utilized by the mass notification system for audible notification. The fire alarm signal generated must be the distinctive three-pulse temporal pattern described by NFPA and ANSI codes.

B. The Evacuation Signal produced by the speakers must be alternated with a custom textual message as indicated in Section 3.07 below.

C. Provide audible systems with voice intelligibility measured in accordance with the guidelines in Annex A of IEC 60849, Sound Systems for Emergency Purposes. When tested in accordance with Annex B, Clause B1, of IEC 60849, the system shall exceed the equivalent of a common intelligible scale (CIS) score of 0.70.

2.11 VISUAL APPLIANCES

A. All visual notification appliances must be xenon strobe, compliant with current requirements of ADA and TAS.

B. All visual notification devices within a room or adjacent space within the field of view must be synchronized as required per NFPA 72.

C. Strobes used in combination systems where the same strobe is used for both mass notification and fire notification shall be clear or nominal while meeting the listing requirements of UL 1971 and either have no marking or be marked with the word “ALERT” stamped or imprinted on the appliance and be visible to the public.

2.12 REMOTE ANNUNCIATOR

A. When required by the project, an LCD remote annunciator shall be located in an open accessible area at or adjacent to the main ground level entrance to the building. The FACP may then be located in a remote location or room.

B. Remote annunciator must display the same addressable and common signal information as the main FACP.

2.13 MONITORING DEVICES

A. Addressable monitoring devices used to monitor contact-closure initiating devices such as waterflow switches, and tamper switches must derive power from the SLC to which they are connected.

B. Each monitoring device must have a unique digital address on the SLC.

C. Monitoring devices used to interface smoke detectors to the SLC shall be limited to existing spot type smoke detectors or duct-mounted smoke detectors.

2.14 CONTROL DEVICES

A. Addressable control devices must not control more than one type of appliance/device.

2.15 DOCUMENT STORAGE

A. Documentation storage shall be provided at or adjacent to (within five feet of) the FACP. This storage shall be capable of storing and securing all documents required for system maintenance and response. Storage shall be separated from all active electrical, electronic, or electromechanical parts and components. If adequate, storage may contain unconnected spare/repair parts.

PART 3 - INTERCONNECTION AND OPERATION

3.1 SIGNALING LINE CIRCUITS (SLC)

A. All FACPs must provide circuit integrity monitoring for all Signaling Line Circuits at a level of Class A, Style 6.

B. All the following devices/appliances must be individually addressed on the SLC:

1. Smoke detectors.
2. Heat detectors.
3. Manual stations.
4. Monitor devices.
5. Control devices.
6. IDCs.
7. Audio NACs.
8. Visual NACs.

3.2 INITIATING DEVICE CIRCUITS (IDC)

A. Initiating Device Circuits (IDCs) must be monitored at a level of Class B.

3.3 NOTIFICATION APPLIANCE CIRCUITS (NAC)

A. All Notification Appliance Circuits (NACs) must be monitored at a level of Class B.

B. Direct current notification appliance power provided from a distributed power supply must be controlled by a digital addressable control device on the SLC.

C. Audible notification appliances and visual notification appliances must always be connected to separate NACs to facilitate maintenance.

3.4 AUXILIARY FUNCTIONS

A. Locate control devices utilized for operating auxiliary functions mounted within 3 feet of the system being controlled as required per NFPA 72.

3.5 POSITIVE ALARM SEQUENCE

A. Positive alarm sequencing shall be permitted.

3.6 VOICE ALARM NOTIFICATION

A. The audible portion of the Public Alarm for all systems must be Voice Alarm. Provide speakers for annunciation of voice messages. Signals generated must be the Distinctive Evacuation Signal (three-pulse temporal pattern) alternated with a digitized custom textual message.

B. Audible message required for voice evacuation shall be selected by Owner.

C. The digitized audible message shall sound twice, and then the three pulse temporal pattern shall resume.

D. The FACP shall provide a microphone and associated controls to allow voice paging to selected areas.

3.7 FAN SHUTDOWN

A. Initiation by duct-mounted smoke detectors must cause shutdown of associated air handling units and supervisory signal at the fire alarm control panel. Motor control circuits must not be routed through the housing.

B. The SLC must connect to a control device within three feet of the motor starter or other approved location to interrupt the motor control circuits.

C. The control device must be assigned a unique digital address on the SLC.

D. A "BYPASS" control must be provided at the FACP.

E. Where a smoke control system is provided, connect FACP to smoke control panel for initiation of smoke control system and associated dampers in accordance with NFPA 92A and NFPA 92B. The smoke control panel, provided by others, is required to comply with UL 864 and listed as smoke control equipment.

3.8 AUTOMATIC DOOR CONTROL

A. Automatic Release-to-Close

1. Smoke control doors normally held open electrically must be allowed to close upon any "ALARM" condition.

B. Automatic Unlock

1. Access control doors normally electrically locked for security must unlock on any "ALARM" condition.

3.9 WIRING

A. Basic wiring materials and installation must comply with NFPA 70.

B. Conductor sizes must be sized in accordance with NFPA 72 and NFPA 70 to provide the minimum required voltage drop.

C. Install wiring in conduit or raceway where required per NFPA 70.

D. All system wiring shall be color coded in accordance with the following:

1. Power Circuits – Black
2. Strobe Circuits – Yellow or White
3. One-Way Voice Speakers – Blue
4. Signaling Line Circuits, Initiating Device Circuits, Network Communications Cable – Red
5. Grounding Conductor – Green

E. Circuits extending beyond buildings

1. Where circuits are required to extend outside of the building, wiring must be provided with primary protectors in accordance with NFPA 70 Article 760 and Article 800.

PART 4 - SPECIAL CONDITIONS

4.1 GENERAL

A. It is the responsibility of the Contractor to assure that there is no disruption of Owner’s normal functions during construction such as studying, testing, class, research or administration.

4.2 CONNECTING TO EXISTING SYSTEMS

A. Operations of and connections to existing fire alarm systems must be supervised and/or coordinated by Owner.

B. Existing systems must remain operational during modifications or additions to the existing system throughout the duration of the project.

C. Where part or all of the existing fire alarm system is required to be demolished, remove the existing fire alarm components only after the new system installation is complete and accepted by the Fire Safety Systems Shop and FPS AHJ.

PART 5 - TESTING

5.1 GENERAL

A. Upon completion of the system, the Contractor must perform a complete and comprehensive test of the entire system in accordance with the provisions of NFPA 72. Contractor shall document their testing electronically using logging software commonly available.

B. It is the responsibility of the Contractor to demonstrate to Owner that the system is installed and functions in accordance with the project documents and applicable codes.

5.2 SPECIFIC TESTS

A. An acceptance test will be conducted at the completion of each project. The test will be the responsibility of the contractor and must be performed in strict compliance with the provisions of NFPA 72.

B. In addition to the provisions of NFPA 72 and/or the above paragraph, it is the responsibility of the Contractor to provide all of the following:

1. Smoke detector sensitivity report.
2. Pressure differential readings for duct detector sample air flow.
3. Closed loop resistance and EOL resistance readings for all field wiring.
4. Programming volatility test.

C. Fix Deficiencies:

1. A copy of the formatted checklist shall be transmitted to the Contractor to serve as a punch-out list for the correction of the noted deficiencies. The Contractor shall notify the verifying party in writing that the deficiencies have been corrected along with a copy of the punch-out list with the corrected deficiencies initialed by the Contractor to indicate the corrections.
2. The Contractor shall provide updated certification forms as set forth in Section II Certification of this document.

D. Fire Alarm Testing Overview:

1. Note: The Owner may, at its sole option, require the assistance and/or participation of the Contractor in this testing.

Fire Alarm System Testing Overview		
	Contractor	General Contractor
I. Contractor’s Test	X	X
II. Contractor’s Certification	X	X
III. Fix Deficiencies	X	X
IV. Retest	X	X
V. Certification		
VI. Owner Test and Acceptance	X*	X*

PART 6 - DOCUMENTATION

6.1 GENERAL

A. A documentation package must be provided by the Contractor before final testing with the Owner and FPS AHJ that shall include all information needed to allow the Owner to perform additions, modifications, maintenance and repair of the system.

B. This must include:

1. Equipment schematic diagrams for all components and modules.
2. Equipment technical data.
3. Field device address register.
4. Equipment repair parts lists.
5. Programming disk with all system software required for a re-start after traumatic failure. Software must be of appropriate and compatible update version for the firmware installed including hardware key, if required.

C. "As-built" wiring, conduit diagrams to include:

1. Floor plan layout drawings showing all significant conduit routes and sizes, wire amounts, sizes and color code and marshaling box locations.
2. Riser diagram showing all significant conduit routes and sizes, wire amounts, sizes and color code and marshaling box locations.

D. Floor plan device layout drawing to include:

1. All initiating device locations and digital addresses.
2. All notification appliance locations and NAC digital addresses or device number.
3. All control device locations and digital addresses.
4. All monitor device locations for supervisory switch groups.
5. All distributed power supply locations and digital addresses.
6. Schematic representation of all SLCs, NACs, control circuits, audio circuits and power circuits.

E. Riser diagram to include:

1. All initiating devices with their electrical location and digital address on the SLC.
2. All notification appliances with their electrical location and device number or digital address on the SLC.
3. All control devices with their electrical location and digital address on the SLC.
4. All supervisory switch locations and their interconnection to the monitor device (IDCs).
5. All monitor devices with their electrical location and digital address on the SLC.
6. All distributed power supplies with their associated wiring and digital address(es) on the SLC.
7. Schematic representation of all SLCs, NACs, audio circuits and power circuits.

F. Interconnection diagram(s) for all internal components of the Fire Alarm Control Panel.

G. State of Texas or NFPA certification form.

H. Programming guide for the functional programming to provide for field changes to the zone schedule or other operational features.

I. Backup copy of the operating system and/or all resident programming, software or firmware, which would be required to restore the system to full operation after a complete failure or equipment replacement.

J. A system hardware component capable of storing and transporting the above listed programming and operating systems and reports.

K. Provide factory logging software for periodic testing.

6.2 WARRANTY AND MAINTENANCE

A. The contractor shall warranty all materials, installation and workmanship for one (1) years from date of acceptance by the Owner, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.

B. Materials, installation or workmanship found to be defective during that period shall be replaced without cost to the Owner. This Contractor shall initiate repair of any warranty defects within 8 hours of notification of such defects and shall be repaired within 24 hours.

C. The warranty or any part of the warranty shall not be made void by any required operation or inspection of the system after acceptance during the warranty period. The Owner will use its own personnel to provide required tests and inspections.

D. If the Owner experiences more than two factitious or unexplained false alarms or troubles in any 24-hour period while the system is under warranty, the Contractor shall provide the necessary labor, materials, and technical expertise to promptly correct the problem(s) at no cost to the Owner.

E. The fire alarm contractor shall maintain a service organization with adequate spare parts stock within 75 miles of the installation.

F. Spare Parts - The Contractor shall supply the following spare parts:

1. Automatic detection devices: Two (2) percent of the installed quantity of each type.
2. Manual fire alarm stations: Two (2) percent of the installed quantity of each type.
3. Modules: Two (2) percent of the installed quantity of each type.
4. Audible and visible devices: One (1) percent of the installed quantity of each type and color, but no less than two (2) devices.
5. Keys: A minimum of three (3) sets of keys shall be provided and appropriately identified.

6.3 TRAINING

A. Provide services of manufacturer's representative to instruct Owner's personnel in operation and maintenance of system for a minimum of two 4 hour sessions.

END OF SECTION

SECTION 31 11 00 - CLEARING AND GRUBBING

PART 1 - GENERAL

A. Subsurface data is available from the Architect. Contractor is urged to carefully analyze the site conditions Survey is available from C.L. Davis & Co Land Surveying and shows the information regarding topography, site entities, pavement materials and underground utilities. Geotech report is available from Terracon dated March 6th 2025.

1.1 SCOPE

A. This section pertains to the specifications for clearing and grubbing, topsoil removal and stockpiling, disconnecting, capping or sealing, and abandoning site utilities in place, and disposal of all vegetation, rubbish and excess material, as required for site grading and related staging areas as noted on the drawings and in accordance with these specifications. Protecting existing trees, shrubs, groundcovers, plants, irrigation system, and grass to remain shall be dictated by Landscape Architect.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 01 Specifications apply to this section.

B. Section 02 41 13 Selective Site Demolition

C. Division 02 Section “Existing Conditions” for demolition of buildings, structures, and site improvements.

D. Section 31 22 13 Site Grading

E. Section 31 23 33 Trenching Backfill and Compaction

F. Section 31 25 00 Erosion and Sedimentation Control

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

C. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.

D. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner's rep. Unauthorized excavation, as well as remedial work directed by the Owner's Rep shall be at the Contractor's expense.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographic and/or video graphic documentation, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements must be prepared. Unless otherwise documented, any damage discovered to trees, plantings, and site features denoted to remain, will be considered the responsibility of the contractor to correct. The owner may at his/her discretion request such photographs and/or video tapes be submitted at any time.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated on drawings to be salvaged and store on Owner's premises where indicated. Contractor to contact Owner for coordination.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place

D. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

E. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

F. General site narrative - Based on Google Earth imagery, the southern part of the site had an existing building which was demolished and is currently a landscape area which will be developed as a new clinic and associated parking lot. The northern side has an asphalt parking lot that will be renovated and extended. The street in the middle is currently a public street which will be converted to a private street to support the new development layout.

G. Staging Areas - Approval must be obtained from the Owner to use any area for staging that is not specifically identified as such on the plans. The Contractor shall restore all areas used for staging, the extent of said restoration to be defined by the Owner upon granting approval for the use of said area for staging.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section 31 22 13 "Site Grading."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

C. Locate and clearly flag trees and vegetation to remain or to be relocated

D. Control dust and noise, perform work in accordance with the requirement of authorities having jurisdiction. No explosives are permitted. No on-site burning is permitted.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures per Section 31 25 00 “Erosion and Sedimentation Controls”.

B. Provide measures according to a sediment and erosion control plan, specific to the site, which complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal

3.3 TREE PROTECTION

A. Refer to Tree and Shrubbery Preservation Sections.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities. Contractor is responsible for any service charge required for shut-off action. If other outstanding fees or billings are encountered, the Contractor shall notify the Owner for direction.

B. Known utilities are shown on drawings. If utility discovered that is not shown contact Engineer for direction. Do not interrupt unknown utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's written permission.

3.5 CLEARING

A. Construction - That portion of the site required for constructing the work under these specifications shall be cleared of all vegetation, such as trees, brush, grass and weeds and all other objectionable matter to the limits as depicted in the plans. Stumps and roots shall be completely removed.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 STRIPPING

A. Topsoil stripping:

1. Remove sod and grass before stripping topsoil.

2. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. A minimum of six (6) inches of soil shall be stripped.
   a. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

3. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   a. Limit height of topsoil stockpiles to 72 inches.
   b. Do not stockpile topsoil within tree protection zones.
   c. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

4. Strip man-made fills under structures and pavements to minimum 12" below the ground surface and dispose of all waste materials.

B. At all times during clearing and stripping operations the area shall be kept in a manner to prevent ponding. Refer to Section 31 25 00 "Erosion and Sedimentation Control."

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal of cleared materials - Subject to approval of the Owner, material from clearing operations shall be disposed of by removal from the worksite.

1. Disposal of Materials by Burning.
   a. The Contractor shall secure the necessary burning permits. All burning shall be in accordance with State and local laws.
   b. All materials to be burned shall be piled in designated burning areas in such a manner as will cause the least fire hazard. Burning shall be thorough and complete and all charred pieces remaining after burning, except for scattered small pieces, shall be removed from the construction area and disposed of as otherwise provided below.
   c. The Contractor shall, at all times, take special precautions to prevent fire from spreading beyond the piles being burned and shall be liable for any damage caused by his burning operations. The Contractor shall have available, at all times, suitable equipment and supplies for use in preventing and suppressing fires and shall be subject to all laws and regulations locally applicable for pre-suppression, and prevention of fires.

2. Disposal of Material by Removal
   a. Material disposed of by removal from the construction area shall be removed from the areas prior to the completion of the work under these specifications. All materials removed shall become the property of the Contractor.
   b. Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any necessary arrangements with private parties and with local officials pertinent to locations and regulations of such dumping. Any fees or charges required to be paid for dumping of materials shall be paid by the Contractor.
   c. In hauling any material from the site, it shall be the responsibility of the Contractor to prevent debris from dropping from vehicles and littering the site or area streets and roads. The Contractor shall promptly remove any debris which falls from vehicles.
   d. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities

3.9 STOCKPILING

A. All topsoil from the stripping operations shall be stockpiled in the areas so designated on the drawings. Materials shall be deposited and spread in such a manner to ensure proper drainage and prevent severe erosion of the stockpile.

B. 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.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

END OF SECTION

SECTION 31 22 13 - SITE GRADING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the earthwork generally consisting of excavation, filling, backfilling and subgrade preparation as required for construction of site retaining walls/structures, slab on grade walks, pavement surfaces, landscaped areas and the general shaping of the site as shown, described or reasonably inferred on the drawings.

B. Subsurface data is available from the Owner. Contractor is urged to carefully analyze the site conditions. Survey is available from C.L. Davis & Co Land Surveying and shows the information regarding topography, site entities, pavement materials and underground utilities. Geotech report is available from Terracon dated March 6th, 2025.

C. This section excludes work necessary for building pad preparations. Work within the building footprint and surrounding 5 feet shall be accomplished under technical specification entitled Earthwork inside building area prepared by STRUCTURAL ENGINEER. For questions on work inside the building area contact STRUCTURAL ENGINEER.

D. Construction Means, Methods, Techniques, Sequences and Procedures:

1. The Contractor is solely responsible for, and has sole control over, construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work.

2. Shoring that is required to complete the Work, is considered a method or technique and is the sole responsibility of the Contractor. If a regulatory agency requires a licensed engineer to design, approve or provide drawings for shoring, then it is the sole responsibility of the Contractor to engage the services of a qualified Engineer for shoring design services.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 01 Specifications apply to this section

B. Section 31 11 00 Clearing and Grubbing

C. Section 31 23 33 Trenching, Backfilling and Compaction

D. Section 31 25 00 Erosion and Sedimentation Control

E. Section 32 12 16 Asphalt Concrete Paving

F. Section 32 13 13 Concrete Paving

G. Contractor shall comply with all current, applicable codes and regulations, including the Uniform Building Code.

H. Contractor shall comply as applicable with Standard Specifications for Public Works Construction, Current Edition, including City of Houston and Harris County Amendments (herein after referred to as "Standard Specifications").

I. Geotechnical Data: Subsurface data is available from the Owner. Contractor is urged to carefully analyze the site conditions.

1.3 PERMITS

A. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractors own expense unless otherwise specified in the Contract, Supplementary or General Conditions, all construction permits necessary to complete the site grading according to the plans and specifications.

1.4 APPLICABLE PUBLICATIONS

A. The following specifications of the latest issue listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent required by the references thereto.

1. American Society for Testing and Materials (ASTM).
   a. ASTM D2216 Standard Test Methods for Laboratory Determination of Water
   b. ASTM D7263 Standard Test Methods for Laboratory Determination of Density (UnitWeight) of Soil Specimens
   c. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
   d. ASTM D1140 Standard Test Method for Determining the Amount of Materials Finer than No. 200 Sieve in Soils by Washing
   e. ASTM D2166/D2166M Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

2. Harris County Standard Engineering Design Specifications for Construction and Maintenance of Roads and Bridges
   a. No. 132 Embankments

1.5 PROTECTION OF EXISTING UTILITIES AND ADJACENT WORK

A. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected. Contractor shall contact the local utility coordinating committee or the utility company involved to locate all public and private utility company lines.

B. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner and the governing utility company when determinable and wait for instructions.

C. For private property utilities found, if it is ascertained by Owner that such utility line has been abandoned, properly cap line at a depth approved by Owner or remove line as directed. All work to cap and remove abandoned public utilities found, must be coordinated through the governing utility company.

D. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and damage is caused to said utilities, Contractor shall repair, at his own expense, such damage to the satisfaction of the Owner and the Utility Company.

E. Refer to Specification section 31 11 00 for other site related items requiring protection.

1.6 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

E. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner’s rep. Unauthorized excavation, as well as remedial work directed by the Owner’s Rep shall be at the Contractor's expense.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

G. Unforeseen Excavation: Excavation of material, regardless of its character or nature, below the subgrade elevation required to construct the work as indicated on the drawings or specified herein.

H. Geotechnical Engineer: Person or company contracted by the owner and/or through the architect to provide testing and onsite Geotechnical services during the construction schedule.

1.7 QUALITY ASSURANCE

A. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings."

B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

C. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

D. Testing:

1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Architect, and Contractor.

2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.

3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.

4. All tests shall be performed by the Soil Engineer in accordance with ASTM D 1557, D1556, D2922, D3017, or other test method selected by Geotechnical Engineer.

1.8 PROJECT/SITE CONDITIONS

A. Based on Google Earth imagery, the southern part of the site had an existing building which was demolished and is currently a landscape area which will be developed as a new clinic and associated parking lot. The northern side has an asphalt parking lot that will be renovated and extended. The street in the middle is currently a public street which will be converted to a private street to support the new development layout

1.9 SUBMITTALS

A. Samples: Submit samples of all materials used for Architect's approval wherever specified or as directed by the Architect.

B. Shoring and Slope Protection Design:

1. Prior to beginning any excavation, submit certification to the Architect that the proposed shoring and slope protection system has been accepted and approved by all governing jurisdictions. Certification shall be signed and sealed by the engineer of record for the shoring design.

2. Provide signed letter from the Geotechnical Engineer stating that the proposed design complies with the recommendations of geotechnical reports.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill materials and sources must be approved by the Owner. The Contractor is responsible for providing adequate samples and testing results to the Owner for testing and approval.

B. Select fill per 2.2 below, shall be used beneath all site retaining walls and site structures where fill material is required to achieve the grades and elevations on the plans.

C. General fill per 2.3 below, material shall be used for fill in landscaping areas not supporting structures. Topsoil per 2.4 below, shall be spread over landscape areas as needed.

D. Fill material beneath paving can be per 2.2 and 2.3 below. Regardless of the fill material used, subgrade treatment shall be chemically stabilized for the thickness specified and detailed in the drawings.

E. Material excavated onsite may be used as fills, with prior Geotechnical Engineer approval.

1. Site Materials:
   a. Onsite fill materials shall be free of organic or deleterious products.
   b. As per thr Geotech report, The onsite clay fill soils should be treated with lime in accordance with the TXDOT 2014 Standard Specifications Item 260. The amount of lime should be determined for subgrade soils by conducting laboratory tests just prior to construction.
   c. Moisture content of existing soils may require adjustment for compaction approval.

2.2 SELECT FILL

A. As per the geptech report, the select fill should consists of low-plasticity clay (CL) and/or clayey sand (SC) with a Plasticity Index between 10 and 20.

2.3 GENERAL FILL

A. General fill material shall be used for fill in landscaping areas not supporting structures, but may be used beneath pavement where approved by the Engineer. General fill material may be any native soil free of debris, trash, rocks over 2 inches in diameter and other objectionable material. General fill shall be placed and compacted in lifts not exceeding 12" in thickness to 95 percent standard density as defined by ASTM D 698. Where called for by the plans or by the landscape specifications, the fill shall be kept sufficiently low to accommodate the proper depth of topsoil and related sod or other vegetation.

2.4 TOPSOIL

A. Topsoil material shall be native earthen material suitable for growth of vegetation such as silty and sandy loams. The site stripings may be used as topsoil unless otherwise dictated by the Owner. Topsoil shall be spread over landscape areas to a depth of 4 to 6 inches and compacted to 85 percent of standard density ASTM D 698. Stockpiling of Topsoil may not exceed 6 feet in height.

2.5 SPECIAL DRAINAGE MEDIA

A. All Retaining Wall backfill material shall be clean open-graded crushed rock or gravel, maximum 3/4" particle size in accordance with the Standard Specifications and detail in the geotechnical report.

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.

C. Approved Materials

1. Mirafi 140 filter fabric

2. or acceptable substitution.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection:

1. Prior to performing the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where work may properly commence.

2. Verify that work may proceed in complete accordance with the design.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

C. General

1. Use all means necessary to control dust on or near the site resulting from the performance of the Work. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public, adjacent uses, and concurrent work on site. Moisture level during compaction operations shall not exceed that amount as specified by Geotechnical Engineer.

2. Verify existing grades and dimensions before starting any grading operations. If any discrepancy exists, notify Architect immediately.

3. Use all means necessary to protect all existing features, products, or items designated to remain, as well as all work of this Section. In the event of damage, repair or replace immediately to the approval of and at no additional cost to the Owner.

4. Protect and maintain existing benchmarks throughout the course of the work. Reestablish monuments or stakes disturbed or destroyed during the course of the Work at no additional expense to the Owner.

5. Conduct work so as to avoid injury to persons and damage to adjacent property. Provide appropriate shoring, bracing and barriers, including light when necessary.

6. Coordinate operations with, and provide access to, the Geotechnical Engineer or designated representative during demolition and construction for purposes of testing, investigation and inspection.

D. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

2. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

3. 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.

4. Protect subgrade from excessive drying or excessive moisture.

3.2 EXCAVATION

A. General - Contractor shall complete all excavation required regardless of the variations in hardness, type, or density of materials encountered, to the dimensions and elevations shown on the drawings. When unsatisfactory material is uncovered, that material shall be removed and replaced with select fill, the extent of such excavation to be directed by the Owner. Unsatisfactory material shall be removed to the stockpile area or from the site as directed by the Owner.

1. Unclassified Excavation: Excavation is unclassified and includes excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
   a. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   b. Remedial work due to over-excavation including provision of suitable and stable backfill meeting the degree of compaction required shall be at the Contractor’s expense.

2. Borrow Material: If excavated materials of a suitable nature are not of sufficient quantity to complete the work, contractor may provide borrow material in sufficient quantity to complete the work at Owner’s approval at no additional cost to the Owner.

3. Disposing of Excavated Material: Dispose of excess satisfactory soil material and all unsatisfactory soil material and rock obtained from excavations in accordance with the provisions of this Section.

B. Excavation for Pavement

1. The material exposed after excavation shall be scarified to a depth of six (6) inches and compacted to at least 95 percent of Standard (ASTM D 698) Maximum Density within 2 percent of optimum moisture content of the soil. Where necessary to achieve the required compaction, stabilization methods as outlined in paragraph 3.C.4 of this specification shall be used.

2. Excavation required beneath pavement sections shall comply with elevations and dimensions shown on the plans and detailed sections within a tolerance of plus or minus 0.10 foot. Contractor shall take care not to disturb areas that are designated to be protected or are outside the construction limits. Excavated areas shall be kept free of ground and surface water.

C. Cut Slopes and Ditches

1. Slopes and grades of ditches shall conform to the plans within a tolerance of plus or minus 0.10 foot. No exposed slopes shall be steeper than three feet horizontal to one foot vertical. Where slope protection is specified or called out on the plans, said protection shall be placed as soon as practical, after exposing the slope. Erosion and sedimentation controls shall be implemented in all cut areas as specified in Section 31 25 00, Erosion and Sedimentation Control.

3.3 FILL AND BACKFILL

A. Placement

1. Fill material shall be placed in loose lifts not exceeding eight (8) inches for areas beneath site structures and pavement, and twelve (12) inches for landscape areas not supporting structures. Fill areas shall be compacted to 95 percent of Standard Maximum Density at the proper moisture of that soil as defined by ASTM D 698.

2. Each lift shall be thoroughly compacted and shall have obtained satisfactory density prior to proceeding with the next lift.

3. The top six (6) inches of material beneath vehicular pavement shall be * stabilized after placement as shown in the details.

4. Fill shall be brought up to the proper elevations as determined from the lines, grades, sections and elevations shown on the plans.

5. Construction methods for embankments shall follow Harris County Standard Engineering Design Specifications for Construction and Maintenance of Roads and Bridges Item No. 132 EMBANKMENT.

B. Site Retaining Wall/Structure Backfill:

1. Place granular material as engineered backfill at all building and site retaining walls.

2. Install specified gravel and filter fabric prior to backfill installation. Position according to manufacturer’s recommendations.

3. Place in accordance with applicable portions of the Standard Specifications.

4. Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with (i) ASTM D 698 (ii) ASTM D 1557 ; and not less than the following percentages of relative density, determined in accordance with ASTM D 4253 and 4254, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils). Cohesive soils are defined as those that have more than 50% of the soil material by weight passing the #200 sieve. Compact each lift at the optimum moisture content (□ 2%) to 95% maximum density.

C. Compaction and Finishing

1. Suitable compaction equipment commonly used to meet the requirements for this type of compaction work should be used.

2. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The surface grade shall be consistent with the drainage intent shown on the plans such that no unwanted ponding shall occur.

3. Surface shall not be more than 0.10 feet above or below the established grade, and all ground surfaces shall vary uniformly between indicated grades.

4. Cut material from the site may be used for fill material if approved by Owner. Where cut material is used as fill, each lift of such material shall be properly mixed to obtain a uniform material, with clay being the predominant material when mixed with silt, maintaining a plasticity index less than 20.
   a. Lime stabilization shall be used for clay material and shall conform to Section 31 32 13.19 - Lime Stabilization or 31 32 13.26 Lime-Fly Ash or Fly Ash Stabilization.
   b. Cement stabilization shall be used for sandy or silty materials and shall conform to Section 31 32 13.16 - Cement Stabilization.

3.4 EROSION AND PROTECTION

A. There shall be at all times adequate protection to newly graded areas to prevent soil erosion as provided in Section 31 25 00, Erosion and Sedimentation Control.

B. Soil erosion that occurs prior to acceptance of the work shall be repaired at no expense to the Owner.

C. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

D. 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 Owner’s Testing and Inspection Service; reshape and re-compact.

E. 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.

3.5 GRADING

A. Rough Grading

   1. Cut and fill shall be left sufficiently high to require cutting by fine grading.

   2. Grade to subgrade depths required for controlled internal drainage of site.

   3. Grade to subgrade depths required for construction of finished surface materials. Grades shown on the plans are top of surface elevations regardless of surface material (ie pavement, sidewalks, softscape, landscape, mulch, sod, etc.).

B. Fine Grading

1. Fine grading shall conform to elevations required to insure finished elevations as indicated on the drawings for the finished surface materials required by the project for that area.

2. Provide a smooth transition between adjacent existing grades and new grades

C. Slope grades to direct water away from buildings and to prevent ponding at a minimum of 5% grade for the initial 20 feet, as shown on the drawings or as directed by architect. Maximum cross slope for all walkways shall be 2% for disabled access. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.1 foot (1.2 inches)

2. Walks: Plus or minus ½ inch

3. Pavements: Plus or minus ½ inch

3.6 TESTING AND INSPECTION

A. Testing of Materials and Installed Work

1. Materials and installed work require testing to show that the specifications for the materials and work have been met. The Owner may, at the Owner's expense, take random tests on materials and installed work. The Contractor shall allow free access to material stockpiles and facilities at all times. In fill areas each lift must be tested and approved before proceeding on the next lift. Tests, not specifically indicated to be done at Owner's expense including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.
   a. Testing to be provided by Owner
   b. Testing to be provided by Contractor
      1) All retesting for areas failing the first test.
      2) [LIST OR EXPLAIN TESTING BY CONTRACTOR.]

B. Contractor shall notify Owner 24 hours prior to performing any testing.

C. Maximum density tests per ASTM D 698 shall be taken on all fill materials at a rate of one test for each type of soil to be used and at least one test for every 1000 cubic yards of fill.

D. Field density tests per ASTM D 1556 or ASTM D 2922 shall be taken on all fill material at a rate of one test for every 10,000 square feet and at least one test per lift.

E. All imported fill material shall be approved prior to importing.

3.7 DUST ABATEMENT

A. The Contractor shall comply with applicable Federal, State, and local laws and regulations concerning the prevention and control of dust pollution.

B. During the performance of the work required by these specifications or any operations appurtenant thereto, whether on right-of-way provided by the Owner or elsewhere, the Contractor shall furnish all the labor, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from the contractor's operations from damaging crops, orchards, cultivated fields, and dwellings, or causing a nuisance to persons. The Contractor will

be held liable for any damage resulting from dust originating from the contractor's operations under these specifications.

C. Dust Control shall be accomplished by one of the following methods:

1. Whenever ordered by the Owner, the Contractor shall furnish and distribute over the traveled road surfaces, which have not yet been fully restored, an application of Calcium Chloride. The material used shall be Regular Flake Calcium Chloride having a minimum chemical content of Calcium Chloride of 77%. Unless otherwise specified or ordered by the Owner, rate of application shall be three (3) pounds per square yard of surface covered.

2. Whenever ordered by the Owner, the Contractor shall apply on traveled road surfaces "Bituminous Surface Treatment" in accordance with the current Texas Standard Specifications for Construction of Highways, Streets and Bridges.

D. The cost of sprinkling or of other methods of reducing formation of dust shall be included in the prices bid in the schedule for other items of work.

3.8 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.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

2. Stockpile Topsoil may not exceed 6 feet in height.

3. Stockpiles shall not be located within the floodway. Stockpiles on property within the floodplain shall be at the contractor's risk and only temporary.

3.9 FIELD QUALITY CONTROL

A. General: Testing shall be the responsibility of the Owner and costs of initial testing shall be paid by Owner. Cost of all subsequent testing necessary due to non-compliance with specifications shall be paid by Contractor.

B. Density Test:

1. Density tests shall be performed by an approved commercial testing laboratory approved per ASTM D 1557.

2. Tests shall be performed in accordance with the referenced Standards.

3. Field and laboratory tests for moisture-density relations shall be determined in accordance with ASTM D 1557. The frequency and location of field density tests will be determined by the Geotechnical Engineer.

4. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Owner.

3.10 DRAINAGE CONTROLS

A. Provide all necessary temporary apparatus, pumps, curbs or ditches as required to divert or convey water from any source away from the Work. Do not allow water from any source to accumulate within or damage earthwork.

END OF SECTION

SECTION 31 23 33 - TRENCHING, BACKFILLING AND COMPACTION

PART 1 - GENERAL

1.1 SCOPE

A. This Section specifies the requirements for excavating and backfilling for storm sewer, sanitary sewer, water distribution lines, and all related appurtenances. Excavation and backfill shall be in conformance with the locations, lines, elevations and grades shown on the plans. This section also specifies the requirements for clay plugs that must be installed near building face on all utility trenches including water, storm sewer, sanitary sewer, mechanical, electrical, telecom, data, plumbing and other utility trenches for slab on grade and structural first floor building projects.

B. Subsurface data is available from the Owner. Contractor is urged to carefully analyze the site conditions. Survey is available from C.L. Davis & Co Land Surveying and shows the information regarding topography, site entities, pavement materials and underground utilities. Geotech report is available from Terracon dated March 6th, 2025.

1.2 APPLICABLE PUBLICATIONS

A. The following specifications and standards of the latest issue listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent required by the reference thereto.

1. American Society for Testing and Materials (ASTM).
   a. D 698 – Laboratory Compaction Characteristics of Soil Using Standard Effort.
   b. D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   c. D 4253 - Maximum Index Density and Unit Weight of Soils using a Vibratory Table.
   d. D 4254 - Minimum Index Density and Unit Weight of Soils in Calculation of Relative Density.
   e. D2321-89 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

2. Texas Department of Transportation (TxDOT) Test Procedures
   a. Tex-110-E Particle Size Analysis of Soils
   b. Tex-120-E Soil Cement Testing

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including A-procurement and Contracting Requirements, Division 00 and Division 01 apply to this section.

B. Section 31 23 33 – Site Grading

C. Section 31 41 33 - Trench Safety

D. Section 33 10 00 – Water Distribution System

E. Section 33 30 00 – Sanitary Sewer

F. Section 33 34 00 – Sanitary Force Main

G. Section 33 40 00 - Drainage

1.4 SUBMITTALS

A. 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 soil material proposed for backfill

B. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before excavation begins.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated

1. Notify Owner not less than five days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner’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.

C. Utilities have been located from surveys and available existing records. Not all utilities may be shown on the Drawings. Locate all utilities prior to beginning any construction activities.

D. Where utilities require adjustment or relocation to construct the Work, and those utilities are shown on the Drawings, relocation or adjustment is a part of the Work and shall be completed at no additional expense to the Owner.

E. Where utilities require adjustment or relocation to construct the Work, and those utilities are not shown on the Drawings, notify Architect before proceeding. Relocate or adjust utility as directed. Utility relocation and/or adjustment will be paid for according to the Contract provisions for changes in Work.

F. If utility is damaged by Contractor, notify utility owner and Architect immediately. Repair or replacement of utilities damaged by Contractor, whether utilities are shown on the drawings or not shown on the drawings, shall be Contractor's expense.

1.6 PERMITS

A. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractors own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.7 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

E. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner's rep. Unauthorized excavation, as well as remedial work directed by the Owner's Rep shall be at the Contractor's expense.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

G. Utilities include underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

H. Unforeseen Excavation: Excavation of material, regardless of its character or nature, below the subgrade elevation required to construct the work as indicated on the drawings or specified herein.

I. Bedding Material: Granular material utilized to bed piped utilities placed in trench excavations.

1.8 QUALITY ASSURANCE

A. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 01.

B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

C. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing.

PART 2 - PRODUCTS

2.1 EARTH BACKFILL

A. Earth backfill shall be native soils free of debris, trash, rocks over 2 inches in diameter and other objectionable material.

2.2 CEMENT STABILIZED SAND BACKFILL

A. Cement stabilized sand material shall contain clean bank sand meeting TxDOT Test Method TEX-110-E, water and a minimum of 7% hydraulic cement based on the dry weight of the aggregate meeting TxDOT Test Method Tex-120-E.

B. The sand cement mixture shall produce a minimum unconfined compressive strength of one hundred pounds per square inch (100psi) in forty eight hours, when compacted to ninety fire percent (95%) of Standard Proctor density (ASTM D558), without additional moisture control and when cured in plastic bags at a temperature of 73.4 degrees F at plus or minus 3 degrees F and tested in accordance with ASTM D1633.

2.3 SAND BACKFILL

A. Clean bank sand meeting TxDOT Test Method TEX-110-E.

2.4 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

C. If onsite reclaimed water sources are used, tanks and appurtenance must be clearly marked with the words “non-potable” water.

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 EXCAVATION

A. General:

1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.

2. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five (5)

feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.

3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be removed from the trench sufficiently prior to the line placing operation to insure a dry, firm bed on which to place the utility line.

4. Unclassified Excavation: Excavation is unclassified and includes excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
   a. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   b. Remedial work due to over-excavation including provision of suitable and stable backfill meeting the degree of compaction required shall be at the Contractor's expense.

5. Borrow Material: If excavated materials of a suitable nature are not of sufficient quantity to complete the work, provide borrow material in sufficient quantity to complete the work at no additional cost to the Owner.

6. Disposing of Excavated Material: Dispose of excess satisfactory soil material and all unsatisfactory soil material and rock obtained from excavations in accordance with the provisions of this Section.

7. Where utilities are in fill, compact fill material to 95% standard proctor maximum dry density at least 12" above the top of the proposed utility prior to excavation of trench

8. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer shall be at the Contractor's expense.

B. Sewer Trenches:

1. For pipe sizes less than 42" in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.

2. For pipe sizes 42" in diameter and larger the minimum trench width shall be outside diameter of pipe plus 24 inches.

3. Trenches shall be excavated to a depth at least 6" below the barrel of pipe, and then the pipe bedding shall be placed as shown on the appropriate details contained with the plans and as described in paragraph 3.3 A. of this section.

C. Appurtenances

1. Excavation for manholes, tie-in to existing facilities and similar structures shall be sufficient to leave at least 12" clear between the outer surfaces and the embankment or sheeting that may be used to hold and protect the banks. Any over depth excavation below such appurtenances shall be refilled with cement stabilized sand, as directed, at no additional cost to Owner.

D. Water line Trenches:

1. Water lines must be a minimum of four feet in depth from the top of proposed grade to the top of pipe, unless otherwise shown on the plans.

2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18 inches.

3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe, and then the pipe bedding shall be placed as shown on the details within the plans and as described in paragraph 3.3 B. of this section.

3.3 PIPE BEDDING AND BACKFILL

A. Storm and sanitary sewer trenches:

1. Pipe shall be bedded in trench in accordance with the details shown on the plans. When pipe has greater than twelve (12) feet of cover, use Class A bedding and backfill.

2. Cement stabilized sand shall be per Part 2.2.A of this specification, mixed in a mill type mixer. When the details call for cement stabilized sand bedding, the material shall extend from a point 6" below the bottom of the pipe to the level of the spring line. This material cannot be used after is loses its moisture content.

3. The cement stabilized sand shall be thoroughly rodded after being placed in trench.

4. Bedding, sewer pipe and initial backfill over the top of pipe must be placed in a single day's operation for any given portion of pipe. Initial backfill shall be placed to one foot above the top of pipe for earth backfill and 6 inches over the top of pipe for cement stabilized sand backfill.

5. Remainder of trench backfill shall be placed the next day or later in 8" lifts, after pipe is laid in conformance with these specifications and the details on the plans.

6. Backfill shall be placed in uniform layers not to exceed 8" loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D 698) at the proper moisture content specified in the Geotechnical report for this project.

7. Backfill, under pavement and to one foot from outer edge, shall be cement stabilized sand of the type and method described under paragraph 3.3 A.1 through 5, above, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 3.3 A.5. above and stabilized where required.

B. Water line Trenches

1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.

2. After laying pipe and insuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.

3. For water lines beneath pavement and to one foot horizontally from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed up to the top of subgrade, thoroughly rodded and tamped.

4. For water lines not beneath pavement or within one foot horizontally from the outer edge of pavement, the remainder of the trench backfill shall be earth fill paced in uniform layers not to exceed 8" loose depth, each lift to be compacted to a minimum of 95 percent of Standard Density (ASTM D698) at the proper moisture content specified in the

Geotechnical report for this project. All earth backfill to be placed the next day or later after the pipe is laid.

C. Bentonite Clay Plug for All Utility Trenches (water, storm, sanitary, mechanical, electrical, telecom, plumping, etc.)

1. All trenches must have a bentonite granular clay plug installed to reduce the transmission of ground water under slab on grade buildings and structural first floor buildings.
   a. The plug must be installed at a distance of one foot beyond the face of the building foundation and be a minimum of one-foot wide.
   b. The plug must extend 6” beneath utility trench into undisturbed soil. This portion of the clay plug must be installed prior to the installation of the utility pipe.
   c. The plug must extend across the entire trench width and extend 6” into undisturbed soil beyond the trench width. Install bentonite clay plug and the utility pipe at the same time.
   d. The plug must extend to within 12” of finished grade. A clay plug cap consisting of material with a plasticity index greater than 15 and a liquid limit in excess of 30 shall be placed on top of the bentonite granular clay plug. This clay plug cap shall fill the remaining 12” up to finished grade and be placed up to the edge of the building.

3.4 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.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.5 FIELD QUALITY CONTROL

A. General: Testing shall be the responsibility of Owner and costs of initial testing will be paid by Owner. Cost of subsequent testing necessary due to non-compliance with Specifications shall be paid by Contractor.

B. Density Test:

1. Density tests shall be performed by representatives of Owner’s Testing Agency.

2. Frequency and scope of testing shall be established by Geotechnical Engineer, and as required by local jurisdictional authority.
   If Geotechnical Engineer has not established a frequency of testing in the Geotechnical Report, testing shall be at every 100 linear foot of trench at a minimum of one per lift and a minimum of one per day.

3. Tests shall be performed in accordance with the referenced Standards.

4. Laboratory tests for moisture-density relations shall be determined in accordance with ASTM D 1557. A minimum of one test shall be performed for each major soils type. In addition, sufficient number of retests or check points shall be performed to evaluate accuracy of maximum density values being used.

5. Field in-place density shall be determined in accordance with ASTM Test Methods D 1556 or D 2922, and the moisture-density relations shall be determined in accordance with ASTM Test Method D 1557.

6. Reopen improperly compacted trenches to depth directed, then refill and compact to the specified density at no additional cost to Owner

END OF SECTION

SECTION 31 25 00 - EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the provisions for the control of erosion in the construction area and in stockpile areas including seeding, and the construction of temporary swales as required and shown on the drawings. All areas where existing vegetation and grass cover have been bared by construction activities shall be protected from erosion.

B. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System, Phase II, regulations from the Clean Water Act.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including A-procurement and Contracting Requirements, Division 00 and Division 01 apply to this section.

B. Section 31 11 00 Clearing and Grubbing

C. Section 31 22 13 Site Grading

D. Section 31 23 33 Trenching, Backfilling and Compaction

E. Section 33 40 00 Drainage

F. Texas Department of Transportation’s Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2014)

G. Harris County Public Infrastructure Department Engineering Division Specifications for the Construction of Roads and Bridges within Harris County, TX – latest printing October 2003.

1.3 PERMITS (NOT USED)

1.4 APPLICABLE PUBLICATIONS (NOT USED)

1.5 PROTECTION OF ADJACENT WORK (NOT USED)

1.6 DEFINITIONS

A. Best Management Practices (BMP's) means physical facilities schedules of activities, prohibition of practices, maintenance procedures, and other management practices , when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities. BMP's also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

B. Block Sodding: Sodding for erosion control and for final stabilization shall consist of providing and planting Bermuda grass, Saint Augustine grass, or other acceptable sod along or across such areas as are designated on the drawings and in accordance with the specification requirements herein outlined.

C. Hydromulch Seeding: Seeding, followed by the application of a mulch erosion control blanket shall consist of preparing the ground, sowing of seeds, application of a fertilizer, and stabilization with mulch consisting of a biodegradable fiber along and across such areas as are designated on the plans and in accordance with these specifications

D. Silt Fence: The reinforced filter fabric barrier consists of geotextile fabric supported by a net reinforced fence stretched across and attached to supporting posts or frame and entrenched. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.

E. Inlet Protection Barriers: The inlet protection barrier consists of a geotextile fabric (filter fabric) supported by a net reinforced fence structure and constructed around a storm drain inlet, catch basin, or culvert. An alternative design of the inlet protection barrier, as approved by the Engineer, consists of fiber rolls placed around a frame, staked in place (or weighted down with clean gravel bags), and constructed around a storm drain inlet, catch basin or culvert. This work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation. As designated on the plans and in accordance with these specifications.

F. Sediment Basins: A sediment basin is a temporary basin or dam constructed across a waterway or excavated location to intercept sediment-laden runoff and to trap and retain the sediment. A sediment basin is usually installed at points of discharge from drainage areas greater than 5 acres. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.

G. Stabilized Construction Access: This work shall consist of the installation of temporary erosion protection and sediment control stabilized construction access - type I, rock, utilized during construction operations and prior to final stabilization, in accordance with these specifications and construction drawings

H. Rock Filter Dams: Rock filter dams are temporary berms constructed of stone to intercept and slow storm water runoff to retain sediment on the construction site.

1. Depending upon the type of rock filter dam specified in the construction plans as Type 1, 2, 3, or 4, the aggregate fill may be unwrapped, wrapped in twisted hexagonal wire mesh, or confined in a gabion wire basket. Applications of Rock Filter Dams are as follows:
    a. Type 1 dams may be used at toe of slopes, around inlets, in small ditches, and at dike or swale outlets. Type 1 dams are recommended for erosion and sediment control from a drainage area of 5 acres or less.
    b. Type 2 dams may be used in ditches and at dike or swale outlets.
    c. Type 3 dams may be used in stream flow.
    d. Type 4 sack gabions may be used in ditches and smaller channels to form an erosion and sediment control dam

1.7 QUALITY ASSURANCE

A. Codes and Standards: Install and maintain erosion control systems in compliance with all authorities having jurisdiction.

1.8 PROJECT/SITE CONDITIONS (NOT USED)

1.9 SUBMITTALS (NOT USED)

PART 2 - PRODUCTS

2.1 SUSTAINABLE MATERIALS

A. Contractor shall strive to utilize sustainable materials, which include rapidly renewable materials, regional materials, regionally manufactured materials, regionally extracted materials, recycled contents.

2.2 GRASS

A. Materials for erosion control seeding shall conform to TxDOT Item 164.

B. Materials for erosion control sodding shall conform to TxDOT Item 162.

2.3 FERTILIZER

A. Materials for fertilizing erosion control seeding and/or sodding shall conform to TxDOT Item 166.2

2.4 WATER

A. Use clean potable water for maintaining the grass developed after erosion control seeding and/or sodding. Water shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

C. If onsite reclaimed water sources are used, tanks and appurtenance must be clearly marked with the words “non-potable” water.

2.5 SILT FENCE

A. Geotextile fabric for Silt Fences must meet the TxDOT Departmental Material Specifications DMS 6230 Temporary Sediment Control Fence Fabric.

2.6 STRAW BALES

A. Standard rectangular hay bales bound by baling wire, clean and dry

2.7 INLET PROTECTION BARRIERS

A. Geotextile per 2.5 Silt Fence above.

B. Hardwood Posts shall be 2x2 minimum length 4 feet.

C. Net reinforced fence shall be 2 inch by 4 inch welded wire fabric mesh. The mesh support height shall be the equivalent height, or greater, of the geotextile fabric to be attached.

2.8 STABILIZED CONSTRUCTION ACCESS

A. Materials to be per TxDOT spec section 506.2.E.1 for Type 1

2.9 ROCK FILTER DAM

A. Materials. Geotextile fabric shall consist of a woven monofilament or spunbond nonwoven fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins. Geotextile fabric shall equal or exceed the following average roll values or as directed by the Engineer:

1. Minimum average roll value.
   a. Elongation - 50 percent.
   b. Grab Strength – 200 pounds.
   c. Puncture Strength – 75 pounds.
   d. UV Stability (retained strength) – 50 percent after 500 hours of exposure.

2. Maximum average roll value.
   a. Apparent Opening Size (AOS) – 0.6 mm/#30 US sieve.

B. Geotextile fabric shall be resistant to commonly encountered soil chemicals, mildew, rot, insects, and deterioration resulting from exposure to sunlight or heat. Geotextile fabric shall provide an expected useable life comparable to the anticipated construction period.

C. Aggregate for the rock filter dams shall consist of crushed stone. Aggregate particles shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials or organic and injurious matter. Aggregate shall be cubic or rounded form, not elongated, flat, shapes. Spalls, fragments, and chips shall not exceed 5 percent by weight. Crushed concrete shall not be substituted for the crushed stone unless as approved by the Engineer. Aggregate size shall depend upon the type of rock filter dam specified in the construction plans. Aggregate size based on type of rock filter dam is as follows:

1. Type 1: 3 inches to 5 inches, open-graded.

2. Type 2: 3 inches to 5 inches, open-graded.

3. Type 3: 4 inches to 8 inches, open-graded.

4. Type 4: 3 inches to 5 inches, open-graded.

D. Mesh is required for reinforced type rock filter dams. Mesh shall be 20 gauge galvanized double twisted hexagonal wire mesh with 1-inch diameter hexagonal openings. Mesh wire shall be zinc coated prior to being double twisted. Reinforcing spiral binders, lacing wire, and stiffeners shall

be made of wire having the same coating material and same wire size as the wire mesh. Gabion wire baskets shall equal or exceed the requirements of the wire mesh.

PART 3 - EXECUTION

3.1 GENERAL

A. Protection

1. Protect benchmarks, monuments, existing structures, existing fences, existing roads, existing sidewalks, existing paving, existing curbs, and other features indicated on Drawings to remain, or not indicated to be removed, from damage and displacement. If damaged or displaced, notify Engineer and correct defects as directed.

2. Protect above and below grade utilities which are to remain.

B. Preparation:

1. Use all means necessary to control dust on and near the work, and on and near off-site storage, and spoil areas, if such dust is caused by performance of the work of this Section, or if resulting from the condition in which Project Site is left by Contractor.

2. Moisten surfaces, as required, to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on Project Site.

C. Install erosion control systems at the site's boundary at locations where stormwater runoff will leave the site prior to starting any clearing, stripping, or earthwork operations

D. Minimize the time areas are to be exposed without vegetative cover.

E. Properly dispose of solid waste, paints, solvents, cleaning compounds, etc.

F. Store construction materials in designated areas away from drainageways and low areas.

G. Provide portable toilets and properly dispose of sanitary sewage.

H. Construct containment berms and utilize drip pans at fuel and liquid storage tanks and containers.

3.2 INSTALLATION OF EROSION CONTROL DEVICES

A. Install erosion control devices to protect adjacent and downstream properties from damage and pollution resulting from erosion caused by the work of this Contract.

1. Implement erosion control measures indicated on drawings and additional erosion control measures necessary to prevent damage to adjacent and downstream properties.

B. Install silt fence located along perimeter of site or grading limits immediately following site clearing operations specified under Division 31 Section 31 11 00 Clearing and Grubbing.

1. Install silt fence fabric from a continuous roll for the length of the silt fence whenever possible to minimize the number of joints.

a. Create joints in fabric by securely fastening fabric at the support post with overlap extending to the next post.

2. Drive support post into ground not less than 18 inches.

3. Excavate a 4 inch wide by 4 inch deep trench on up-slope side of silt fence.
   a. Line trench with silt fence fabric material.
   b. Backfill trench with soil or gravel.

C. Install straw bale fence at completion of grading operations in affected area as indicated on drawings.

1. Install erosion control devices at storm sewer inlets immediately after completion of the storm sewer.

2. Place straw bales in a single row, lengthwise on the contour, and embedded 4 inches into soil.

3. Secure each individual bale in place by stakes or reinforcement bars driven through bales into the ground to a depth of not less than 18 inches.

D. Install inlet protection barriers at curb inlets and at area inlets.

E. Install straw bale fences as ditch checks in drainage ditches.

F. Install Stabilized Construction Access per TxDOT specification 506.4.C.5.

G. Rock filter dams shall be installed so as to prevent downstream deposition of sediment and debris from the construction site. Rock filter dams shall be constructed to meet the following criteria:

1. Type 1:
   a. Non-reinforced.
   b. Height: 18-24 inches
   c. Top width: 2 feet minimum.
   d. Upstream and downstream side slope of dam: 2:1 maximum.
   e. Open graded aggregate 3-5 inches.

2. Type 2:
   a. Reinforced with wire mesh.
   b. Height: 18-36 inches.
   c. Top width: 2 feet minimum.
   d. Upstream and downstream side slope of dam: 2:1 maximum.
   e. Open graded aggregate 3-5 inches.

3. Type 3:
   a. Reinforced with wire mesh.
   b. Height: 36-48 inches.
   c. Top width: 2 feet minimum.
   d. Upstream and downstream side slope of dam: 3:1 maximum.
   e. Open graded aggregate 4-8 inches.

4. Type 4:
   a. Reinforced in a gabion wire basket.
   b. Height: 30 inches minimum.
   c. Top width: 2 feet minimum.

d. Upstream and downstream side slopes of dam: none specified.
e. Open graded aggregate 3-5 inches.

5. The separation geotextile fabric and wire mesh shall be sized and placed in accordance with the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The separation geotextile fabric may be omitted only as approved by the Engineer. The separation geotextile fabric and wire mesh shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel prior to aggregate placement. Sack gabions for Type 4 rock filter dams shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel, as well.

6. Aggregate fill shall be placed to the width, length, height and slopes in accordance with this specification and the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The height of the dam shall be measured vertically from the existing ground to the top of the filter dam. The length of the dam shall be measured across the top centerline of the dam from embankment to embankment and includes the additional length embedded into the embankment. Width of the dam shall be measured along the top face of the dam.

7. Wire mesh shall be folded upstream side over the aggregate fill and tightly secured to itself on the downstream side using wire tires. Hog rings may be substituted for wire ties.

8. Additional aggregate fill or gravel bags shall be placed and secured at the embedded section to prevent low flows from short circuiting the dam at the adjacent dirt embankment area.

9. The Contractor shall be responsible for periodic reshaping, repairing, and maintaining of rock filter dams as directed by the Engineer.

10. The Contractor is responsible for removal and proper disposal of sediment and debris from the rock filter dam. Removed sediment and debris shall not be allowed to flush into the storm sewer system, waterways, jurisdictional wetlands, or onto adjacent properties. Sediment deposits shall be removed before they reach one-third of the height of the dam. Uncontaminated sediment can be placed at the project spoil site or, if properly handled, spread out to supplement fill requirements. If sediment has been contaminated, then it shall be disposed of in accordance with the applicable federal, state, and local regulations. Offsite disposal shall be the responsibility of the Contractor. Contractor is encouraged to reuse aggregate and wire mesh if remaining materials meet original spec requirements.

3.3 EROSION CONTROL SEEDING

A. Exposed fill and stockpile areas shall be protected from windborne erosion if the phasing of the construction operations is anticipated to leave the exposed fill and stockpile areas unattended for 6 weeks or more. At completion of stockpiling operations, stockpiles shall be shaped and graded to drain. Provide a layer of mulch to all sides of the stockpile to protect the stockpile from windborne erosion.

B. Areas designated on the drawings to be seeded shall be seeded in accordance to the Texas Department of Transportation Standard Specifications, Item 164, titled "Seeding for Erosion Control". Broadcast seeding method shall be used as described in TxDOT, Item 164.4 unless otherwise instructed.

C. Areas to be seeded with slopes steeper than 10H:1V shall also utilize a soil retention blanket as specified in TxDOT Item 169 Soil Retention Blanket.

3.4 TEMPORARY SWALES

A. Temporary drainage swales shall be provided as required to carry drainage away from the work area to an approved outfall point.

B. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least two (2) feet deep with a slope of 0.1%.

C. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.

D. Swales shall have erosion control barriers as required in these specifications.

3.5 FILL AND CUT SLOPES

A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's Geotechnical engineer.

B. When cut slopes exceed 2:1 for depths over three (3) feet, proper bracing and shoring per OSHA requirements shall be used and maintained.

C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydromulch, seeding, sodding, or other method as approved.

D. Where cut slopes of more than 5 feet deep, extend more than 100 feet in length, contractor shall provide a backfill drain at the top of the slope to ease in drainage and erosion control.

E. Sedimentation ponds shall be provided when designated on the plans.

F. All drainage from cleared areas shall be routed through the sedimentation basin.

G. Contractor will be responsible for the operation and maintenance of the pond during construction.

3.6 MAINTENANCE

A. Check all erosion control measures after each rainfall event to ensure that they are in proper working order.

1. Immediately restore all measures to installed condition.

2. During the course of construction all temporary swales constructed for this contract shall be maintained so as to allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, all temporary swales must be reworked to meet final conditions as set forth in the drawings and specifications.

3. The Contractor shall assure that all sub work with other contractors at the site understand the importance of the erosion control features. The Contractor shall require all subcontractors to respect the function of the erosion control features and enlist their coordination in maintaining existing swales and ditches.

B. Inspect silt and straw bale fences at least once a week.

1. Immediately replace damaged portions of the silt fences, including portions which have collapsed, contain tears, have decomposed, or have become ineffective.

2. Remove sediment deposits, as necessary, to provide adequate sediment storage and to maintain the integrity of fences. Dispose of accumulated sediment by spreading over upland areas of the site.

C. Maintain erosion control devices in place, as specified, until completion of the work of this Contract.

1. At completion of work, inspect all systems, make necessary repairs, remove and dispose of all accumulated sediment, and turn completely operable systems over to Owner for continued maintenance.

D. Where necessary for equipment and vehicular access to the work areas, adequately sized culverts shall be installed and maintained to provide the access without disturbing the site drainage.

3.7 INSPECTIONS

A. Inspect all erosion control systems and devices at least once every seven calendar days.

B. Inspect all erosion control systems and devices within 24 hours of the end of any storm which results in precipitation of 1/2 inch or more.

C. During inspections, locations where stormwater leaves the site shall be inspected for evidence of erosion or sediment deposition.

D. Correct deficiencies within three calendar days.

E. Complete a report of each inspection. Report shall contain the following minimum information:

1. Inspector's name

2. Inspection date

3. Observations of the effectiveness of erosion control systems

4. Actions taken if necessary to correct deficiencies

5. Listing of areas where construction operations have permanently or temporarily stopped

6. Authorized signature

END OF SECTION

SECTION 31 32 13.19 - LIME STABILIZATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for treating and stabilizing existing subgrade material or select fill material under pavements or site structures as shown on the drawings, by pulverizing, adding lime, and finishing to the lines and grades shown on the drawings and constructed as specified herein.

B. This section excludes work necessary for building pad preparations. Work within the building footprint and surrounding 5 feet shall be accomplished under technical specification Excavation and Fill prepared by STRUCTURAL ENGINEER.

1.2 APPLICABLE PUBLICATION

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references thereto:

A. Texas Department of Transportation 2014 Standard Specifications for Construction of Highways, Streets and Bridges (TxDOT):

1. Item 260 - Lime Treatment (Road Mixed).

2. Item 263 – Lime Treatment (Plant Mixes)

B. Texas Department of Transportation Departmental Material Specifications (DMS) latest edition.

1. DMS 6350 – Lime and Lime Slurry

C. American Society for Testing and Materials Standards (ASTM):

1. D 698-07e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Efforts (12,400 ft-lbf/ft3 (600 kN-m/m3))

2. D 1556-07 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including A-procurement and Contracting Requirements, Division 00 and Division 01 apply to this section.

B. Section 31 11 00 – Clearing and Grubbing

C. Section 31 22 13 – Site Grading

D. Section 32 12 16 – Asphalt Concrete Pavement

E. Section 32 13 13 – Concrete Pavement

1.4 DEFINITIONS

A. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.

B. Backfill: Soil material or controlled low-strength material used to fill an excavation.

C. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

D. Geotechnical Engineer: Person or company contracted by the owner and/or through the architect to provide testing and onsite Geotechnical services during the construction schedule.

1.5 SUBMITTALS

A. None required for this section.

1.6 PROJECT CONDITIONS

A. Based on Google Earth imagery, the southern part of the site had an existing building which was demolished and is currently a landscape area which will be developed as a new clinic and associated parking lot. The northern side has an asphalt parking lot that will be renovated and extended. The street in the middle is currently a public street which will be converted to a private street to support the new development layout.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

C. Testing:

1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Architect, and Contractor.

2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.

3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.

4. All tests shall be performed by the Geotechnical Engineer in accordance with ASTM D 698, D1556, or other test method selected by Geotechnical Engineer.

PART 2 - PRODUCTS

2.1 LIME SLURRY

A. Lime slurry for use in treating the subgrade shall conform to the chemical and physical requirements listed in Tables 1 and 2 of TxDOT Departmental Material Specification (DMS) 6350 for Commercial Lime Slurry. Lime Slurry may be prepared at the job site or other Owner approved location by using Hydrated Lime or Quicklime as specified by chemical and physical requirements in Tables 1 and 2 of TxDOT Departmental Material Specifications (DMS) 6350.

2.2 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

C. If onsite reclaimed water sources are used, tanks and appurtenance must be clearly marked with the words “non-potable” water.

2.3 SOIL

A. Soil should be a clayey type soil, free of organic material, large rocks and other unsuitable materials with a plasticity index greater than 15 and a liquid limit in excess of 30. The soil should not contain more than twenty percent sands or silts.

PART 3 - EXECUTION

3.1 GENERAL

A. Construction methods shall conform to the applicable specifications of the TxDOT specifications, Item 260, Lime Treatment.

B. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day.

3.2 APPLICATION

A. The percent of lime to the dry weight of the soil shall be a minimum of five (5) percent to 7 percent. Refer to the Project Geotechnical Report.

B. The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry.

C. The distribution of lime shall be uniformly placed in such quantity that all soil to be treated receives the minimum percentage of lime and successive passes made until the proper moisture and lime content is obtained.

D. The distributor truck shall be equipped with an agitator which will keep the lime and water in uniform mixture unless the prescribed consistency can be otherwise maintained. If an agitator is not used, a standby pump shall be available at the site for agitating the lime and water in case of delays in dispersing the slurry.

3.3 MIXING

A. The material and lime shall be thoroughly mixed by approved road mixers until a homogeneous, friable mixture of material and lime is obtained, free from all clods or lumps.

B. Immediately after the "first mixing" operation, the mixture shall be brought to the proper moisture content and sealed with a light pneumatic rubber tire roller and left to cure for 1 to 4 days, as directed by the Owner. If rework is required to obtain compaction after 72 hours of the last mixing, add 25% of the specified rate of lime.

C. After curing time the material shall be uniformly mixed. All clods shall be reduced in size by raking, blading, disking, harrowing, scarifying or other approved method.

3.4 COMPACTION

A. Compaction of the mixture shall begin immediately after final mixing and in no case later than 3 calendar days after final mixing.

B. The moisture content at time of compaction shall be at optimum to 4 percent above optimum.

C. The mixture when used as pavement subgrade shall be compacted by sheepsfoot rollers or 25 ton pneumatic self-propelled rollers until a minimum density of 95 percent of Standard Maximum Density (ASTM D-698-07e1) is obtained.

D. The mixture when used for support of a building slab or foundation shall be compacted, each lift at the optimum moisture content (2%) to 95% maximum density or 85% relative density. (ASTM D-1557)

3.5 FINISHED SUBGRADE GRADING

A. Surface of the subgrade shall not show any deviation in excess of 1/4 inch above or one inch below established subgrade elevation.

B. The surface shall be uniform and smooth without large clumps or voids.

END OF SECTION

SECTION 31 41 33 - TRENCH SAFETY

PART 1 - GENERAL

A. This Section is intended to provide specifications for the minimum requirements for trench safety. The Contractor shall endeavor to insure the safety of their employees working in and around trenches and other excavations in accordance with current Occupation and Safety Health Administration (OSHA) standards and in particular, Excavations, Trenching and Shoring, Federal OSHA Standards, 29 C.F.R. part 1926, Subpart P, as amended including Final Rule, published in Federal Register Vol. 54, No. 209 Tuesday October 31, 1989 and latest amendment thereto. These specifications outline minimum standards of construction safety to be followed, but should not be construed as the means, methods and operations of construction. Where the Contractor deviates from these outlined minimum standards, the Contractor is required to submit for approval by the Owner sealed engineering plans designed by a Registered Professional Engineer in the State of Texas showing the proposed method of trench protection. A copy of the approved design shall be kept at the site.

1.2 SCOPE OF WORK

A. For all trenches in excess of five (5) feet of depth or for all trenches less than five (5) feet of depth in soils which will not stand up in vertical excavations, the Contractor shall either lay back the sides of the excavation, provide sheeting and shoring to hold the walls of the excavation in place, or use a trenching box meeting or exceeding the protection provided by the sheeting and shoring system. Trenches are defined by a horizontal width less than 15 feet. In all cases the method of trench wall protection shall be in conformance with the plans, details, and specifications or an Owner approved method designed and sealed by a Registered Professional Engineer. Owner's approval shall be permission to deviate from the specifications only and shall not be construed in any way to mean approval of the specific design, means or method of construction. The Contractor shall assume full responsibility for the system design the contractor uses, including those options presented in the contract documents and in these specifications.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 22 13 Site Grading

B. Section 31 23 33 Trenching, Backfilling and Compaction

C. Section 33 10 00 Water Distribution System

D. Section 33 30 00 Sanitary Sewer

E. Section 33 34 00 Sanitary Force Main

F. Section 33 40 00 Drainage

PART 2 - PRODUCTS

A. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, underpinning, and other structural retaining systems shall be in good serviceable condition, of good quality, of a suitable condition and grade to perform the intended use. Wood shall be sound, free from large or loose

knots, and of the proper dimensions. The Contractor shall be responsible for maintaining the systems in a manner consistent with the intended design and in a manner that will prevent exposure of workers to hazards.

PART 3 - EXECUTION

3.1 GENERAL SAFETY REQUIREMENTS

A. The work area shall be kept free of hazards to the employees. All surface encumbrances which may create a hazard shall be removed, supported or otherwise isolated as necessary to safeguard employees.

B. The Contractor shall take special precautions to locate existing utilities and to protect those systems as required. The Contractor shall call the Utility Coordinating Committee as required 24 hours prior to excavating around existing utilities.

C. The Contractor shall provide safe access and egress to excavations. Ramps or stairways shall be structurally sound and capable of providing a safe means of escape from the excavation. Trenches in excess of four (4) feet in depth shall have a safe means of egress from the trench spaced such that no more than 25 feet of lateral travel would be required to reach the egress system.

D. The employees shall be protected from work place hazards such as vehicular traffic, falling loads, and hazardous atmosphere. Excavations shall be marked so that employees and equipment are clearly warned of the location of the excavations. Trenches shall be kept free of water accumulations that would present a hazard to employees. Adjacent structures shall be stabilized as necessary so as not to present a possible hazard to the employees. Equipment shall be kept sufficiently clear of excavations so as not to create a potential overburden stress to trench walls causing cave-ins. Safe access shall be provided with handrails where access over trenches is required.

E. Emergency rescue equipment as required by OSHA shall be readily available at the site and shall be maintained to good working condition.

F. Daily inspections of excavations, the adjacent areas, and the protective systems shall be made by a person or persons competent to make such inspections to keep the Contractor notified of unsafe conditions so that necessary precautionary actions can be taken.

3.2 TRENCH WALL LAYBACK

A. General

In areas where no pavement or other structural elements are to be constructed, the sides of the trenches over five (5) feet deep may be sloped to provide protection from cave ins. If written approval is given by the Owner, trenches beneath pavement or other structures may also be laid back. Backfill for laid back trenches shall be as provided for a vertical wall trench for the full width of the excavation.

B. Layback Slope Requirements

1. The Contractor shall be responsible for providing the proper lay back slopes for all soil conditions encountered. Where soils data is provided for the Contractor's use, that information is intended as a sampling of the types of soils materials that may be

encountered; however, the Contractor shall be diligent in observing the actual soil conditions as the work proceeds and shall be responsible for providing a safety system adequate to meet the minimum standards for the actual types of soils encountered. Special precautions shall be taken to monitor conditions when working in fill areas, areas subject to surcharge and areas exposed to vibrations from nearby equipment and machinery.

2. At the Contractor's option where a layback trench system is approved for use, the Contractor may layback the sides of the trench at a slope of one and one-half (1-1/2) feet horizontal to one (1) foot vertical without testing for the soil's stability. When this method is used, it does not preclude the removal of unsuitable materials encountered and replacement with suitable materials. This method shall not be used in unsuitable soils such as wet sands, silts, peat or in other areas which require special procedures, equipment and materials.

3. The Contractor may engage a competent person in the means of soil classification to determine the soil classification as a means of reducing the trench wall slopes. Layback slopes may be sloped up to the maximum allowable slopes as follows for the given types of soil.

MAXIMUM ALLOWABLE SLOPES

Soil Materials	For Excavations Less than 20 Feet Deep Slope H:V	
Stable Rock	Vertical	(90°)
Type A-[b]	3/4:1	(53°)
Type B	1:1	(45°)
Type C	1 1/2:1	(34°)

Notes:

a. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
b. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
c. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

4. The types of soil given in paragraph 3.2.B are defined as follows:
   a. Stable Rock - Natural solid mineral matter that can be excavated with vertical sides and remain in tract while exposed.
   b. Type A - Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam cemented soils such as caliche and hard pan are also considered Type A. However, no soil is Type A if:
      1) The soil is fissured.
      2) The soil is subject to vibration from heavy traffic, piling driving, or similar effects.
      3) The soil has been previously disturbed.
      4) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater.

5) The soil is subject to other factors that would require it to be classified as a less stable material.

c. Type B - Soil that meets one of the following:
   1) Cohesive soil with an unconfined compressive strength greater than 0.5 tons per square foot, but less than 1.5 tons per square foot.
   2) Granular cohesionless soils including: angular gravel, silt, silt loam, sandy loam and in some cases, silty clay loam and sandy clay loam.
   3) Previously disturbed soils except those which would otherwise be classified as Type C soil.
   4) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration.
   5) Dry rock that is not stable.
   6) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical, but only if the soil would otherwise be classified as Type B.

d. Type C - Soil that meets one of the following:
   1) Cohesive soil with an unconfined compressive strength of 0.5 tons per square foot or less.
   2) Granular soils including: gravel, sand and loamy sand.
   3) Saturated or submerged soil.
   4) Submerged rock that is not stable.
   5) Soil in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater.

5. Unconfined compressible strength shall mean the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, estimated in the field using a pocket penetrometer, or other previously approved methods.

6. Wet soil shall mean soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

7. Layered systems shall be classified in accordance with its weakest layer; however, each layer may be classified individually where a more stable layer lies under a less stable layer.

8. Previously classified material whose properties, factors, or conditions affecting its classification change in any way shall be reclassified as necessary and changes to the trench safety plan shall be accomplished before continuing any work in or near the trench where there may be potential danger to workers due to trench failure.

9. The slope of a laid back trench wall shall be less steep than the maximum allowable slope when there are signs of distress. The maximum allowable slope for a material in distress shall be 1/2 horizontal to one vertical or less steep than the maximum allowable slope for the material in a non-distressed condition. Distress shall mean a condition in which a cave-in is imminent or likely to occur.

10. When surcharge loads from adjacent structures, stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such a reduction is achieved.

11. An adequate means of exit such as a ladder or steps shall be provided and located so as to require no more than 25 feet of lateral travel to exit the trench.

3.3 TIMBER SHORING

A. General

Timber shoring may be used as a means of trench protection from cave-ins in trenches that do not exceed 20 feet in depth. The timber shoring system may be used in lieu of sloping and benching systems, or in conjunction with those systems. Good judgment shall be used by the Contractor in selecting the proper system when alternative designs are given.

B. Soil Classification

The timber shoring system designs are subject to soil classifications outlined in 3.2.B.4 of this section. Classification shall be conducted by a competent person using the proper means and methods of classification as described in this section.

C. Basis and Limitations

1. Dimension of Timber Members
   a. The sizes of the timber members shown in the details are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition where NBS did not recommend specific sizes for members, member sizes are based upon an analysis of the sizes required for use by existing codes and an empirical practice.
   b. The required dimensions of the members listed in the tables refer to actual dimensions and not nominal dimensions of the timber.

2. Limitation of Application
   a. It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. This data was developed to apply to situations that are anticipated to be present at the site. Where the system provided does not meet the requirement of the actual conditions in the field, the Contractor shall either notify the Owner of the situation and present an engineered solution designed and sealed by the Registered Professional Engineer, or shall notify the Owner of the unanticipated conditions and await instructions.
   b. When any of the following conditions are present, the members specified and shown in the details are not considered adequate.
      1) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two foot soil surcharge. Adjacent shall mean the area within a horizontal distance from the edge of the trench equal to the depth of the trench.
      2) When vertical loads imposed on cross braces exceed a 240 pound gravity load distributed on a one foot section of the center of the cross brace.
      3) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.
      4) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless:
         a) The sloped portion is sloped at an angle less steep than 3H:1V;
         b) The members are selected from the tables based upon the total trench depth from the top of the overall trench and not the toe of the slope.

3. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling or kickouts.

4. Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

5. An adequate means of exit shall be provided such as a ladder or steps and shall be located so as to require no more than 25 feet of lateral travel to exit the trench.

6. Where necessary due to wet soils or other similar conditions, the shoring system shall use tight sheeting such that material is contained behind the sheeting.

3.4 ALTERNATIVE SHORING SYSTEMS

A. General

Alternative shoring systems may be used when approved by the Owner. Steel, aluminum or other approved materials may be used in lieu of wood for shoring where the system is designed, constructed and maintained in a manner that will give equal to or greater protection than the wood system.

B. Sheet Piling

Sheet piling may be used when approved by the Owner to shore the sides of the trench. Sheet piles shall be removed at the completion of the work unless otherwise directed by the Owner. When piling is to remain, the piling shall be cut off at least three feet from the top of the excavation or at least three feet from the top of the proposed finished grades, whichever is lower. The sheet piling system shall be designed by a Registered Professional Engineer and shall provide equal or greater protection than the specified wood shoring system. Materials for the piling shall be approved by the Owner.

C. Trench Boxes

Trench boxes that provide equal or greater protection as the specified wood shoring system may be used. The Contractor shall be responsible for insuring the adequacy, maintenance, and design of the trench box used. The Contractor shall also be responsible for the proper use and operation of the trench box.

D. Shield Systems

1. General
   a. Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.
   b. Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
   c. Workers shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
   d. Workers shall not be allowed in trenches or shields when shields are being installed, removed, or relocated.

2. Excavations of earth material to a level not greater than two feet below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of a possible cave-in below the bottom of the shield.

3. Use of shields shall be subject to approval by the Owner.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for forming and placing reinforced concrete curbs, pavement and sidewalks to the lines and grades shown on the drawings and constructed as specified herein.

1.2 APPLICABLE PUBLICATIONS

The following specifications and standards of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

A. Texas Department of Transportation 2014 Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (TxDOT).

1. Item 360 - Concrete Pavement

2. Item 421 – Hydraulic Cement Concrete

B. American Society for Testing and Materials Standards (ASTM):

1. D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction

2. A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

3. C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

4. A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

5. C 94 – Standard Specification for Ready-Mixed Concrete

6. C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

7. C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

8. A 185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

9. D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

10. D 994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Typed)

11. C 1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

12. E 329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 22 13 Site Grading

B. Section 31 32 13.16 Cement Stabilization

C. Section 31 32 13.19 Lime Stabilization

D. Section 31 32 13.26 Lime-Fly Ash or Fly Ash Stabilization

E. Section 32 17 23.13 Painted Pavement Markings

F. Section 32 17 23.33 Thermoplastic Pavement Markings

1.4 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.5 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Qualification Data: For manufacturer

D. Material Test Reports: From a qualified testing laboratory indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.

3. Admixtures.

4. Curing compounds.

5. Applied finish materials.

6. Bonding agent or epoxy adhesive.

7. Joint fillers.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Concrete Testing Service: Engage a qualified independent testing laboratory to perform material evaluation tests and to design concrete mixtures.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Cement, aggregates, admixtures, and water shall conform to the specifications of TXDOT, Item 421. Preparation of concrete mix shall be in accordance with article 360.4 of TxDOT, Item 360

B. Maximum size of aggregate 1-1/2 inches. Maximum size aggregate on concrete curbs to be 3/8 inch.

C. Slump shall range from 2 to 5 inches.

D. Air entrainment concrete mixture shall have an air content by volume of 4.5 percent plus or minus 1.5%.

E. Concrete shall be mixed in accordance with TxDOT, Item 421.

F. Ready mixed concrete conforming to ASTM C 94 may be used.

G. The concrete mix shall be designed by a commercial testing laboratory, and submitted for approval. The concrete design must produce a compressive strength of 3500 psi min at 7 days and 4000 psi min at 28 days for vehicular pavements. For pavements supporting pedestrian sidewalks only, the compressive strength shall be 3000 psi min.

2.2 REINFORCEMENT

A. Reinforcing steel shall meet the specifications of ASTM A615, Grade 60. Bars shall be deformed billet steel free of defects.

2.3 BOARD FILLER

A. Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.

2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

B. Board filler shall be free of defects which will impair their usefulness as expansion joint fillers.

2.4 PREFORMED BITUMINOUS EXPANSION BOARD

A. Preformed bituminous expansion boards shall meet the specifications for ASTM D 994 and D 1751.

2.5 JOINT SEALING MATERIAL

A. Curb and Pavement joint sealing material shall meet the requirements and specifications of TxDOT Items 360.2F and 360.4D.

B. Sidewalk joint sealing materials shall be NR-201Self Leveling, Traffic Grade and Traffic Loop Sealant as manufactured by Pecora or approved equal.

2.6 DEFORMED CONTRACTION JOINT METAL STRIPS

A. Deformed contraction joint metal strips shall be 28 ga. steel, galvanized 1.25 oz. per square foot or heavier and meet the specifications of ASTM A 653.

2.7 CURING COMPOUND

A. Curing compound shall conform to the specifications of ASTM C 309, Type 1 or Type 2, white pigmented.

2.8 LOAD TRANSMISSION DEVICES FOR EXPANSION AND CONTRACTION JOINTS

A. Load Transmission devices shall be as detailed on plans and conform to the properties specified in ASTM A615, Grade 60 steel.

2.9 STEEL DOWEL BARS

A. Steel dowel bars and steel reinforcement shall be deformed or smooth bars conform in properties to ASTM A 615 Grade 40. Unless otherwise shown on the plans all reinforcing steel shall be deformed bars, all dowel bars at joints shall be smooth bars, and all curb dowels shall be deformed bars.

B. Greenstreak two component speed dowel system can be used at construction joints pending engineer approval. Product submittal required for approval.

C. Greenstreak two component speed load system can be used at expansion joints pending engineer approval. Product submittal required for approval.

PART 3 - EXECUTION

3.1 GENERAL

A. The curb and sidewalk pavement shall be constructed to the lines and grades shown on the drawings.

3.2 PAVEMENT

A. Preparation of Subgrade

1. The subgrade shall be a previously prepared subgrade, stabilized if required, compacted to a minimum of 95% standard density ASTM D-698, and graded to the required section and grades shown on the drawings and as specified.

2. Rolling and sprinkling shall be performed to maintain the specified moisture content of the subgrade as necessary prior to placing the concrete curbs.

3. Refer to Section 32 22 13 Site Grading for applicable specifications for materials and placement.

B. Placing and Removing Forms

1. Forms shall be of wood or metal, properly treated to insure concrete does not adhere to the forms, straight, clean, free from warp or defect, and of sufficient depth.

2. The forms shall be so placed that when placed each form section will be firmly in contact for its whole length and base width and exactly at the established grade.

3. Any subgrade under the forms below established grade shall be corrected using suitable material, placed, sprinkled, and rolled.

4. Forms shall be securely staked and tightly jointed and keyed to prevent displacement.

5. Sufficient stability of forms to support equipment operated thereon and to withstand its vibration without springing shall be required.

6. Forms shall remain in place not less than 24 hours after concrete is placed.

C. Joints in Concrete Pavement

1. Shall be constructed in the pavement slab at locations and according to details as shown on the drawings. Stakes, braces, brackets or other devices shall be used as necessary to keep the entire joint assembly in true vertical and horizontal position.

2. When prefabricated plastic strips are used to form joints, they shall be placed after the concrete surface has been leveled and before the finishing is completed. The strips shall be of a type specifically manufactured for the purpose of forming joints in concrete pavement and to the dimensions as required to form the specified joints. The strips shall be removed after the concrete has set per the manufacturer's recommendations. Any blemishes caused by the removal of the strips shall be repaired immediately using approved methods.

D. Tie Bars and Load Transmission Devices shall be accurately placed and held securely (parallel to pavement surface and perpendicular to joint) during placing and finishing of pavement.

E. Expansion Joints shall be constructed with board filler and sealed at top. Board filler must be perpendicular to plane of concrete slab. Alignment of joint shall not vary more than 1/4 inch in 10 feet.

F. Reinforcing Steel shall be accurately placed as shown on drawings and secured in place. Each bar intersection shall be tied. All bars shall be supported on steel or plastic bar chairs. Laps shall be spaced per the details contained in the plans and tied. Wire fabric may not be used in vehicular pavement.

G. Concrete Placing and Finishing

1. Concrete not placed as herein prescribed within 90 minutes after mixing shall be rejected.

2. Concrete shall not be placed when temperature is below 40 degrees F and falling, but may be placed when the temperature is above 35 degrees F and rising, the temperature being taken in the shade and away from artificial heat.

3. Concrete shall not be placed before the time of sunrise, and shall not be placed later than will permit the finishing of the pavement during sufficient natural light.

4. Concrete shall be consolidated by a mechanical vibrator to remove all voids. Special care shall be exercised in placing and spading concrete against forms and at all joints to prevent the forming of honeycombs and voids and to prevent displacement of steel reinforcement and load transmission devices.

5. The concrete shall be struck off with an approved strike-off screed to such elevation that when consolidated and finished, the surface of pavement shall conform to the required section and grade. In no case shall the maximum ordinate from a 10 foot straight edge to the pavement be greater than 1/8 inch.

6. The strike template shall be moved forward with a combined transverse and longitudinal motion in the direction the work is progressing, maintaining the template in contact with the forms, and maintaining a slight excess of material in front of the cutting edge.

7. After completion of a strike-off, consolidation and transverse screeding, a hand-operated longitudinal float shall be operated to test and level the surface to the required grade.

8. Workmen shall operate the float from approved bridges riding on the forms and spanning the pavement. The longitudinal float shall be held in contact with the surface and parallel to the center line, and operated with short longitudinal strokes while being passed from one side of the pavement to the other. If contact with the pavement is not made at all points, additional concrete shall be placed if required, and screeded, and the float shall be used to produce a satisfactory surface. After a section has been smoothed so that the float maintains contact with the surface at all points in being passed from one side to the other, the bridges may be moved forward half the length of the float, and the operations repeated.

9. After completion of the straightedge testing, a pass with a burlap drag shall be made as soon as construction operations permit and before the water sheen has disappeared from the surface. This shall be followed by as many passes of the drag as required to produce the desired surface texture.

10. After completion of dragging and about the time the concrete becomes hard, the edge of the slab and joints shall be left smooth and true to line.

H. Curing

1. Concrete pavement shall be cured by protecting it against excessive loss of moisture for a period of not less than 72 hours from the beginning of curing operation.

2. Immediately after finishing operations have been completed, the entire surface of the newly laid concrete shall be covered and cured in accordance with the requirements of "Membrane Curing", TxDOT Item 360.4I.

3. Special care should be exercised to keep spraying curing compound out of pavement joints.

3.3 CURBS

A. Dowelled on Curb

1. After curing the concrete pavement, doweled on curbs, using secure forms shall be constructed to the size shown on the plans.

2. Dowels may be placed in the pavement slab before the concrete has set, or placed in drilled holes using epoxy adhesive to secure the bars in place.

3. Pavement joints shall extend through the curbs. Expansion joint material shall be the same thickness, type and quality as specified for the pavement.

4. When sawed joints are provided, the placement of curb shall be delayed until all transverse joints are sawed.

5. Weakened plane joints shall be formed by inserting an asphaltic board strip cut to conform to the shape of the curb.

6. All joints should be tool finished after sufficient curing of the concrete.

7. The concrete, reinforcement and curing of the curbs shall conform to the requirements specified for the concrete pavement.

8. In finishing the curbs, a thin coating of mortar shall be worked into the exposed face of the curb in order to obtain a brush finish free of all blemishes and form or tool marks.

9. Curbs shall have a straightness tolerance of 1/8 inch in 10 feet, measured longitudinally along the back and face of the curb.

10. The top of the curb shall not vary vertically in height more than 1/8" when measured up from the concrete pavement.

3.4 SIDEWALKS

A. Preparation of Subgrade

1. The subgrade shall be four (4) inches of compacted subgrade, compacted to at least 95% dry standard proctor ASTM D 698, placed in accordance with the elevations and section shown on the drawings.

B. Forms

1. Forms shall be of wood or metal, straight, free from warp, and of sufficient depth to finish the work to the plan required thickness.

2. Forms shall be securely staked to line and grade and maintained in a true position during the depositing of the concrete.

3. Forms shall be properly treated to insure that the concrete does not adhere to the forms.

C. Reinforcing Steel

1. Reinforcing steel, shall be #3 reinforcing steel bars as per ASTM A615/A615M, Grade 60: deformed placed in position as shown on the plans.

2. Care shall be exercised in the work and operation to keep all steel in its proper location and off the ground.

3. Tie at all sheet overlaps and intersections. Support on steel or plastic bar chairs.

4. Do not stand on steel to pour and finish concrete.

D. Expansion Joints

1. Expansion joints shall be placed where shown on the plans and where two lines of sidewalks intersect, where meeting existing sidewalk or driveway, and at intervals not to exceed 30 feet.

E. Crack Control Joints

1. Crack control joints for all sidewalks other than exposed aggregate or other special finish or as noted otherwise on the plans shall be marked off 1/4" deep, transversely at intervals equal to the width of the sidewalk and along the centerline of sidewalks eight (8) feet in width and greater.

2. All edges shall be edged with a tool having a 1/4" radius.

F. Joint Sealant

1. Joint sealant shall be placed in construction joints only where sidewalks meet structures and as shown on the plans.

G. Concrete Placing and Finishing

1. Concrete shall be placed in the forms to the depth specified, thoroughly tamped and compacted, until the concrete mixture covers the entire surface.

2. The top shall then be struck off with a wood strike off board to a smooth finish.

3. Surface shall then be floated and finished to a gritty texture with a wood hand float working in circular motion.

H. Tolerances

1. The surface shall be checked with a 10 foot straightedge and any irregularities of more than 1/8" in 10 feet shall be corrected.

I. Curing

1. Curing shall conform to the above paragraph 3.2.H.

3.5 APPLICATION OF JOINT SEALING COMPOUND

A. Joints shall be thoroughly cleaned of loose scale, dirt, dust and curing compound. When necessary, existing joint material shall be removed to the depth as shown on the plans.

B. Joints shall be filled to the full depth of the joint opening. Pouring shall be done in a neat and workman like manner to give satisfactory results. Sufficient joint sealer shall be poured into the joints so that upon the completion of the work the surface of sealer within the joint shall be 1/4" above top of the pavement surface.

3.6 TESTS

A. Concrete Test Specimens

1. Test cylinders for compressive strength shall be taken and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

2. At least 3 cylinders shall be made for each day for each 100 c.y. of concrete or fraction thereof, placed. A testing laboratory for the tests shall be selected and paid for by the Owner.

3. Laboratory technician will prepare concrete test cylinders.

B. Testing of Concrete Surface

1. After finishing is complete and while the concrete is still workable, the surface shall be tested for trueness with an approved 10' steel straightedge.

2. The straightedge shall be operated from the side of the pavement placed parallel to the pavement center line and passed across the slab to reveal any high spots or depressions.

3. The straightedge shall be advanced along the pavement in successive stages of not more than 1/2 its length. A tolerance of 1/8" in 10' must be met.

4. Any correction of the surface required shall be accomplished by adding concrete if required and by operating the longitudinal float over the area.

5. The surface test with the straightedge shall then be repeated.

3.7 OPENING PAVEMENT TO TRAFFIC

A. The pavement shall be closed to all traffic, including vehicles of the Contractor, until the concrete is at least 7 days old or has attained a minimum average of 3000 psi compressive strength.

B. Any damage to the pavement prior to acceptance by the Owner shall be repaired by the Contractor at no extra cost to the Owner.

C. This does not relieve the Contractor from the normal liabilities and maintenance responsibilities, implied or otherwise, for the pavement or other items.

END OF SECTION

SECTION 32 17 23.13 – PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the application of pavement marking as indicated on the drawings and as specified herein.

1.2 APPLICABLE PUBLICATIONS

A. Harris County Public Infrastructure Department Engineering Division Specifications for Roads and Bridges within Harris County, Texas, published April 1988 latest revision February 2011.

B. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 01 Specifications apply to this section.

1.3 SUBMITTALS (NOT USED)

1.4 PROJECT CONDITIONS

A. The Contractor shall provide adequate public protection at all times, by erecting fences, barricades, and etc., as necessary.

B. All work shall be in accordance with the Texas Manual on Uniform Traffic Control Devices latest edition.

C. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees F (4 degrees C) for oil-based materials, 50 degrees F (10 deg C) for water-based materials, and not exceeding 95 degrees F (35 degrees C).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Materials shall consist of paint and glass beads. Paint for striping shall conform to Harris County Engineering Specifications Item 676 latest edition 2011. Glass reflective beads for traffic paint shall conform to Harris County Engineering Specification Item 662 latest edition 2011.

PART 3 - EXECUTION

3.1 APPLICATION

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. The pavement surface to receive the striping shall be thoroughly cleaned of all dirt, organic growth, oil, grease, or other materials that will prevent adhesion of the paint to the roadway surface.

D. Paints shall be applied by brush, spray, or flow methods to clean and dry surfaces with surface temperature 50 F or above.

1. Paint shall have net film thickness of 0.015 inches with a uniform cross section. Minimum thickness of 0.010 inches measured in the dry condition prior to adding any glass reflective spheres.

2. Paint shall be applied no sooner than 14 days after seal coat has been applied.

3. Paint shall be applied in one (1) coat.

4. Paint shall be applied as shown on drawings.

5. Glass spheres or reflectorized granules shall be applied, before the paint sets or dries, evenly at a rate of 6 pounds of glass spheres or 1.7 pounds of reflectorized granules per gallon of paint.

END OF SECTION

SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Decorative metallic-coated-steel tubular picket fences - matching existing style installed on site.
   2. Pedestrian swing gate system, key access manual pull latch on non-secure side, and integrated panic hardware with full infill mesh panel on secure side.
   3. Dumpster enclosure post supported swing gates with framed louvered panel infill.
   4. Horizontal-slide gates, with motor operator and access control for emergency access of Fire Lane.
   5. Gate operators, including controls.

1.2 RELATED WORK

A. Owner's Published Design Standards: Materials/Products in this seciton are required to comply with Harris Health Design Standards.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.
   1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.
   2. Horizontal Slide Gates: Sizing of members to accommodate size and operation of horizontal slide gate shown.
   3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
   4. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.
   1. Provide Samples 12 inches in length for linear materials.
   2. Provide Samples 12 inches square for sheet or plate materials.

D. Delegated Design Submittal: For Class IV horizontal sliding decorative metal gates, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Field quality-control reports.

C. Product Test Reports: For decorative metallic-coated-steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.

D. Sample Warranties for gates, fence, hardware and operators.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Include 10-foot length of fence complying with requirements.
   2. Include Pedestrian Swing Gate with Panic Hardware
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design horizontal sliding gates, including attachment to site.

B. Wind Loading: See Structural Drawings

2.2 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES

A. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F2408 for light-industrial (commercial) application (class) unless otherwise indicated.
   1. Basis of Design: Subject to compliance with requirements, provide Montage II Steel Fencing, as manufactured by Ameristar.

B. Gate and Fence Height: 6’-0” unless noted otherwise on Drawings

C. Posts:
   1. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet.
   2. Posts at Swing Gate Openings: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet.
   3. Posts at Horizontal-Slide Gate Openings Wider Than 12 Feet: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.

D. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.

E. Rails: Square tubes.
   1. Size: 1-1/2 by 1-1/2 inches.
   2. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet.

F. Pickets: Square tubes.
   1. Size: ¾ inch square tube
   2. Metal and Thickness: 0.902-inch nominal thickness, metallic-coated steel sheet.
   3. Provide "Classic" point at top of picket, extending beyond top rail.
   4. Picket Spacing: 4 inches clear, maximum.

G. Fasteners: Manufacturer's standard concealed fastening system.

H. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.

I. Finish: Inline electrode position coating (E-Coat) process consisting of a multi- stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat.
   1. Color: Black

2.3 PEDESTRIAN SWING GATES WITH ACCESS CONTROL AND PANIC HARDWARE

A. Decorative Metallic-Coated-Steel Tubular Picket Gates: Comply with ASTM F2408 for light-industrial (commercial) application (class) unless otherwise indicated.
   1. Basis of Design: Subject to compliance with requirements, provide Exodus Pedestrian Gate, as manufactured by Ameristar.

B. Gate Configuration: Single leaf.

C. Gate Frame Height: 72 inches.

D. Gate Opening Width: 36 inches, unless noted otherwise on Drawings.

E. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet..

F. Frame Corner Construction: Welded.

G. Additional Rails: Provide as indicated, complying with requirements for fence rails.

H. Picket Size, Configuration, and Spacing: 1-inch square tubes formed from 0.078 inch thick metallic-coated steel sheet. Pickets shall be spaced no greater than 5” o.c. Infill frame shall be 12ga steel.

I. Kick plate: On the push side of the gate provide a 12 inch by 2 inch by 3/16 tube

J. Exit device plate: Where the exit device is mounted provide a 12-inch by 2-inch by 3/16 inch tube

K. Provide ¼ inch metallic-coated steel plate-reinforced hinge mounting.

L. Infill material: Expanded metal mesh shall be ¾” x #9 flattened or Perforated metal mesh shall be 3/16” round x ½” x 18ga

M. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding

N. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide.

O. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
   1. Function: 39 - Full surface, triple weight, antifriction bearing.
   2. Material: Stainless Steel

P. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
   1. Function: 09 - Entrance from non-secure side by pull lever/latch only when released by key. Key removable only when locked.
   2. Mounting Channel: Bent-plate channel formed from 1/8-inch-thick, steel plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch beyond push pad surface.

Q. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

R. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

S. Metallic-Coated-Steel Finish: High-performance coating.

2.4 DUMPSTER ENCLOSURE POST-SUPPORTED SWING GATES WITH LOUVERED INFILL

A. Post supports: welded steel tube with welded cap, hot dipped galvanized finish.

B. Gate Panels: Welded construction.
1. Frame: Welded steel rectangular tube,
   a. Tube depth: Align with depth of louver.
   b. Tube face width: Minimum face dimension required to support panel.
2. Infill: Galvanized steel louver panels perimeter welded to steel angle frames (back-to-back angles). Welded corners, mitered.
3. Finish: Hot dip galvanized after fabrication.

C. Hardware:
1. High Load Butt Hinge, full bearing hinge manufactured by welding and machining, welded to the gate panel frame in the shop, and support post in the field.
   a. Basis of Design: 625 Series High Load Butt Hinge by Daro
2. High Density Spring Loaded Caster assembly, welded to gate panel frame at each cantilevered end. Galvanized steel construction.
3. Cane Bolt: Galvanized steel cane bolt assembly welded to gate panel frame, to secure both gate leaves when in fixed position.
4. Repair galvanization at all field welds prior to field painting.

2.5 HORIZONTAL-SLIDE GATES

A. Decorative Metallic-Coated-Steel Tubular Picket Gates: Comply with ASTM F2408 for light-industrial (commercial) application (class) unless otherwise indicated.
1. Basis of Design: Subject to compliance with requirements, provide PassPort Commercial Ornamental 3-Rail Roll Gate System (#MB307026R), as manufactured by Ameristar.

B. Automated vehicular gates shall comply with ASTM F2200, Class IV.

C. Gate Configuration: Single leaf.
1. Type: Cantilever slide, with internal roller assemblies.

D. Gate Frame Height: 72 inches.

E. Gate Opening Width: As indicated.

F. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.
1. Frame Members: Square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet.
   a. Bottom Rail: 2 inch by 4 inch, metallic-coated steel sheet
2. Bracing Members: Square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet.

G. Frame Corner Construction:
1. Welded frame.

H. Additional Rails: Provide as indicated, complying with requirements for fence rails.

I. Infill: Comply with requirements for adjacent fence.

J. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

K. Hardware: Latches permitting operation from both sides of gate, locking devices roller assemblies and stops fabricated from galvanized steel.

L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

N. Metallic-Coated-Steel Finish: PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pre-treatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm).

2.6 GATE OPERATORS

A. Gate Operators: Medium to Heavy Duty Commercial or Industrial Slide Gate Operator.
   1. Basis of Design: Subject to compliance with requirements, provide LiftMaster SL3000UL High Traffic Commercial Slide Gate Operator, or one of the following:
      a. DoorKing DC 9024 Slide Gate Operator
      b. HySecurity SlideSmart CNX
      c. LiftMaster CSL24UL High Traffic Commercial Slide Gate Operator
      d. LiftMaster SL585UL Heavy Duty Industrial Slide Gate Operator

B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
   1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
   2. Provide operator with UL approval.
   3. Provide electronic components with built-in troubleshooting diagnostic feature.
   4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

C. Comply with NFPA 70.

D. UL Standard: Manufacturer and label gate operators to comply with UL 325.

E. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.

F. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
   1. Voltage: 120VAC
   2. Horsepower: Not less than 1/2.

3. Enclosure: Totally enclosed.
4. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
6. Phase: One.

G. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 4 enclosure for pedestal mounting, and with space for additional optional equipment. Provide the following remote-control device(s):
1. Digital Keypad Entry Unit: Programmable, multiple-code capability of not less than five possible individual codes, consisting of 4-digit codes, and permitting four different access periods.
a. Features: Limited-time usage.
b. Face-lighted unit with keypad fully visible at night.

H. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
1. Action: Stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.
a. Across entire gate leaf bottom edge.
b. Along entire length of gate posts.
4. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

I. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.

J. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.
1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

K. Operating Features:
1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Open Override Circuit: Designed to override closing commands.
4. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
5. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
6. Clock Timer: Seven-day programmable for regular events.

L. Accessories:
1. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.
a. Fail-Safe: Gate opens and remains open until power is restored.
b. Fail-Secure: Gate cycles on battery power, then fail-safe when battery is discharged.

2. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.7 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A36/A36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

C. Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Bar Grating: NAAMM MBG 531.
1. Bars: Hot-rolled steel strip, ASTM A1011/A1011M, Commercial Steel, Type B.
2. Wire Rods: ASTM A510/A510M.

E. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 50, with G90 coating.

F. Aluminum-Zinc, Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, with AZ60 coating.

2.8 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 30 00 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C387/C387M mixed with potable water according to manufacturer's written instructions.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

2.9 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

B. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc-phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.

C. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.
1. Color and Gloss: Black.
2. Comply with surface finish testing requirements in ASTM F2408.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
   1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails to posts.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
      b. Concealed Concrete: Top 2 inches below gradeto allow covering with surface material. Slope top surface of concrete to drain water away from post.
   3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
   4. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.
      a. Extend posts at least 5 inches into concrete.
      b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
   5. Space posts uniformly at 6 feet o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Support Posts, Pedestals, and Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.

C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
   1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
   2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
   3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION

SECTION 32 84 00 - IRRIGATION

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. Work covered by Contract Documents.
2. Contractor requirements and responsibilities
3. Coordination

1.3 DEFINITIONS

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

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Provide a complete and fully functional irrigation system for all landscape areas with 100% coverage. Contractor shall furnish labor, equipment, materials, and services necessary for installation, testing, and warranty of the irrigation system.

2. This irrigation plan is diagrammatic. Contractors shall provide final irrigation design layout with licensed irrigator's seal and signature and include all required design calculations to comply with TCEQ requirements.

1.5 CONTRACTOR REQUIREMENTS AND RESPONSIBILITIES

A. Cooperate fully with Owner, so work may be conducted smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Perform all work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State, and local authorities in supply, transportation, and installation of materials.

C. The irrigation contractor must be licensed to do business in the State of Texas, as required by TCEQ.

D. The contractor shall be responsible for the verification of all underground utility lines (telephone, gas, water, electrical, cable, TV, etc.) and all overhead utility easements prior to start of any planting work.

E. Codes and Permits
   1. All materials and equipment shall conform to all applicable State of Texas, City, and County codes. The irrigation contractor shall secure all required permits prior to commencement of work.

1.6 COORDINATION

A. Prior to commencement of work, the irrigation contractor shall contact the Owner to coordinate all required inspections. Coordinate sleeve locations with Owner and/or general contractor.

B. Fine grading works must be in adherence to civil grading and drainage plan.

C. Existing Utilities
   1. Extreme care shall be exercised in excavating and working near existing utility easements. Contractors shall verify location of all utility lines and shall be responsible for damages inflicted on utilities.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Section Includes:

   1. Materials.
   2. Accessories
   3. Special Tools

2.2 MATERIALS

A. All pipes and fittings shall be Schedule 40 PVC. Sleeves under pavement shall be Schedule 40 and extend 24" out from pavement edge. All threaded joints to be coated with Teflon tape or Liquid Teflon. All 24-volt wire shall be No. 12 UF/UL (common) and No. 14 UF/UL (control), solid copper, direct burial. Use color-coded wire: white for common, red for control.

2.3 ACCESSORIES

A. Sprinkler heads to be installed per manufacturer specifications and mounted on swing joints unless otherwise noted. Provide automatic drain devices where low head drainage may occur. Install a separate common wire for each controller. Provide manufacturer's grounding and lightning protection devices including (2) 5/8" copper clad ground rods for power supply and valve output.

2.4 SPECIAL TOOLS

A. Provide Owner with 2 wrenches for each type of sprinkler head and valve, 2 keys for automatic controller, 2 quick coupler keys with matching hose swivels.

PART 3 - EXECUTION

3.1 SUMMARY

A. Section Includes:

   1. Installation Requirements

2. Protection and Performance
3. Warranty

3.2 INSTALLATION REQUIREMENTS

A. The Irrigation contractor shall flush and adjust the system for optimum performance. This shall include regulating the pressure at each valve to obtain the optimum operating pressure for each system.

B. Use glue joints in mainline passing through sleeves under pavement. PVC sleeves shall be Schedule 40 and shall extend 24" out of the nearest existing pavement areas for easy location. The irrigation contractor shall be responsible for coordinate all sleeve locations on the project site with the Owner and/or general contractor.

C. The irrigation contractor shall also comply to these additional special requirements to the irrigation system shall include the following.
1. Mainlines to have minimum 18" cover. (Sch. 40 PVC Pipe).
2. Lateral/sub-main pipes to have minimum 12" cover. (Sch. 40 PVC Pipe).
3. Do not backfill trenches with rocks, boulders, or extraneous materials.
4. Install all components per manufacturer specifications.
5. All threaded joints to be coated with Teflon tape or Liquid Teflon
6. All lines to be thoroughly flushed before installation of any sprinkler heads.
7. Sprinkler and related equipment shall be installed as per manufacturer's specification.
8. No electrical connections shall be made in the field except at a valve control box or another valve box specifically for connections.
9. All 24 volt wire shall be No. 12UF/UL for common wire and No. 14 UF/UL for control wires, direct burial shall be solid copper.
10. The irrigation contractor shall be responsible for proper coverage of areas to be watered, i.e. adjust heads with insufficient coverage due to blockage by existing or proposed site features or sizing down sprinkler heads to avoid excessive overthrow.
11. The irrigation contractor shall refer to landscape planting plan to keep sprinkler equipment and accessory materials from interfering with proper planting, i.e. Verify rootball size for planting; configuration of shrub/groundcover beds, etc.
12. The irrigation contractor shall provide expansion coils at each wire connection in valve box (wrap around 3/4" pipe 12 times).
13. The irrigation contractor shall utilize appropriate automatic drain device where low head drainage may occur.
14. All sprinkler heads shall be mounted on swing joints unless otherwise noted.
15. The irrigation contractor shall install a separate common for each controller.
16. 24 Volt wire shall be color coded: Common shall be white and Control red.
17. The irrigation contractor shall install manufacturer's recommended grounding equipment for power supply and valve output with (2) 5/8" copper clad ground rods.
18. The irrigation contractor shall install manufacturer's recommendation on fault ground and lightning protection.
19. The irrigation contractor shall furnish the owner with the following: 2 wrenches for disassembling and adjusting each type of sprinkler heads and valves + 2 keys for the automatic controller +2 quick coupler keys with matching hose swivels.
20. The irrigation contractor shall add extension risers to pop up sprinklers when needed for proper coverage. Coordinate with landscape contractor as to where risers for sprinkler heads are required.
21. The irrigation contractor shall install sprinkler equipment 12" from all buildings' foundations and install sprinklers 4" from any curbs or walkways.
22. The irrigation backflow prevention device shall be installed within areas of proposed shrub plantings. The purpose of this is to keep the device screened from view.

3.3 PROTECTION AND PERFORMANCE

A. The Irrigation contractor shall at all times protect his work from damage and theft and replace all damaged or stolen parts at his expense until receipt of the Certificate of Substantial Completion from the Owner.

3.4 WARRANTY

A. Provide a one-year warranty on all irrigation system labor and materials commencing upon final acceptance by Owner.

END OF SECTION

SECTION 32 90 00 - PLANTING

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. Definitions Work covered by Contract Documents.
2. Work covered by Contract Documents.
3. Contractor requirements and responsibilities

1.3 DEFINITIONS

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

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Commercial property that involves landscaping on the perimeter of the site and throughout the landscaping beds provided by the architect and civil engineer and other Work indicated in the Contract Documents.

1.5 CONTRACTOR REQUIREMENTS AND RESPONSIBILITIES

A. Cooperate fully with Owner, so work may be conducted smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Perform all work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State, and local authorities in supply, transportation, and installation of materials.

C. The contractor shall be responsible for the verification of all underground utility lines (telephone, gas, water, electrical, cable, TV, etc.) and all overhead utility easements prior to start of any planting work.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Section Includes:
1. Plant material

2.2 PLANT MATERIAL

A. All plant materials shall possess the following minimum qualities:

1. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of the project for at least twelve months.
2. All plants shall be heavy, symmetrical, tightly knit, so trained or favored for development and appearance as to be superior in form, number of branches, compactness, and symmetry.
3. Plants shall be sound, healthy, vigorous, well branched, and densely foliated when in leaf. They shall be free of disease, insects, pests, eggs, or larvae.
4. All plants shall be true of species and variety and shall conform to measurements (caliper size, trunk heights, spread) as specified on the drawings.
5. Container grown stock when specified shall have grown in the container in which delivered for at least six months, but not over two years. Samples must prove no rootbound conditions exist.
6. Caliper measurements shall be taken at a point on the trunk six inches (6”) above natural ground line for trees up to four inches (4”) in caliper.
7. All trees shall be staked by a minimum of two metal “T” stakes for single trunk trees and three stakes for all multi-trunk trees.

B. Planting Mix shall be thoroughly mixed in the following proportions.

1. Prepared soil as backfill for shade and ornamental tress shall be: 5-part clay loam topsoil + 2-part compost + 1-part sharp sand + 4 lbs. commercial fertilizer per CY. or 10 lbs. organic fertilizer.
2. Prepared soil as backfill for shrubs and groundcovers and seasonal colors shall be: 1-part enriched mulch +1-part No.1 bank sand +3 lbs. time-released fertilizer, 14-14-14 per CY or 8 lbs. organic fertilizer.

PART 3 - EXECUTION

3.1 SUMMARY

A. Section Includes:
1. Site Preparation
2. Excavation
3. Additional Work requirements
4. Maintenance
5. Warranty Periods, Plant Guarantees, and Replacements

3.2 SITE PREPARATION

A. Before landscaping with plants, grass, mulch, gravel, or any other materials, all areas must be cleared of debris, including construction waste, rocks of any size, concrete pieces, and equivalent items to be removed and disposed of.

B. Fine grading works must be in adherence to civil grading and drainage plan.

3.3 EXCAVATION

A. Excavation work and Surface drainage work shall conform to the following requirements:

1. Evaluate drainage of plant beds and plant pits by filling with water twice in succession. Conditions permitting the retention of water for more than 24 hours shall be brought to the attention of the Owner.

2. Work shall include the final responsibility for proper surface drainage of planted areas. Any obstructions on the site, or prior work done by another part, which precludes establishing proper drainage shall be brought to the attention of the Owner in writing.

3. Excavate each tree hole 18" deep plus the depth of the tree container size (15 gal. Or 30 gal. Or 65 gal. Or 100 gal.).

4. Excavate entire shrub bed to a depth of 8" plus the depth of the shrub container size (5 gal.) unless noted as being pit planted on landscape legend.

5. Excavate entire groundcover bed to a depth of 6" plus the depth of the groundcover container size (4" pot or 1 gal.).

3.4 ADDITIONAL WORK REQUIREMENTS ON LANDSCAPE AREAS:

A. Prior to installation of any planting works (trees, shrubs, groundcover, and grass works); apply "Round Up" in all planting areas to eradicate all weed growths on site.

B. ADD ALTERNATE: Install weed control barriers in all trees, shrub, and groundcover planting areas. Weed barrier fabric shall be back polypropylene sheet 27 mils thick, 4 oz/Sy grab tensile strength per ASTM D-4632: 90 lbs. (machine direction) 50 lbs. (cross machine direction). Provide DeWitt "Weed Barrier" or approved substitute.

C. Use "Shovel Edge" to separate all plant beds from grass areas.

D. Spread a minimum two-inch layer of pine bark mulch overall shrub and groundcover bed areas.

3.5 MAINTENANCE

A. Landscape maintenance work by the Landscape Contractor after final acceptance shall include the following:

1. The maintenance period shall commence upon inspection and approval at Final Acceptance and shall be for a period of Sixty Days (60).
2. The landscape contractor shall coordinate the watering program for all the landscape work with the Owner.
3. Maintenance of new plantings shall consist of watering, cultivating, weeding, mulching, re-staking, tightening and repair of guys; resetting plants for proper grades or upright position, and furnishing and application of pesticides/herbicides; sprays, and invigorants as are necessary to keep plantings free of insects and disease and in a thriving condition.

3.6 WARRANTY PERIODS, PLANT GUARANTEES, AND REPLACEMENTS

A. P a. Planting supplied shall be warranted to remain alive and healthy for a period of twelve months (12) after the date of Final Acceptance by Owner. Plants in an impaired, dead, or dying condition after initial acceptance or within 12 months shall be removed and replaced immediately to the satisfaction of the Owner.

END OF SECTION

SECTION 33 10 00 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for furnishing and installing water lines, laterals, stubs, and appurtenances for both potable and non-potable water distribution systems. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33 Trenching, Backfilling, and Compaction

B. Section 31 41 33 Trench Safety

1.3 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of these specifications to the extent indicated by reference thereto:

1. American Water Works Association (AWWA)
   a. C 500 AWWA Standard for Metal-Seated Gate Valves for Water Supply Service.
   b. C 900 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4" through 12", for Water Transmission and Distribution.
   c. C 151 AWWA Standard for Ductile Iron Pipe, Centrifugally Cast, for Water
   d. C 110 or 153 AWWA Standard for Ductile-Iron and Gray-Iron Fittings.
   e. C 105 AWWA Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
   f. C 104 AWWA Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
   g. C 701-70 AWWA Standard for Cold-Water Meters-Turbine Type, for Customer Service
   h. C 703-70 AWWA Standard for Cold Water Meters Fire Service Type
   i. C 509 AWWA Standard for Resilient-Seated Gate Valves for Water Supply Service

2. American Society for Testing and Materials Standards (ASTM).
   a. F 645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water-Pressure Piping Systems

3. National Fire Protection Association (NFPA)
   a. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances
   b. NFPA 70 – national electric code

4. National Sanitation Foundation International (NSF)
   a. NSF 14 Plastics Piping System Components and Related Materials
   b. NSF 61 Drinking Water System Components - Health Effects

5. City of Houston
   a. Standard Construction Specifications for Wastewater Collection Systems, Water Lines, Storm Drainage, Street Paving and Traffic

b. Public Works and Engineering Approved Water Products List]

1.4 PROJECT/SITE CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

B. Notify **Owner** no fewer than **two** days in advance of proposed interruption of service.

C. Do not proceed with interruption of water-distribution service without Owner's written permission.

D. Do not proceed with interruption of water-distribution service without prior approval and coordination with local municipal water supplier.

1.5 SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

1.6 DEFINITIONS

A. LLDPE: Linear, low-density polyethylene plastic.

B. PE: Polyethylene plastic.

C. PP: Polypropylene plastic.

D. PVC: Polyvinyl chloride plastic.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements for potable water systems:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Regulatory Requirements for Non-potable water systems

1. The system shall be comprised of purple components. Use purple colored pipe, Pantone 522 embossed or integrally stamped/marked in English and in Spanish “CAUTION RECLAIMED WATER DO NOT DRINK” and “AGUA DE RECUPERACIÓN - NO BEBER”.

2. A minimum of an eight inch by eight inch sign, in English and Spanish, is prominently posted on/in the area that reads “Reclaimed Water – Do not drink” and "AGUA DE RECUPERACIÓN - NO BEBER" on the storage tank of such non-potable system if within the construction site.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

2. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

PART 2 - PRODUCTS

2.1 PIPE

A. For water line construction 9 feet or more from any existing or proposed sanitary sewer, all materials and equipment shall be:

1. New, or best grade and standard manufacture.

2. PVC pipe and joints shall conform to AWWA C-900, latest edition, schedule 40 for 150 PSI, 80 for 200 PSI.

3. Ductile iron pipe shall conform to AWWA C 151, pipe class per Table 51.1, latest edition, standard outside coating with cement mortar lining to AWWA C 104 standards. All ductile iron pipe and fittings shall be wrapped with polyethylene per AWWA C 105.

4. Fittings shall conform to AWWA C 110, latest edition, Pressure Rated 350 psi wrapped with polyethylene per AWWA C 105.

B. For construction within 9 feet of any existing or proposed sanitary sewer and all water services, all materials and equipment shall be:

1. New, or best grade and standard manufacture.

2. Ductile iron pipe shall conform to AWWA C 151, latest edition, standard outside coating with cement mortar lining to AWWA C104 standards. Wrap pipe with 8 mil polyethylene.

3. PVC pipe and joints shall conform to AWWA C-900 - 200 psi pressure pipe.

4. Fittings shall conform to AWWA C 110 or AWWA C153, latest edition, Pressure Rated 250 PSI, wrapped with polyethylene per AWWA C 105.

C. For offsets of water mains 6" and larger required to miss conflicts with other lines or objects, steel pipe shall be used meeting the requirements of AWWA 200, Schedule 40.

2.2 VALVES

A. Line Valves:

1. Valves shall have a minimum working pressure of not less than 175 PSI.

2. The operating nut shall be 2-inch square and shall have an arrow, cast in the metal, indicating the clockwise direction of opening.

3. Gate valves shall conform to AWWA C509, latest edition, standard NRS resilient seating type.

4. Valves shall have push-on or mechanical joint hubs.

B. Tapping Valves:

1. Tapping valves shall conform to AWWA Standard C509, latest edition, standard NRS resilient seating type water works valve.

2. The operating nut shall be 2-inch square and shall have an arrow, cast in the metal, indicating the clockwise direction of opening.

3. Inlet shall be a Class 125 flange with a machined projection.

4. Outlet shall be a standard push-on or mechanical joint.

5. Valves shall have a minimum working pressure of not less than 175 psi.

C. Valves for Meter Installation:

1. Commercial meter valves shall meet the specifications for line valves except that they shall have a handwheel, Class 125 flanges and shall open counter-clockwise.

2. Fire flow meter valves shall be OS&Y double disc valves (line valves only), Fire Marshall approved, clockwise to close with Class 125 flanges.

2.3 VALVE BOXES

A. Valve boxes shall be installed over each line and tapping valve except as otherwise noted.

B. Cast the letter “W” into lid, ½ inch in height and raised 3/32 inch, for valves serving potable waterlines.

C. Valve boxes shall be extension type with screw or locking slide adjustment with flapped base.

2.4 FIRE HYDRANTS

A. Fire hydrants shall be as manufactured by Mueller Company, or approved equal, AWWA type, 250 psig working pressure, No. A 423, 3 way, 5 1/4 inch valve opening, bury as shown to a depth shown, 6 inch MJ shoe, open left, 1 1/2 inch top operating nut, 2 1/2 inch hose coupling, 4 1/2 inch pumper connection with national standard threads.

2.5 METERS

A. All meters and meter boxes shall be of the size shown and meet the specifications of the City of Houston Standard Construction Specifications for Wastewater Collection Systems, Water Lines, Storm Drainage, Street Paving and Traffic - Section 02526 And COH Public Works and Engineering Approved Water Products List For water meter type.

2.6 WATER

A. All water used for testing and sterilizing must be supplied by municipal supplies approved by the state's Department of Health.

PART 3 - EXECUTION

3.1 LOWERING/RELOCATING EXISTING WATER LINES

A. Water lines to be lowered/relocated shall not be shut down without prior approval of the local governing agency.

B. Contractor shall install necessary valves so as not to disrupt service outside limits of water lines to be lowered/relocated whether or not indicated on the plans.

C. Whether or not indicated on the plans, the lowered/relocated water line shall have minimum of four (4) feet of cover. Location shall be a minimum distance from existing location as necessary to facilitate construction.

D. If the lowered/relocated water lines are of potable water systems, they shall be required to meet same hydrostatic and sterilization test results as new water lines.

E. Installation of lowered/relocated water lines shall meet the same requirements of new water lines as in paragraph 3.2 INSTALLATION below.

3.2 INSTALLATION

A. The interior of the pipe shall be thoroughly cleaned of all foreign matter before lowered into the trench, and shall be kept clean during these operations.

B. Pipes for potable water lines shall not be laid in water, or when trench or weather conditions are unsuitable for work.

C. For potable water line installation, when work is not in progress, open ends of pipes and fittings shall be securely closed so that water, earth, or other substances will not enter the pipes or fittings.

D. All bends, tees, valves, and plugs shall have thrust blocks installed in accordance with the details on the plans.

E. For potable water line installation, when a water line is to be installed such that it will cross over an existing or proposed sanitary sewer, a section of pipe at least 18' long of either ductile iron or PVC pipe C-900 (200 PSI) shall be installed such that it will be centered over the sanitary sewer. Water lines shall in no case be installed below a sanitary sewer.

F. For potable water line installation, when a water line is being installed parallel to a sanitary sewer, a horizontal distance of separation of nine (9) feet (outside to outside) must be maintained.

G. A minimum clearance of 6" must be maintained between water lines and all other utility lines.

H. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.3 TESTING

A. All water lines to be installed shall be hydrostatic tested and all potable water lines shall also be sterilized. Discharge of water used for testing and sterilization shall follow state construction general permits regarding storm and other waters discharged during construction activities.

B. Hydrostatic Test

1. General
   a. After the pipe has been laid and initial backfill completed, the water line shall be subjected to a hydrostatic pressure of 150 psi. Joints shall remain exposed during testing whenever possible.
   b. The Contractor shall furnish, install, and operate, at his expense, the necessary connections, pumps, meters, and gauges necessary to conduct the test. The meters used in the testing shall be tested, sealed and approved at the Contractor's expense prior to running any test.

2. Procedures
   a. Before applying the specified pressure test, all air shall be expelled from the pipe by slowly filling each valved section of pipe with water and providing taps if necessary to expel trapped air.
   b. All pipe, fittings, and joints will be examined during testing.
   c. Any defective material shall be replaced with sound material and the test repeated until satisfactorily completed and approved.
   d. Allowable leakage for water lines with rubber gasketed joints shall not exceed 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.
   e. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered, shall be replaced, regardless of total leakage shown.
   f. Where practicable, pipe lines shall be tested in lengths between valves or plugs of no more than 1500 feet. Contractor must have written approval for test sections greater than 1500 feet.

C. Sterilization

1. General
   a. After approved completion of the hydrostatic tests, the water distribution system shall be sterilized before acceptance for domestic operation.

2. Procedures
   a. Distribution system shall be disinfected using chlorine or chlorine compounds added to the water resulting in 50 ppm (parts per million) chlorine.
   b. After the water containing this amount of chlorine has been in contact with the pipe and appurtenances at least 24 hours, the water shall be replaced with water to be transported normally, and samples of water taken and tested to assure that the disinfection procedure was effective.
   c. No main shall be placed in service or accepted until water samples are approved by applicable regulatory agency.
   d. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 33 30 00 - SANITARY SEWER

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for furnishing and placing sanitary sewer pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33 Trenching, Backfilling and Compaction

B. Section 31 41 33 Trench Safety

1.3 APPLICABLE PUBLICATIONS

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

A. American Society for Testing and Materials Standards (ASTM).

1. C-700 Specifications for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.

2. C-478 Specification for Precast Reinforced Manhole Sections.

3. D-3034 Specification for Polyvinyl Chloride (PVC) Pipe.

4. C-76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

5. A-48 - Specification for Gray Iron Castings.

6. C-476 - Specification for Grout for Masonry.

7. A-615 - Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

8. C-443 - Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.

9. D-3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

10. F-679 Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.

11. F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

12. A746 Standard Specification for Ductile Iron Gravity Sewer Pipe

13. C150 Standard Specification for Portland Cement

14. C33 Standard Specification for Concrete Aggregates

15. C890 Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

16. C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

17. F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

18. C924 Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

19. C969 Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

20. D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

B. Texas Department of Transportation 2014 Standard Specifications for Construction of Highways, Street and Bridges (TxDOT).

1. Item 465 Manholes and Inlets

C. American Water Works Association (AWWA)

1. C110 AWWA Standard for Ductile-Iron and Gray-Iron Fittings

2. C111 AWWA Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

3. C105 Polyethylene Encasement for Ductile Iron Pipe Systems

4. C600 Installation of Ductile Iron Water Mains and Their Appurtenances

D. American Concrete Institute (ACI)

1. ACI 318 Building Code Requirements for Structural Concrete

1.4 SUBMITTALS

A. Product Data: For the following:

1. Corrosion proof liner selected for protecting concrete pipe from sewer gases. Contractor shall submit data on the selected liner for approval prior to construction.

2. Special pipe fittings.

3. Shop Drawings: For the following:
   a. Cast in Place Manholes: Include plans, elevations, sections, details, design calculations, and concrete design-mix report, and frames and covers

4. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

5. Field quality-control test reports.

1.5 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. LLDPE: Linear low-density, polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.6 PROJECT CONDITIONS

A. When working with sanitary manholes new or existing, contractor must keep requirements for confined space entries. In all activities, contractor shall work in a safe manner as required by OSHA and other governing criteria.

B. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two <2> days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Owner's written permission.

3. If work requires interference with any public sewer systems within or outside of Public Rights of Way or Easements, contractor must obtain prior approval and coordinate with local municipality before commencing work.

1.7 DELIVERY STORAGE AND HANDLING

A. Contractor is responsible for protecting materials per manufactures recommendations

1. Do not store plastic manholes, pipe, and fittings in direct sunlight.

2. Protect pipe, pipe fittings, and seals from dirt and damage.

3. Handle cast in place manholes according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PIPE

A. PVC pipe, 6” to 10” shall conform to ASTM D3034, SDR 26. PVC pipe 12” and 15” shall conform to ASTM D3034, SDR 35. PVC pipe 18” to 27” shall conform to ASTM F679, SDR 35. All diameters shall use bell and spigot ends for gasketed joints with ASTM F 477 elastomeric seals. For sewers up to 12” diameter crossing over or under waterlines, provide minimum 150 psi pressure rated pipe conforming to ASTM D2241 with suitable PVC couplings.

B. Ductile iron pipe shall conform to ASTM A746 and cast iron fittings shall conform to AWWA C110. Gaskets shall conform to AWWA C111, rubber. Wrap pipe with polyethylene per AWWA C 105.

C. Reinforced concrete pipe where approved for sanitary sewers shall conform to ASTM C-76 Class as required for laying condition and shall be lined with a corrosion proof liner satisfactory for protecting concrete from sewer gases. Contractor shall submit data on the selected liner for approval prior to construction

D. Vitrified clay pipe shall conform to ASTM C-700 extra strength plain end pipe. .

2.2 JOINTS

A. PVC pipe joints shall conform to ASTM D3212.

B. Ductile iron pipe joints shall be push-on type unless otherwise indicated on the plans.

C. Reinforced concrete pipe joints shall be "Ram-Nek" flexible plastic gaskets or approved equal per ASTM C 443.

D. Vitrified clay pipe joints shall be plain and push-on type with compression joint gaskets.

2.3 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water
   a. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
   b. Water sources other than the local municipal domestic water supply must be approved by the Owner.
   c. If onsite reclaimed water sources are used, tanks and appurtenances must be clearly marked with the words “non-potable” water.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

C. Reinforcement Bars: ASTM A 615, Grade 60 deformed steel.

D. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.
   a. Slope: 8 percent.

E. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

F. Reinforcement Bars: ASTM A 615, Grade 60 deformed steel.

2.4 MANHOLES

A. Precast concrete manholes shall conform to ASTM C-478.

B. Cast-in-Place-Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

C. Ballast: Increase thickness of concrete as required to prevent flotation.

D. Watertight Fiberglass Manholes: Manufactured from commercial grade polyester resin with fiberglass reinforcements, meeting all requirements of ASTM D-3753 as manufactured by L.F. Manufacturing Inc. or an approved equal.

E. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.

F. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

G. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

H. Manhole Frames and Covers: To meet those detailed in the detail section of the plans as specified with precast concrete manholes

2.5 MORTAR

A. Mortar for flowline directioning in all manholes shall conform to TxDOT Item 465.2B and ASTM C 476.

2.6 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

B. Available Manufacturers:

1. Canplas Inc.
2. IPS Corporation.
3. NDS Inc.
4. Plastic Oddities, Inc.
5. Sioux Chief Manufacturing Company, Inc.
6. Zurn Light Commercial Specialty Plumbing Products; Zurn Plumbing Products Group.

PART 3 - EXECUTION

3.1 PIPE SEWERS

A. Utilities have been located from surveys and available existing records. Not all utilities may be shown on the Drawings. Locate all utilities prior to beginning any construction activities. Start construction of gravity sanitary piping from lowest end and work back up to the highest flowline elevation.

B. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of the trench has been properly shaped.

C. Batter boards where used shall be placed into position properly. Boards shall be nominal 1 x 4 inch lumber, planed on all four sides to parallel faces. The boards and all location stakes must be protected from injury or change of location.

D. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.

E. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream.

F. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.

G. Before laying pipes a sufficient bed shall be prepared at the grade indicated on the drawings. Backfill shall be placed as outlined in Section 31 23 33 Trenching, Backfill and Compaction.

H. A minimum clearance of six (6) inches must be maintained between the sewer and all other lines. Sanitary sewers shall not be routed over water lines.

I. Sanitary sewers shall not be constructed within nine (9) feet (outside to outside) parallel to a water line. Where sanitary sewers cross under water lines, the pipe material for the sewer shall be an 18' length of ductile iron pipe or PVC schedule 80 pressure pipe, centered on the water line.

J. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.2 MANHOLES

A. Manholes shall be constructed at locations shown on the plans and to the depth indicated thereon.

B. Manholes may be constructed of brick, concrete or precast concrete sections and in all types shall be constructed to the dimensions shown on the plans. Where concrete or precast concrete sections are used, the interior wall shall be thoroughly coated with coal tar epoxy.

C. Joints between precast concrete sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.

D. The construction of manholes shall be done as soon as practical after sewer lines into or through the manhole are completed.

E. All sewers shall be cut neatly at the inside face of the walls of the manhole and pointed up with mortar.

F. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.

G. The inverts of the sewer line or several sewer lines entering the manhole at or near the flow line elevation of the manhole shall be shaped and routed across the floor of the manhole using mortar to obtain the proper contour.

H. When sanitary sewer pipes enter a manhole three (3) feet or greater above the bottom of the manhole, a drop pipe of equal diameter shall be constructed outside the manhole to the bottom of the manhole per the details on the plans.

I. Fiberglass manhole installation must meet the requirements of L.F. Manufacturing, Inc. or the approved manufacturer if different than what is expressed in this specifications.

3.3 FRAMES, GRATES, RINGS AND COVERS

A. Casting shall conform to the type shown on the plans and shall be clean castings, free from sand or blow holes or other defects. Materials shall be not less than Class 30B gray iron conforming to ASTM A-48.

B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.

C. Bearing surfaces between manhole rings and covers and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

3.4 FIELD QUALITY CONTROL AND TESTING

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

3. Alignment: Less than full diameter of inside of pipe is visible between structures.

4. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter. (Check to see if this is similar to mandrel test and use it instead)

5. Crushed, broken, cracked, or otherwise damaged piping.

6. Infiltration: Water leakage into piping.

7. Exfiltration: Water leakage from or around piping.

8. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

9. Reinspect and repeat procedure until results are satisfactory.

10. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

11. Do not enclose, cover, or put into service before inspection and approval.

12. Test completed piping systems according to requirements of authorities having jurisdiction.

13. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

14. Submit separate report for each test.

B. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

1. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.

2. Close openings in system and fill with water.

3. Purge air and refill with water.

4. Disconnect water supply.

5. Test and inspect joints for leaks.

6. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig

C. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, and the following:

1. Option: Test plastic gravity sewer piping according to ASTM F 1417.

2. Option: Test concrete gravity sewer piping according to ASTM C 924.

3. Leaks and loss in test pressure constitute defects that must be repaired.

4. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

D. Manhole tests: Test sanitary manholes according to requirements of authorities having jurisdiction, and the following:

1. Option: Vacuum testing:
   a. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
   b. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 02533-4, Vacuum Test Time Table.
   c. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury (Hg).

2. Option: Perform hydraulic test according to ASTM C 969

3. Leaks and loss in test pressure constitute defects that must be repaired.

4. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

SECTION 33 40 00 - DRAINAGE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for furnishing and placing drainage pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.2 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

1. American Society for Testing and Materials Standards (ASTM).
   a. A 48 Specification for Gray Iron Castings.
   b. A 615 Specification for Deformed and Plain Carbon -Steel Bars for Concrete Reinforcement.
   c. C 32 Specification for Sewer and Manhole Brick (Made from Clay or Shale)
   d. C 76 Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
   e. C 443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
   f. C 476 Specification for Grout for Masonry
   g. C 478 Specification for Precast Reinforced Manhole Sections.
   h. C 1433 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers.
   i. D 3034 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   j. D 3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
   k. F 679 Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
   l. F 758 Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport and Similar Drainage.
   m. A 746 Specification for Ductile Iron Gravity Sewer Pipe.
   n. F 477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
   o. C 150 Standard Specification for Portland Cement
   p. C 33 Standard Specification for Concrete Aggregates
   q. D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
   r. F 2306 Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

2. Texas Department of Transportation 2014 Standard Specifications for Construction of Highways, Streets and Bridges (TxDOT).
   a. Item 460 Corrugated Metal Pipe.
   b. Item 462 Concrete Box Culverts and Sewers.
   c. Item 465 Manholes and Inlets
   d. Item 466 Headwalls and Wingwalls
   e. Item 467 Safety End Treatment

f. Item 476 Jacking, Boring or Tunneling Pipe or Box
g. Item 479 Adjusting Manholes and Inlets

3. American Water Works Association (AWWA)
a. C 110 AWWA Standard for Ductile-Iron and Gray-Iron Fittings.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33 Trenching, Backfilling and Compaction

B. Section 31 41 33 Trench Safety

1.4 PROJECT CONDITIONS

A. When working with storm manholes new or existing, contractor must keep requirements for confined space entries. In all activities, contractor shall work in a safe manner as required by OSHA and other governing criteria.

B. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated: Notify Owner no fewer than two days in advance of proposed interruption of service.

C. Do not proceed with interruption of service without Owner's written permission.

D. If work requires interference with any public drainage systems within or outside of Public Rights of Way or Easements, contractor must obtain prior approval and coordinate with local municipality before commencing work

1.5 SUBMITTALS

A. Product Data: For the following as used on the project:

1. Pipe material

2. Special pipe fittings, special fittings between dissimilar pipe materials, pressure type fittings, etc.

3. Backwater valves.

4. Drains.

5. Channel drainage systems.

6. Storage and leaching chambers.

B. Shop Drawings: For the following:

1. Cast in place manholes, inlets and catch basins: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report

2. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings (if not already shown in the plans): Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.6 QUALITY ASSURANCE (NOT USED)

1.7 DEFINITIONS

A. LLDPE: Linear low-density, polyethylene plastic.

B. PE: Polyethylene plastic.

C. PP: Polypropylene plastic.

D. PVC: Polyvinyl chloride plastic.

PART 2 - PRODUCTS

2.1 PIPE

A. Reinforced concrete pipe shall conform to ASTM C-76, wall “B” thickness for, Class III and Class IV as shown on the plans or as necessary to meet ASTM cover design requirements.

B. Corrugated metal pipe shall conform to TxDOT Item 460 specifications.

C. Polyvinyl Chloride (PVC) pipe 4 inch in diameter shall be DR 18 and conform to AWWA C900. PVC pipe 6” to 10” shall be SDR 26 and conform to ASTM 3034. PVC pipe 12 to 15 inch diameter shall be SDR35 and conform to ASTM D3034. Polyvinyl chloride pipe 18 to 36 inches shall be SDR35 and conform to ASTM F679.

D. Precast box culverts shall conform to ASTM C 1433 and TxDOT Item 462.

E. Polyvinyl Chloride Perforated pipe and fittings shall conform to ASTM F758.

F. Ductile Iron Pipe (DIP) shall be Class 51 and conform to ASTM A-746.

G. High Density, high molecular weight polyethylene HDPE virgin compound material meeting requirements of cell class outlined in ASTM D 3350. Manufacturing shall meet requirements of ASTM F 2306.

2.2 JOINTS

A. Reinforced concrete pipe joints shall conform to ASTM C-443 Rubber Gaskets or approved equal.

B. PVC pipe joints shall conform to ASTM D-3212 and ASTM F477 specifications.

C. DIP pipe joints shall conform to AWWA C110, latest edition.

2.3 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, and the following for manholes and inlets:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water
   a. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
   b. Water sources other than the local municipal domestic water supply must be approved by the Owner.
   c. If onsite reclaimed water sources are used, tanks and appurtenances must be clearly marked with the words “non-potable” water.

B. Portland Cement Design Mix: 4000 psi minimum in 28 days, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Bars: ASTM A 615, Grade 60 deformed steel.

2.4 BRICK

A. Sewer brick for manholes, inlets and junction boxes shall be clay and shale masonry units that conform to ASTM C-32 grade MM. Compressive strength: 2200 psi min for individual brick; 2500 psi average for five bricks.

2.5 MORTAR

A. Mortar for brick drainage structures and manholes shall conform to TxDOT Item 465.2(B) and ASTM C 476.

2.6 RIMS, GRATES AND FRAMES

A. Castings for manhole and inlet rims, grates and frames shall conform to ASTM A 48, Class 35B gray iron or better quality.

2.7 SAFETY END TREATMENTS

A. Safety End Treatments shall conform to the products and installation requirements listed in TxDOT Item 467.

2.8 HEADWALLS AND WINGWALLS

A. Headwalls and Wingwalls shall conform to the products and installation requirements listed in TXDOT Item 466

PART 3 - EXECUTION

3.1 PIPE SEWERS

A. Open Trench Construction

1. Utilities have been located from surveys and available existing records. Not all utilities may be shown on the Drawings. Locate all utilities prior to beginning any construction activities. Start construction of storm drainage piping from lowest end and work back up to the highest flowline elevation.

2. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of trench has been properly shaped.

3. Batter boards where used shall be placed into position properly. Boards shall be nominal 1 x 4 inch lumber, planed on all four sides to parallel faces. The boards and all location stakes must be protected from injury or change of location.

4. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.

5. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream.

6. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.

7. Outfall pipes shall be as detailed on the drawings. Before laying pipes a sufficient bed shall be prepared at the grade indicated on the drawings. Backfill shall be placed as outlined in Section 31 23 33 Trenching, Backfill and Compaction.

B. Boring, Jacking or Tunneling Construction

1. Suitable pits shall be constructed for the boring, jacking or tunneling operations. Excavations greater than 5 feet in depth shall be protected as specified in Section 31 41 33 Trench Safety.

2. Construction operations shall be done in such a manner that the operation and structural integrity of the road or other area over the bore is not weakened or damaged in any way nor operations interfered.

3. Pits shall be filled immediately upon completion of the pipe installation.

4. Jacking operations shall meet the requirements of TxDOT Item 476.3(A and D).

5. Boring operations shall meet the requirements of TxDOT Item 476.3(B and D)

6. When pipe sizes are sufficient for tunneling methods, contractor may tunnel and jack pipe. When this method is used, special safety precautions shall be used to protect the workers involved. Any over excavation shall be filled with drilling mud after the pipe is installed. Tunneling operations shall meet the requirements of TxDOT Item 476.3(C)

3.2 MANHOLES, JUNCTION BOXES AND INLETS

A. Manholes and inlets shall be constructed at locations shown on the plans and to the depth indicated thereon.

B. Manholes may be constructed of brick, concrete or precast concrete sections and in all types shall be constructed to the dimensions shown on the plans.

C. Inlets and junction boxes shall be constructed in accordance with the details shown on plans.

D. Joints between precast concrete manhole and inlet sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.

E. The construction of manholes, junction boxes and inlets shall be done as soon as practical after sewer line into or through the manhole, junction box or inlet locations are completed.

F. All sewers shall be cut neatly at the inside face of the walls of the manhole, junction box or inlet and pointed up with mortar.

G. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.

H. The inverts of the sewer line or several sewer lines entering the manhole or junction box at or near the flow line elevation of the manhole or junction box shall be shaped and routed across the floor of the manhole or junction box using mortar to obtain the proper contour.

I. Adjusting Manholes and Inlets shall conform to specifications in TxDOT Item 479.

3.3 FRAMES, GRATES, RINGS AND COVERS

A. Castings shall conform to the type shown on the plans and shall be clean substantial castings, free from sand or blow holes or other defects.

B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.

C. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

D. Castings in pavement areas or areas designated to receive traffic loading shall be a heavy duty type capable of H-20 loading.

3.4 UNDERDRAIN SYSTEMS

A. Pipe shall be laid per paragraph 3.1 and per the details on the plans.

B. Prior to placing granular backfill and bedding, line trench with drainage fabric according to the details. The drainage fabric shall be Supac 4NP or approved equal.

C. Granular bedding shall be prepared to a depth of 2 to 4 inches below the pipe invert. The pipe shall be laid with the perforations facing down. The granular backfill shall then be placed to the depth shown on the details. The filter fabric shall then be wrapped around the granular material with a minimum overlap at the top of 6 inches.

D. Where vertical pipe risers penetrate the granular backfill to the surface, the drainage fabric shall be cut in an 'X' to accommodate the pipe penetration and then the fabric shall be sealed with a heavy duty tape to the pipe in the manner to insure the integrity of the filter fabric.

END OF SECTION