SECTION 08710 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.

E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Hardware Supplier and Hardware Installer must obtain a license with the Louisiana Office of State Fire Marshall in accordance to RS 40:1464 and RS 40:1664.

B. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity.

E. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained,

certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.

F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.
4. Five years for motorized electric latch retraction exit devices.
5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.

d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. Bommer Industries (BO) - LB Series.
b. Hager Companies (HA) - CB Series.
c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

a. Bommer Industries (BO).
b. Hager Companies (HA).
c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Hager Companies (HA) - ETW-QC (# wires) Option.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a 12" removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Bommer Industries (BO) - SER-QC (# of wires) Option.
    b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) - SER-QC (# wires) Option.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. Hager Companies (HA) - Quick Connect.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.

3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU).
    b. Sargent Manufacturing (SA).
    c. Schlage (SC).

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer's Standard.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.

1. Manufacturers:

a. Schlage Lock (SC) - Everest D Series.

F. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.

1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.

a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
b. Level 2 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders constructed to provide protection against bumping and picking.
c. Level 3 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders to be UL437 certified and constructed to provide protection against bumping, picking, and drilling.
d. Refer to hardware sets for specified levels.

2. Manufacturers:

a. Sargent Manufacturing (SA) - Degree Series.
b. Corbin Russwin (RU) – Access 3 Series.

G. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

H. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

I. Construction Keying: Provide temporary keyed construction cores.

J. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

K. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

L. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into "Key Wizard" software.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Mortise locks to be certified Security Grade 1.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) – ML2000 Series.
b. Sargent Manufacturing (SA) – 8200 Series.

c. Schlage (SC) – L9000 Series.

2.7 INTEGRATED WIEGAND OUTPUT LOCKING DEVICES – MULTI-CLASS READER

A. Integrated Wiegand Output Multi-Class Mortise Locks: Wiegand output ANSI A156.13, Grade 1, mortise lockset with integrated card reader, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
2. Integrated reader supports the following credentials:

    a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
    b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.
3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
5. Support end-of-line resistors contained within the lock case.
6. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.

8. Manufacturers:

    a. Corbin Russwin (RU) – ML2000 SE-LP10 Series.
    b. Sargent Manufacturing (SA) – M1 8200 Series.
    c. Schlage (SC) – AD300 Series

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.

7. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

8. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

9. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

10. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

11. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

12. Rail Sizing: Provide exit device rails factory sized for proper door width application.

13. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
b. Sargent Manufacturing (SA) - 80 Series.
c. Von Duprin (VD) - 35A/98 XP Series.

2.10 INTEGRATED WIEGAND OUTPUT EXIT DEVICES – MULTI-CLASS READER

A. Integrated Wiegand Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Integrated reader supports the following credentials:
   a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
   b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.
3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.

5. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.

6. Manufacturers:

   a. Corbin Russwin (RU) – ED5000 SE-LP10 Series.
   b. Sargent Manufacturing (SA) – M1 80 Series.
   c. Von Duprin (VD) – AD300 Series.

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

   a. Corbin Russwin Hardware (RU) - DC6000 Series.

b. LCN Closers (LC) - 4040 Series.
c. Sargent Manufacturing (SA) - 351 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

   a. Burns Manufacturing (BU).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.13 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

   a. Burns Manufacturing (BU).

b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

2.14 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.15 ELECTRONIC ACCESSORIES

A. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw plus 50% for the specified electrified hardware and access control equipment.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - BPS Series.

b. Securitron (SU) - BPS Series.
c. Von Duprin (VD) - PS.

B. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power limited outputs. Units shall tolerate brownout or overvoltage input ± 15% of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults and units shall be available with a single relay fire trigger or individually triggered relayed outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw plus 50% for the specified electrified hardware and access control equipment.

1. Manufacturers:

a. Securitron (SU) - AQ Series.

2.16 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.17 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer's Abbreviations:
1. MK - McKinney

2. PE - Pemko
3. RO - Rockwood
4. RU - Corbin Russwin
5. OT - OTHER
6. SU - Securitron

Hardware Sets

Set: 1.0
Doors: D37, D38, D56, D60
Description: Ext Alum ELR NL x Pull Exit

1	Continuous Hinge	CFM__SLF-HD1 SER*		PE
1	Rim Exit Device, Nightlatch	ED5200 K157ET M92 MELR ACP	630	RU
1	Door Pull	TBF157	US32D	RO
1	Surface Closer Unitrol	DC6200 A11	689	RU
1	Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Sweep	3452AV		PE
1	ElectroLynx Harness	QC-CxxxP length as required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	By Security Contractor		OT
1	Power Supply	AQD Series		SU
1	Seals, Sweeps & Astragals	By Alum door supplier		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.
Doors noted as wide stile.

Set: 2.0
Doors: D27
Description: Ext Pr Alum ELR NL x DT Pull Exit

2	Continuous Hinge	CFM__SLF-HD1 SER*		PE
1	Rim Exit Device, Nightlatch	ED5200 K157ET M92 MELR ACP	630	RU
1	Rim Exit Device, Exit Only	ED5200 EO M92	630	RU
2	Door Pull	TBF157	US32D	RO
2	Surface Closer Unitrol	DC6200 A11	689	RU
1	Threshold	2005AT		PE
1	Rain Guard	346C		PE
2	Sweep	3452AV		PE
2	ElectroLynx Harness	QC-CxxxP length as required		MK
2	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	By Security Contractor		OT
1	Power Supply	AQD Series		SU
1	Seals, Sweeps & Astragals	By Alum door supplier		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.
Doors noted as wide stile.

Set: 3.0
Doors: D01
Description: Exterior Aluminum - Exit NL

1	Continuous Hinge	CFM_SLF - HD1		PE
1	Rim Exit Device, Nightlatch	ED5200 K157ET ACP (NL/Pull)	630	RU
1	Door Pull	TBF157	US32D	RO
1	Surface Closer Unitrol	DC6200 A11	689	RU
1	Threshold	2005AT		PE
1	Sweep	3452AV		PE
1	Seals, Sweeps & Astragals	By Alum door supplier		OT
1	ElectroLynx Harness	QC-CxxxP length as required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	By Security Contractor		OT
1	Power Supply	AQD Series		SU

Notes: Access control locking device to be furnished by Authorized Channel Partner (ACP) and installed by Certified Integrator (CI).

Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.
Set: 4.0
Doors: D48
Description: Ext HM MELR Exit x Pull UL437

1	Continuous Hinge	CFM__HD1 SER*		PE
1	Rim Exit MELR NL - UL 437	ED5200 K157ET M92 MELR ACHS	630	RU
1	Door Pull	TBF157	US32D	RO
1	Surface Closer Unitrol	DC6200 A11	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Gasketing	2891APK		PE
1	Sweep	3452AV		PE
1	ElectroLynx Harness	QC-CxxxP length as required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	By Security Contractor		OT
1	Power Supply	AQD Series		SU

Notes: Access control locking device to be furnished by Authorized Channel Partner (ACP) and installed by Certified Integrator (CI).

Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss

of power, doors will remain secure. Free egress at all times.

Set: 5.0
Doors: D08, D47, D52, D55, D69
Description: Ext HM MELR Exit x Pull

1	Continuous Hinge	CFM__HD1 SER*		PE
1	Rim Exit Device, Nightlatch	ED5200 K157ET M92 MELR ACP	630	RU
1	Door Pull	TBF157	US32D	RO
1	Surface Closer Unitrol	DC6200 A11	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Gasketing	2891APK		PE
1	Sweep	3452AV		PE
1	ElectroLynx Harness	QC-CxxxP length as required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	By Security Contractor		OT
1	Power Supply	AQD Series		SU

Notes: Access control locking device to be furnished by Authorized Channel Partner (ACP) and installed by Certified Integrator (CI).

Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 6.0
Doors: D65
Description: Ext HM Exit NL x Pull UL437

1	Continuous Hinge	CFM__HD1		PE
1	Rim Exit Device, Nightlatch	ED5200 K157ET ACHS (NL x Pull)	630	RU
1	Door Pull	TBF157	US32D	RO
1	Surface Closer Unitrol	DC6200 A11	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Gasketing	2891APK		PE
1	Sweep	3452AV		PE

Set: 7.0
Doors: D64
Description: Ext HM Exit NL x Pull

1	Continuous Hinge	CFM__HD1		PE
1	Rim Exit Device, Nightlatch	ED5200 K157ET ACP (NL/Pull)	630	RU
1	Door Pull	TBF157	US32D	RO

1	Surface Closer Unitrol	DC6200 A11	689	RU	
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO	
1	Threshold	2005AT		PE	
1	Rain Guard	346C		PE	
1	Gasketing	2891APK		PE	
1	Sweep	3452AV		PE	

Set: 8.0
Doors: D26, D49
Description: Int Rated SELP10 Exit UL437

1	Hinge (heavy weight)	T4A3786 QC*	US26D	MK	
2	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Access Cont Fire Rated Rim UL437	ED5200AN 1109605ET-SELP10 MELR		630	RU
1	Cylinder (UL437)	As required.		RU	
1	Closer (surface)	DC6200/DC6200 A3	689	RU	
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO	
1	Door Stop	406/409/441CU	US26D	RO	
1	Gasketing	S88		PE	
2	ElectroLynx Harness	QC-CxxxP length as required		MK	
1	ElectroLynx Harness	QC-C1500P		MK	
1	Power Supply	AQD Series		SU	

Notes: Access control locking device to be furnished by Authorized Channel Partner (ACP) and installed by Certified Integrator (CI).

Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 9.0
Doors: D25, D33
Description: Int Rated SELP10 Exit

1	Hinge (heavy weight)	T4A3786 QC*	US26D	MK	
2	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Access Cont Fire Rated Rim Exit	ED5200AN 1109605ET-SELP10 MELR		630	RU
1	Cylinder	As required - ACP (Access 3)	626	RU	
1	Closer (surface)	DC6200/DC6200 A3	689	RU	
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO	
1	Door Stop	406/409/441CU	US26D	RO	
1	Gasketing	S88		PE	
2	ElectroLynx Harness	QC-CxxxP length as required		MK	
1	ElectroLynx Harness	QC-C1500P		MK	
1	Power Supply	AQD Series		SU	

Notes: Access control locking device to be furnished by Authorized Channel Partner (ACP) and installed by Certified Integrator (CI).

Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 10.0
Doors: D02
Description: Int SELP10 Exit

1	Hinge (heavy weight)	T4A3786 QC*	US26D	MK
2	Hinge (heavy weight)	T4A3786	US26D	MK
1	Access Control Rim Exit	ED5200N 1109605ET-SELP10 MELR	630	RU
1	Cylinder	As required - ACP (Access 3)	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
1	Gasketing	S88		PE
2	ElectroLynx Harness	QC-CxxxP length as required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Power Supply	AQD Series		SU

Notes: Access control locking device to be furnished by Authorized Channel Partner (ACP) and installed by Certified Integrator (CI).

Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 11.0
Doors: D68
Description: Storeroom Pairs - Closer/stop MFB

6	Hinge	TA2714 (NRP)	US26D	MK
2	Manual Flush Bolt	555/557 12" / 72" AFF	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom Lock	ML2057 110T ACP	626	RU
2	Surface Closer w/stop arm	DC6200 A4	689	RU
2	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing	S88		PE
1	Astragal Set (2)	18061CNB		PE

Set: 12.0
Doors: D16, D28, D32, D66, D70
Description: Storeroom Function x Closer x Gasket

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock	ML2057 110T ACP	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO

1	Gasketing	S88		PE

Set: 13.0
Doors: D35, D36
Description: Storeroom Function x Closer/stop x Gasket

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock	ML2057 110T ACP	626	RU
1	Surface Closer w/stop arm	DC6200 A4	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing	S88		PE

Set: 14.0
Doors: D59, D63
Description: Storeroom Function x Door Closer

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock	ML2057 110T ACP	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
3	Silencer	608/608CA		RO

Set: 15.0
Doors: D24, D45, D67
Description: Storeroom Function x Door Closer - Gasket - UL437

3	Hinge	TA2714 (NRP)	US26D	MK
1	Storeroom Lock UL437	ML2057 110T ACHS	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
1	Gasketing	S88		PE

Set: 16.0
Doors: D29, D30
Description: Classroom Function - Fire Rated

3	Hinge	TA2714	US26D	MK
1	Classroom Lock	ML2003 110T ACP	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
1	Gasketing	S88		PE

Set: 17.0
Doors: D03, D04, D05, D06, D07, D09, D10, D12, D13, D14, D18, D22, D23, D39, D41, D42, D43, D44, D46, D58, D62
Description: Office Function x Door Closer

3	Hinge	TA2714	US26D	MK
1	Office Lock	ML2051 110T ACP	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
3	Silencer	608/608CA		RO

Set: 18.0
Doors: D17, D19, D40, D57, D61
Description: Privacy Function x Closer

3	Hinge	TA2714	US26D	MK
1	Privacy Lock	ML2030 110T M19V	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
1	Gasketing	S88		PE

Set: 19.0
Doors: D51
Description: Privacy Function x Closer/stop

3	Hinge	TA2714	US26D	MK
1	Privacy Lock	ML2030 110T M19V	626	RU
1	Surface Closer w/stop arm	DC6200 A4	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing	S88		PE

Set: 20.0
Doors: D15
Description: Passage Function x Door Closer

3	Hinge	TA2714	US26D	MK
1	Passage Latch	ML2010 110T	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
3	Silencer	608/608CA		RO

Set: 21.0
Doors: D11, D21
Description: Int SELP10 Lock x Closer - Gasket

2	Hinge	TA2714 (NRP)	US26D	MK
1	Hinge	TA2714 QC* (NRP)	US26D	MK
1	Access Control Mort Lock	ML20608 x SELP10-SEC 110T	626	RU
1	Cylinder	As required - ACP (Access 3)	626	RU
1	Closer (surface)	DC6200/DC6200 A3	689	RU

1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406/409/441CU	US26D	RO
1	Gasketing	S88		PE
1	ElectroLynx Harness	QC-CxxxP length as required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Power Supply	AQD Series		SU

Notes: Access control locking device to be furnished by Authorized Channel Partner (ACP) and installed by Certified Integrator (CI).

Doors are normally closed and secure. Presentation of valid credential will allow entry by trim. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 22.0
Doors: D31, D50, D53, D54, D71, D72
Description: Lock Cylinder Only, If Required

1	Cylinder	As required - ACP (Access 3)	626	RU
1	Balance of Hardware	By the door manufacturer		OT

Notes: Verify with door system manufacturer.

Set: 23.0
Doors: D34
Description: Rated Aluminum

1	Cylinder	As required - ACP (Access 3)	626	RU
1	Balance of Hardware	By the door manufacturer		OT

END OF SECTION 08710

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Glass for windows, hollow metal windows, borrowed lights, doors and storefront framing.
2. Glazing sealants and accessories.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sample glass: Provide sample of Glass for Architect's review and approval in color as selected by Architect.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved [and certified] by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: 141.
    c. Building Risk Category: IV.

d. Exposure Category: C.

2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch , whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is indicated or otherwise required by codes, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 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, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F .
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 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. GANA 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, or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C 1048, 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.

D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, 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.

2.4 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer, ionomeric polymer interlayer, or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: 0.090" pvb.
   a. Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

2.7 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. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

E. 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.

F. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

G. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

H. 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.

I. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into 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.

3.6 MONOLITHIC GLASS SCHEDULE

A. Glass Type: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
   a. Glazing at RECEPTION #110 Transaction Window to be 1/2" thick, tempered glass with polished edges.
2. Safety glazing required.

3.7 INSULATING-LAMINATED-GLASS SCHEDULE

A. Glass Type: Tinted, insulating laminated glass.
1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Outdoor Lite: 6 mm.
3. Outdoor Lite: Tinted fully tempered float glass.

4. Tint Color: "Solar Gray" or as selected by Architect.
5. Interspace Content: Air.
6. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
   a. Minimum Thickness of Each Glass Ply: 3 mm.
7. Safety glazing required.

END OF SECTION 08800

SECTION 08830 - MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:

1. Annealed monolithic glass mirrors as indicated on Drawings.

B. Related Sections:
1. Division 10 Section "Toilet and Bath Accessories" for metal-framed mirrors.

1.3 SUBMITTALS

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

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

D. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Clear Glass: Mirror Glazing Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.3 MIRROR HARDWARE

A. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

B. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Edge Treatment:

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
2. Install mastic as follows:

a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08830

SECTION 09111 - NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.

B. Related Requirements:

1. Division 5 Specifications for load-bearing structural steel studs.
2. Section 06100 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
3. Section 09250 "Gypsum Board" for wall board applied to metal studs and furring and sound attenuation blankets in metal stud wall cavities.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:
   a. Minimum Base-Metal Thickness: 0.033 inch (20 ga.) or as otherwise indicated on drawings. Use 0.043 inch (18 ga.) studs where indicated on Drawings or for partition walls over 16'-0" in height if not indicated.
   b. Depth: As indicated on Drawings.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width required.

1. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).
2. Width: 1-1/2 inches
3. Install Flat straps on metal studs where gypsum board is not installed on both sides of studs. Straps to be installed @ 24" O.C. maximum (vert.) on side of studs opposite gypsum board.

D. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
2. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
3. Provide radiused furring channels where indicated.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

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 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 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 (406 mm) o.c. unless otherwise indicated.
2. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.

B. Where studs are installed directly against dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09111

SECTION 09250 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Sound attenuation blankets in stud wall cavities where indicated on Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 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.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Chinese Drywall Products are NOT acceptable.

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.

2.3 INTERIOR GYPSUM BOARD

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

1. CertainTeed Corp.
2. Georgia-Pacific Gypsum LLC.
3. National Gypsum Company.
4. Temple-Inland.
5. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm) or as indicated on Drawings.
2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Locations: As required for use in Fire Rated Assemblies
2. Thickness: 5/8 inch (15.9 mm).
3. Long Edges: Tapered.

A. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

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

a. C-Cure; C-Cure Board 990.
b. Custom Building Products; Wonderboard.
c. FinPan, Inc.; EZ Backer.

d. James Hardie Building Products, Inc.; Hardiebacker.
e. National Gypsum Company, Permabase Cement Board.
f. USG Corporation; DUROCK Cement Board.

2. Thickness: As indicated.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: REQUIRED AT ALL GYPSUM SURFACES EXPOSED TO VIEW (UNLESS OTHERWISE NOTED): For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For panels in un-conditioned spaces, use galvanized or stainless steel screws.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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

a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Pecora Corporation; AIS-919.
c. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
d. USG Corporation; SHEETROCK Acoustical Sealant.

E. Thermal Insulation: As specified in Section 07210 "Building Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels. Install expansion joints at 20'-0" O.C. maximum spacing.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally or where otherwise indicated on Drawings.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings or where required for fire-resistance-rated assembly.
3. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On partitions/walls, apply gypsum panels horizontally (perpendicular 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 high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

2. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application (if required):

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise 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 C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are to be covered by Insulation in air-handler rooms or where indicated on Drawings.
3. Level 5: Where panels are exposed to view unless indicated otherwise.
   a. Primer and its application to surfaces are specified in Section 09911 "Painting."

3.7 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 09250

SECTION 09310 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.

B. Related Sections:
1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Division 9 Section "Gypsum Board" for cementitious backer units.

DEFINITIONS

C. 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.

D. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

E. Module Size: Actual tile size plus joint width indicated.

F. Face Size: Actual tile size, excluding spacer lugs.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the required values as determined by testing identical products per ASTM C 1028:

1.4 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

1.5 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Stone thresholds.
2. Joint sealants.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

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.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Type MT-1: Factory-mounted glazed ceramic mosaic tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Basis of Design: "Mayfair" by Anatolia;
2. Composition: Vitreous or impervious natural clay or porcelain.
3. Module Size: 2 by 2 inches (50.8 by 50.8 mm).
4. Thickness: 3/8 inch (9.8 mm).
5. Face: Plain with cushion edges.
6. Surface: Smooth, without abrasive admixture.
7. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
8. Grout Color: As selected by Architect from manufacturer's full range. The intention is for the grout color to closely match tile color.

B. Tile Type MT-2: Polished natural stone mosaic wall tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Basis of Design: "Rittenhouse Square, glazed ceramic wall tile" by Daltile; Division of Dal-Tile International Inc.
2. Module Size: 3 inches by 6 inches.
3. Base configuration: Coved
4. Thickness: 5/16 inch (8 mm).
5. Face: Pattern of design indicated, with manufacturer's standard edges.

6. Tile Colors and Pattern: As selected by Architect from manufacturer's full range with two colors per room.
7. Grout: Polymer modified unsanded.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Joint Width: 1/16"

C. Tile Type CWT-1, CWT-2, CWT-3: Glazed wall tile and base.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Basis of Design: "Color Wheel Classic, glazed ceramic wall tile" by Daltile; Division of Dal-Tile International Inc.
2. Module Size: 3 inches by 6 inches.
3. Base configuration: Coved
4. Thickness: 5/16 inch (8 mm).
5. Face: Pattern of design indicated, with manufacturer's standard edges.
6. Tile Colors and Pattern: As selected by Architect from manufacturer's full range with two colors per room.
7. Grout: Polymer modified unsanded.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Joint Width: 1/16"

D. Tile Type PT-1 : Glazed Porcelain Floor Tile.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Basis of Design: "Aspen" by Anatolia.
2. Composition: Porcelain.
3. Module Size: 6" by 36"
4. Thickness: 3/8 inch.
5. Tile Color: As selected by Architect from manufacturer's full range.
6. Pattern: Brick Joint pattern (1/2)
7. Grout: Polymer modified sanded.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Joint Width: 3/16"

D. Tile Type PT-2 : Glazed Porcelain Floor Tile.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Basis of Design: "Mayfair" by Anatolia.
2. Composition: Porcelain.
3. Module Size: 12" by 24"
4. Thickness: 3/8 inch.
5. Tile Color: As selected by Architect from manufacturer's full range.
6. Pattern: Brick Joint pattern (1/2)
7. Grout: Polymer modified sanded.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Joint Width: 3/16"

3.2 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 (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

a. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 or 12 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
   1) Provide the following:

      a) "Carrara White" as manufactured by DALTILE.

3.3 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Subject to compliance with requirements, provide product by one of the following:

   a. Custom Building Products

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

3.4 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.
   1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

B. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

3.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
   1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

3.6 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. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

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 Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

3.7 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 4 - EXECUTION

4.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors 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.

4.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

4.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, and apply to types of setting and grouting materials used.

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. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: As indicated

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

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. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. Set thresholds in latex-portland cement mortar (thin set).
2. Do not extend cleavage membrane or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane or crack isolation membrane with elastomeric sealant.

I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

4.4 TILE BACKING PANEL JOINTS

A. Treat Joints of cementitious backer units according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

4.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09310

SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings as indicated on Drawings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

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

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

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. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 1.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.1 MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING TYPE SA-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide "FINE FISSURED High NRC" (#1754) square lay-in, medium texture with "HumiGuard Plus" as manufactured by Armstrong World Industries or a prior approved comparable product.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type III, Form 2, Pattern C E.

C. Color: White.

D. LR: Not less than 0.86.

E. NRC: Not less than 0.75.

F. CAC: Not less than 35.

G. Edge Detail: Square, lay-in.

H. Thickness: 7/8 inch.

I. Size: 24 by 24 inches.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING TYPE SA-2

A. Basis-of-Design Product: Subject to compliance with requirements, provide "Ceramaguard" #607 Fine Fissured Square Lay-In as manufactured by Armstrong World Industries or a prior approved comparable product.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
   1. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
   2. Pattern: CE (perforated, small holes and lightly textured).

C. Color: White.

D. LR: Not less than 0.82.

E. NRC: 0.55.

F. CAC: Not less than 38.

G. Edge/Joint Detail: Square

H. Thickness: 5/8 inch (15 mm).

I. Modular Size: 24 by 24 inches (600 by 600 mm).

J. Inherent Antimicrobial Treatment

K. Sag Resistance: "Humiguard Max"

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

   1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance".

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

   1. Anchors: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
3. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

E. Hold-Down Clips: Provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees in rooms indicated on drawings where new ceilings are specified. If not specifically indicated, Hold Down clips are to be located at ceilings inside interior doors for a minimum distance of 10' away from door in all directions.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING TYPES SA-1 & SA-2

A. Basis-of-Design Product: Subject to compliance with requirements, provide "Prelude XL" Exposed Tee 15/16" wide grid system by ARMSTRONG or a prior approved comparable product.

B. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide, aluminum caps on flanges.

1. Structural Classification: Heavy-duty system.
2. Face Design: Flat, flush.
3. Face Finish: Painted white aluminum.

2.5 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints @ Building Interior: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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.

1. 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, and comply with layout shown on reflected ceiling plans

B. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. 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.
6. Do not attach hangers to steel deck tabs.
7. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

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 panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. Install panels with pattern running in one direction parallel to long axis of space unless otherwise directed by Architect.
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.
4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

SECTION 09513 - EXTERIOR METAL PAN CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes exterior metal pans and associated suspension system for exterior soffits under porches and drive-through areas.

B. Related Requirements:

1. Section 09511 "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For units with factory-applied finishes.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

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. Acoustical Metal Pans: Full-size units equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each grid, exposed molding, and trim equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical metal pans, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle acoustical metal pans, suspension-system components, and accessories carefully to avoid damaging units and finishes in any way.

PART 2 - PRODUCTS

2.1 ACOUSTICAL METAL PANS, GENERAL

A. Source Limitations: Obtain each type of acoustical metal ceiling pan and supporting suspension system from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

C. Sheet Metal Characteristics: For metal components 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, roughness, stains, or discolorations.

1. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635/C 635M.

a. Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A 879/A 879M, 13Z (40G) coating, surface treatment as recommended by finish manufacturer for type of use and finish indicated.
b. Chemical/Mechanical Finishes: Uncoated steel sheet complying with ASTM A 1008/A 1008M with luster or bright finish as required by finisher for applying electroplating or other metallic-finishing processes.

2.2 STEEL PANS FOR EXTERIOR ACOUSTICAL METAL PAN CEILING – SA-3

A. Basis of Specifications: CELEBRATION, Snap-In Metal panels by USG
1. Color: Silver Satin 002

B. Alternative Manufacturer/Product: ARMSTRONG, METALWORKS Vector, Exterior 6466 M1, unperforated.

C. Classification: Units complying with ASTM E 1264 for Type XX, Pattern G type described as unperforated steel facing (pan) units.

D. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.

1. Material to be Electrogalvanized Steel suitable for exterior applications and Class 90 wind uplift.

2. Clip-in Pans: Designed to clip in and be securely retained in exposed suspension grid by formed edges or accessory clips provided by manufacturer. Pans shall be 100% downward accessible.

E. Pan Material Thickness: Not less than 0.021 inch.

F. Edge/Joint Detail: 1/8" reveal.

G. Pan Size: 24 by 24 inches or as indicated on Drawings.

H. Pan Face Finish: Factory powder coated.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635/C 635M requirements.

B. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
3. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel copper alloy for UNS No. N04400 alloy.

4. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung, is less than yield stress of wire, but provide not less than 0.135-inch-(3.5-mm-) diameter wire.

E. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure metal pans in place at each pan.

F. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units unless otherwise indicated.

1. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

2.4 DIRECT-HUNG, STANDARD-GRID, METAL SUSPENSION SYSTEM FOR EXTERIOR METAL PAN CEILING

A. Basis of Specifications: USG Donn Brand Fineline DXF Acoustical Suspension System.

B. Alternative Grid: ARMSTRONG, PRELUDE XL for Exterior Applications

C. Suspension System: For clip-in pans designed to interface properly with Armstrong Vector Exterior panels.

D. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G90 coating designation, with prefinished, cold-rolled, 15/16-inch-(24-mm-)wide aluminum caps on flanges.

1. Structural Classification: Heavy-duty system.
2. Face Design: Flat, flush.
3. Face Finish: Factory painted face as selected by Architect from Manufacturer's full range of solid colors. Grid cap color shall generally match Metal Panel finish. "Silver Satin"

E. Suspension System for Torsion-Spring-Hinged Metal Pans: Provide runners with factory-cut slots fabricated to accept torsion-spring-hinged attachment.

F. Brace suspended systems as required for UL90 uplift classification and wind loads for project location as required by building codes and standards.

2.5 ACOUSTICAL SEALANT

A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.

2.6 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. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

2.7 METALLIC-COATED STEEL SHEET FINISHES

A. Color-Coated Finish: Manufacturer's standard powder-coat baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

2.8 STEEL SHEET FINISHES

A. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical metal pan 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 metal pan ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and coordination drawings.

3.3 INSTALLATION

A. General: Install acoustical metal pan ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that do not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
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. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans in accordance with Manufacturer's recommendations.

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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Cut acoustical metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

G. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim. Comply with installation tolerances according to CISCA's "Metal Ceilings Technical Guidelines."

1. For clip-in pans, position pans according to manufacturer's written instructions.
2. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
3. Fit adjoining units to form flush, tight joints.
4. Install directionally patterned or textured metal pans in directions indicated or as directed by Architect.

H. Install hold-down clips on each panel.

3.4 CLEANING

A. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings, after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09513

SECTION 09651 - RESILIENT FLOOR TILE - SOLID VINYL

PART 1 - GENERAL

0.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

0.2 SUMMARY

A. Section Includes:

1. Solid vinyl floor tile.

B. Related Sections:
1. Division 9 Section "Resilient Wall Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

0.3 SUBMITTALS

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

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

E. Maintenance Data: For each type of floor tile to include in maintenance manuals.

0.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

0.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

0.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

0.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

0.1 SOLID VINYL FLOOR TILE (LVT-1):

A. Products: Subject to compliance with requirements, provide one of the following:
1. Basis of Design: "Amtico Signature Stone" Mannington Commercial

B. Tile Standard: ASTM F 1700.

1. Class/Type: Class III, Type B, embossed surface.

C. Overall Thickness: 0.098 inch (2.5 mm).

D. Wear Layer Thickness: 40 mil (0.8 mm).

E. Size: 12 by 12 inches.

F. Colors and Patterns: As indicated on Drawings or as otherwise selected by Architect from full range of industry colors.

0.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

0.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

0.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

0.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

0.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
1. Strip surface with stripping pad on commercial buffing machine.
2. Apply two coats of polish and buff with commercial floor buffer.

E. Cover floor tile until Substantial Completion.

END OF SECTION 09651

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

0.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

0.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

B. Related Sections:
1. Division 9 Sections where flooring materials are specified.
2. Section 09310 "Ceramic Tile" for marble thresholds/transitions at rigid tile.

0.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Product Schedule: For resilient products. Use same designations indicated on Drawings.

0.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

0.5 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 (10 deg C) or more than 90 deg F (32 deg C).

0.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

0.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

0.1 RESILIENT BASE

A. Resilient Base (RB-1):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Basis of Design: Johnsonite Millwork; "Reveal" 6" rubber profile base

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
3. Style: Millwork Wall Finishing System.

C. Minimum Thickness: 0.25 inch (6.35 mm).

D. Height: 6 inches (15.24 mm).

E. Lengths: 8 foot lengths

F. Outside Corners: Mitered .

G. Inside Corners: Mitered.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

0.2 RESILIENT MOLDING ACCESSORY:

A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flexco, Inc.
    b. Johnsonite.

B. Description: Transition pieces for different floor surfaces as indicated on drawings or otherwise required.
1. General locations: Where flooring finish surfaces changes between different materials including concrete, resilient flooring and carpet. Marble Transitions/thresholds at Rigid tile are specified in Division 9.
2. See details on Drawings.

C. Material: Rubber.

D. Profile and Dimensions: As indicated on drawings or otherwise required.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

0.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

0.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

0.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

0.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

0.4 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 resilient floor covering that would otherwise be exposed.

0.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 09653

SECTION 09656 - RESILIENT RUBBER ATHLETIC FLOORING – GYM

PART 1 - PART 1 - GENERAL

0.1 RELATED DOCUMENTS

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

0.2 SUMMARY

A. Section Includes:
1. Resilient (rubber) Athletic Flooring.

0.3 SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives, include printed statement of VOC content and chemical components.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

E. Product Schedule: For resilient products. Use same designations indicated on Drawings**.**

0.4 QUALITY ASSURANCE

A. Mockups: Provide resilient products with mockups specified in other Sections.

0.5 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 Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

0.6 PROJECT CONDITIONS

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

C. Maintain the ambient relative humidity between 40% and 60% during installation.

D. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PART 2 - PRODUCTS

0.1 RESILIENT ATHLETIC FLOORING

Manufacturer:

Johnsonite, Inc.	Phone:	(800) 899-8916
16910 Munn Road		(440) 543-8916
Chagrin Falls, Ohio 44023	Tech:	Ext 9297
Web: www.tarkettna.com	Samples:	Ext 9299
E-mail: info@johnsonite.com	Fax:	(440) 543-8920

A. Resilient Rubber Athletic Tile Flooring - Interlocking:
1. Basis of Design REPLAY Rubber Tile – R-1 – Resilient Rubber Athletic Tile Flooring:
a. Manufactured from a composition of recycled truck tire crumb rubber encapsulated in a urethane binder.
b. Overall thickness: 3/8" (9.55 mm).
c. Tile texture and color:
1) Hammered Textured Speckled Color
d. Tile style and size:
1) Interlocking (loose lay) 23" X 23" (58.42 cm X 58.42 cm)
e. ASTM D 2240 Standard Test Method for Rubber Property—Durometer Hardness: 65 Shore A.
f. ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring or 0.6 or greater.
g. ASTM F 970, Standard Test Method for Static Load Limit – passes 250 PSI.
h. ASTM D 3389 Standard Test Method for Coated Fabrics Abrasion Resistance: < 1.00 gram weight loss.
i. ASTM D 2859 Standard Test Method for Ignition Characteristics of Finished Floor Covering Materials (Pill Test): passes with greater than 1" of un-charred area.
j. Johnsonite offers a RESTART reclamation program for returning jobsite scrap
k. Replay Rubber Athletic Sheet Flooring contains 92% post-consumer recycled content
l. Resilient Rubber athletic Flooring contains 7% rapidly renewable content
m. 100% Recyclable
n. Phthalate, chlorine and halogen-free

0.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

PART 3 - EXECUTION

0.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

0.2 PREPARATION

A. Prepare substrates according to Johnsonite written instructions to ensure acceptance of Resilient Athletic Flooring.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Mechanically remove contamination on the substrate that may cause damage to the resilient athletic flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

4. Prepare Substrates according to ASTM F 710 including the following:

a. For loose lay (UnderLock, Interlocking) Tile:

1) The Moisture Vapor Emission Rate (MVER) of the concrete will have no measurable effect on the UnderLock or Interlocking Tile as they are not adhered to the concrete substrate.

2) Moisture testing must be conducted to identify if the MVER of the concrete is within the approved limits of the patching compound manufacturers specifications. (Follow patching compound manufactures instructions for proper selection and use.)

5. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.

a. The floor must be rigid, free of movement.

b. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.

1) Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.

2) Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).

c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Floor covering shall not be installed over expansion joints.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

0.3 RESILIENT ATHLETIC FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient athletic flooring.

B. Resilient Athletic Loose Lay UnderLock and Interlocking Tile Flooring:
1. Do not adhere Loose Lay tile to substrate.
2. Roll the flooring tabs with a hand roller.

0.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
1. No traffic for 24 hours after installation.
2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

D. Wait 72 hours after installation before performing initial cleaning

E. A regular maintenance program must be started after the initial cleaning.

END OF SECTION 09656

SECTION 09681 - CARPET TILE

GENERAL

RELATED DOCUMENTS

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

SUMMARY

Section includes modular carpet tile with matching carpet base.

Related Requirements:

Division 9 Sections for Flooring materials other than carpet tile.

Section 09653 "Resilient Wall Base and Accessories" for resilient wall base and accessories installed with carpet tile.

ACTION SUBMITTALS

Product Data: For each type of product.

Include manufacturer's written data on physical characteristics, durability, and fade resistance.
Include installation recommendations for each type of substrate.

Shop Drawings: Show the following:

Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
Carpet tile type, color, and dye lot.
Type of subfloor.
Type of installation.
Pattern of installation.
Pattern type, location, and direction.
Pile direction.
Type, color, and location of insets and borders.
Type, color, and location of edge, transition, and other accessory strips.
Transition details to other flooring materials.

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.

Carpet Tile: Full-size Sample.

Carpet Base: 12” long section of Carpet base with one edge bound with complimentary color edge binding.
Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

Product Schedule: For carpet tile. Use same designations indicated on Drawings.

INFORMATIONAL SUBMITTALS

Qualification Data: For Installer.

Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

Sample Warranty: For special warranty.

CLOSEOUT SUBMITTALS

Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
Precautions for cleaning materials and methods that could be detrimental to carpet tile.

MAINTENANCE MATERIAL SUBMITTALS

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.

Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

QUALITY ASSURANCE

Installer Qualifications: An experienced installer who is certified by the manufacturer to install the specified carpet tile and carpet base.

Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

Build mockups at locations and in sizes shown on Drawings.
Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

DELIVERY, STORAGE, AND HANDLING

Comply with CRI 104.

FIELD CONDITIONS

Comply with CRI 104 for temperature, humidity, and ventilation limitations.

Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

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.

Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

WARRANTY

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.

Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber and delamination.
Warranty Period: 10 years from date of Substantial Completion.

PRODUCTS

CARPET TILE – C-1

Sequences II Modular, Pix II GT158 as Manufactured by Mohawk Group.
Color: As selected by Architect from manufacturer's full range.
Construction: Textured Patterned Cut and Loop
Pattern: As selected by Architect.
Installation: Monolithic
Size: 24" x 24"
Fiber: Duracolor by Mohawk Group's Stain Resistant System
Dye Method: Solution Dyed/ Yarn Dyed
Backing: EcoFlex NXT
Stain Release Technology, Permanent Built into Fiber
Size: 24" x 24"
Gauge: 1/12” (49.00 rows per 10cm)
Stitches: 14.0 per inch
Finished Pile Thickness: 0.116 inches

Average Density: 8,069
Total Thickness: 0.275 inches
Tufted Weight: 26.0 oz
Fiber Type: Duracolor Premium Nylon
Dye Method: Solution Dyed/ Yarn Dyed
Backing: EcoFlex NXT
Pile Characteristic: Textured Patterned Cut and Loop
Finished Pile Thickness: 0.116 inches for finished carpet tile according to ASTM D 6859.
Antimicrobial Treatment: Manufacturer's standard material.

RESILIENT WALL BASE

All areas to receive resilient rubber wall base as specified in Section 09653

INSTALLATION ACCESSORIES

Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Resilient Transition Strips: Specified in Section 09653.

EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
Subfloor finishes comply with requirements specified in Section 03300 "Cast-in-Place Concrete" for slabs receiving carpet tile.
Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

For wood subfloors, verify the following:

Underlayment over subfloor complies with requirements specified in Section 06100 "Rough Carpentry."

Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

INSTALLATION

General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

Maintain dye lot integrity. Do not mix dye lots in same area.

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.

Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

Install pattern parallel to walls and borders unless indicated otherwise.

Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

CLEANING AND PROTECTION

Perform the following operations immediately after installing carpet tile:

Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
Remove yarns that protrude from carpet tile surface.
Vacuum carpet tile using commercial machine with face-beater element.

Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

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 09681

SECTION 09911 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Metal Access door and frame.
2. Steel/Iron Gratings at drainage structures and covers over valves, etc.

B. Related Sections include the following:

1. Division 2 Section for paving marking paint.
2. Division 5 Section for shop priming of metal substrates with primers specified in this Section.
3. Division 9 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
4. Division 9 Section "High Performance Coatings" for coating Exterior steel columns where indicated.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 2 gallons of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. 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.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

2.4 EXTERIOR ALKYD PAINTS

A. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

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 work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that 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.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

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 items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner reserves the right to engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates (Metal Access door and frame):

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.

c. Topcoat: Exterior alkyd enamel (semigloss).

END OF SECTION 09911

SECTION 09912 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete masonry units (CMU).
2. Gypsum board.
3. Steel doors and frames.
4. Exposed Metal Ductwork.
5. Underside of Steel roof deck in areas where exposed to view.
6. Steel roof structure, etc. in areas where exposed to view.
7. Misc. mechanical and electrical items as indicated.

B. Related Sections include the following:

1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 9 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
3. Division 9 Section "High Performance Coatings" for coating exterior steel columns at Front Porch.

1.3 DEFINITIONS

A. Gloss Level 1 (Matte Flat): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2 (Velvet-like Flat): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3 (eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4 (satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7 (High Gloss): More than 85 units at 60 degrees, according to ASTM D 523.

1.4 SUBMITTALS

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

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.5 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 2 gallons of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

2.4 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

2.5 METAL PRIMERS

A. TNEMEC SERIES 115 UNI-BOND DF - Self-crosslinking Hydrophobic Acrylic Dry-Fall Type

B. Alkyd Anticorrosive Metal Primer: MPI #79.

C. Quick-Drying Alkyd Metal Primer: MPI #76.

D. Cementitious Galvanized-Metal Primer: MPI #26.

2.6 LATEX PAINTS

A. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).

2.7 ALKYD PAINTS

A. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

2.8 ACRYLIC DRY-FALL PAINTS

A. TNEMEC SERIES 115 UNI-BOND DF - Self-crosslinking Hydrophobic Acrylic Dry-Fall Type

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 work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (CMU): 12 percent.
2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that 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.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

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.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Exposed metal ductwork.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

a. Switchgear.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner reserves the right to engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials

from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. High-Performance Architectural Latex System: MPI INT 4.2D.

   a. Prime Coat: Interior/exterior latex block filler.
   b. Intermediate Coat: High-performance architectural latex matching topcoat.
   c. Topcoat: High-performance architectural latex (semi-gloss).

B. Gypsum Board Substrates:

1. High-Performance Architectural Latex System: MPI INT 9.2B.

   a. Prime Coat: Interior latex primer/sealer.
   b. Intermediate Coat: High-performance architectural latex matching topcoat.
   c. Topcoat: High-performance architectural latex (satin).

C. Steel Substrates @ underside of roof deck and steel structure where exposed to view in spaces without ceilings:

1. TNEMEC SERIES 115 UNI-BOND DF - Self-crosslinking Hydrophobic Acrylic Dry-Fall Type:

   a. Prime Coat: Tnemec Series 115 Unibond 2.0 - 3.0 dry mils. Verify compatibility with any prior applied shop primer.
   b. Intermediate Coat: Tnemec Series 115 Unibond 2.0 - 3.0 dry mils.
   c. Topcoat: Tnemec Series 115 Unibond 2.0 - 3.0 dry mils.
      1) Gloss Level: Eggshell

D. Steel Substrates (General steel substrates, Steel Doors & Frames):

1. Alkyd System: MPI INT 5.1E.

   a. Prime Coat: Alkyd anticorrosive or Quick-drying alkyd metal primer.
   b. Intermediate Coat: Interior alkyd matching topcoat.

c. Topcoat: Interior alkyd (semigloss).

E. Galvanized-Metal Substrates:

1. Alkyd System: MPI INT 5.3C.

a. Prime Coat: Cementitious galvanized-metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (semigloss).

END OF SECTION 09912

SECTION 09960 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:
   a. Steel Columns where indicated to be coated.

B. Related Requirements:

1. Section 05120 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
2. Section 09911 "Exterior Painting" for general field painting at exteriors.
3. Section 09912 "Interior Painting" for general field painting at interiors.

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) 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.

D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in the Exterior High-Performance Coating Schedule and Interior High-Performance Coating Schedule or comparable product by one of the following:

1. TNEMEC, INC.

C. Products: Subject to compliance with requirements, provide products listed in the High-Performance Coating Schedules for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. 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.
3. Products shall be of same manufacturer for each coat in a coating system.

B. Colors: As indicated on Drawings or as selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner reserves the right to engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing 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 and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating 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 coatings, 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 coating systems indicated.

D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 6/NACE No. 3.

F. 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 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

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 coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates - 5 Steel columns at Front (Main) Porch:
   1. TNEMEC FLUOROPOLYMER SYSTEM:
      a. Prime Coat & touch up for shop primed steel: Tnemec Series 90G-1K97 Tneme-Zinc 2.5 - 3.5 dry mills.
      b. Intermediate Coat: Tnemec Series 66 Epoxoline 4.0-6.0 dry mils.
      c. Topcoat: Tnemec Series 1071/1072 Fluoronar 2.5 - 3.0 dry mils.
         1) Gloss Level at exposed structural steel: Semi-gloss.

END OF SECTION 09960

SECTION 10141 - PLAQUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes metal plaques.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque 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 layout for each plaque at least half size.

C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Product Schedule: For plaques. Use same designations indicated on Drawings or specified.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques 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.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLAQUES

A. Cast Plaque <Exterior Custom Plaque>: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers:
   a. Gemini Incorporated.
   b. A.R.K. Ramos
   c. Metallic Arts
2. Plaque Material: Cast aluminum.
3. Plaque Thickness: 0.50 inch.
4. Plaque Size: As indicated on Drawings.
5. Finishes:
   a. Overcoat: Manufacturer's standard baked-on clear coating.
6. Background Texture: Stipple.
7. Applied Frame Material, Style, and Finish: As indicated on Drawings.
8. Mounting: Concealed studs.

B. Cast Plaque <Interior Plaque>: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers:
   a. Gemini Incorporated.
   b. A.R.K. Ramos
   c. Metallic Arts
2. Plaque Material: Cast aluminum.
3. Plaque Thickness: 0.50 inch.
4. Plaque Size: 36" tall x 24" wide rectangular
5. Finishes:
   a. Overcoat: Manufacturer's standard baked-on clear coating.
6. Background Texture: Leatherette.
7. Applied Frame Material, Style, and Finish: As indicated on Drawings.
8. Mounting: Concealed studs.

2.2 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by plaque manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, 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. Plaque Mounting Fasteners:
    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.

B. Adhesive: As recommended by plaque manufacturer.

2.4 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques 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. 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 plaque finish.
6. 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. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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 plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque 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. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of plaque and of suitable quantity to support weight of plaque after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as plaque is applied and to prevent visibility of cured adhesive at plaque edges. Place plaque in position, and push to engage adhesive. Temporarily support plaque in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques 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 plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10141

SECTION 10155 - TOILET COMPARTMENTS

PART 1 - GENERAL

0.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

0.2 SUMMARY

A. This Section includes solid-polymer units as follows:

1. Toilet Enclosures: Overhead braced.
2. Urinal Screens: Wall hung & floor braced.

0.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.

C. Samples for Initial Selection: For each type of unit indicated.

0.4 REFERENCES

A. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

B. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

0.5 QUALITY ASSURANCE

A. Comply with requirements in CID-A-A-60003, "Partitions, Toilets, Complete."

B. Fire Resistance: Partition materials shall comply with the proper flame spread/smoke developed rating requirements, when tested in accordance with ASTM E 84.

C. Material Fire Ratings:

1. National Fire Protection Association (NFPA) 286: Pass.
2. International Code Council (ICC): Class B.

0.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

0.1 SOLID-POLYMER UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hiny Hiders (HDPE) by Scranton Products
2. HDPE by Hadrian Inc.
3. HDPE by Metpar Corp.

B. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.

C. Pilaster Shoes: Manufacturer's standard design; stainless steel.

D. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel or aluminum.

E. Door Hinges: Continuous Hinges, adjustable. Stainless steel or aluminum.

F. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-polymer components to prevent burning.

0.2 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel or aluminum

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

0.3 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide stainless steel shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be accessible to people with disabilities.

1. Hinges: Stainless Steel or Aluminum, Continuous, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
3. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
4. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

0.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Panels and Walls: 1 inch (25 mm).

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (50 mm) into structural floor, unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Wall-Hung Urinal Screens: Attach with continuous, stainless steel brackets and anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact. Include floor mounted End Post.

0.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10155

SECTION 10280 - WASHROOM ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Washroom & Shower accessories.
2. Air dryers.

B. Related Requirements:

1. Section 08830 "Mirrors" for large, frameless mirrors.

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. 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 designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

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.

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.

2.2 WASHROOM/SHOWER ACCESSORIES

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Toilet Tissue (Roll) Dispenser – TP-1:
1. Description: Double-roll dispenser.
2. Mounting: Surface mounted.
3. Operation: Noncontrol delivery with standard spindle.
4. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Paper Towel (Folded) Dispenser – TD-1:
1. Mounting: Surface mounted.
2. Minimum Capacity: 400 C-fold or 525 multifold towels.
3. Material and Finish: Stainless steel, No. 4 finish (satin).
4. Lockset: Tumbler type.
5. Refill Indicator: Pierced slots at sides or front.

D. Waste Receptacle – TB-1:
1. Basis of Design: BOBRICK B-2300
2. Mounting: Freestanding
3. Minimum Capacity: 18 gal..
4. Material and Finish: Stainless steel, No. 4 finish (satin).

5. Liner: Rigid plastic liner.

E. Liquid-Soap Dispenser Wall Mounted – SD-1:

1. Description: Designed for dispensing antibacterial soap in liquid form.
2. Mounting: Horizontally oriented, surface mounted.
3. Capacity: 40 oz.
4. Materials: 20 gauge stainless steel (No. 4 satin finish).
5. Lock: Lockable Filler hole with special key provided.
6. Retain last subparagraph above and subparagraph below if required.
7. Refill Indicator: Window type sight gauge.

F. Liquid-Soap Dispenser – SD-2:

1. Description: Designed for dispensing soap in liquid form.
2. Mounting: Deck mounted on lavatory.
3. Capacity: 20 oz.
4. Materials:
   a. Reservoir: Shatter-resistant polyethylene container
   b. Valve: Stainless Steel

G. Sanitary- Napkin Disposal - ND-1:

1. Basis of Design: BRADLEY 4722-15
2. Mounting: Surface
3. Capacity: 1.5 gal.
4. Operation: Self-Closing Push flap door and removeable receptacle w/ tumber lock
5. Material and Finish: Stainless steel, No. 4 satin finish

H. Grab Bars - GB-1, GB-2, GB-3, GB-4 & GB-5:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
   a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
3. Outside Diameter: 1-1/2 inches (38 mm).
4. Configuration and Length:
   a. GB-1: Straight, 36 inches long.
   b. GB-2: Straight, 42 inches long.
   c. GB-3: Two wall end Curved 18"x36".
   d. GB-4: Two wall end Curved 18"x42".
   e. GB-5: Straight, 18" long, Vertical.

I. Shower Rod/ Curtain/ Rings - SR-1, SR-2 & SR-3:
1. Basis of Design: BRADLEY
2. Lengths:
   a. SR-1: 36" long
   b. SR-2: 54" long
   c. SR-3: 40" long
3. Mounting: Flanges with concealed fasteners
4. Material and Finish:
   a. Rod: Stainless steel, No. 4 satin finish BRADLEY 9538

b. Curtain: White nylon-reinforced antimicrobial PVC fabric w/ top edge hemmed. Aluminum grommets 6" o.c. BRADLEY 9537
c. Shower Hooks: Stainless-steel spring wire w/ snap fastner w/ nickle-plated brass rollers BRADLEY 9540

J. Mirror Unit – MR-1:
1. Basis of Design: BRADLEY B-290 1836
2. Frame: 18-8 gauge stainless-steel angle. Satin Finish.
3. Corners: Welded and ground smooth.
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
5. Size: Size: 18" w. X 36" tall.

K. Towel/Robe Hook - TH-1:
1. Basis of Design: BRADLEY Model #9314
2. Single Hook configuration
3. Mounting: Surface with vandal resistant escutcheons.
4. Material and Finish: Stainless steel, No. 4 satin finish

L. Folding Shower Seat – SS-1:
1. Configuration: L-shaped seat, designed for wheelchair access. Reversable for right or left hand installation.
2. Seat: One-piece, 1/2" (13mm) thick, solid phenolic with matte-finish, ivory-colored, melamine surfaces and black phenolic resin core.
3. Dimensions: 33" W x 20-15/16″ D
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
5. Mount at approved ADA height

2.3 AIR DRYERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
1. Excel dryer Inc.
2. Dyson

B. Air Dryer HD-1:
1. Basis of Design: Excel Dryer XLERATOR Hand Dryer XL-SB.
2. Acceptable Alternative: Dyson HU02-N Airblade V (LV) Hand Dryer
3. Mounting: Surface mounted.
4. Operation: Automatic operation, activated by infrared optical sensors.
5. Cover Material and Finish:
a. Excel - Stainless steel, No. 4 finish (satin).
b. Dyson – Polycarbonate w/ sprayed Nickel finish.

2.4 MATERIALS

A. Stainless Steel: ASTM A666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10280

SECTION 10431 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Panel signs.

B. Related Sections include the following:
1. Division 10 Section "Plaques" for Aluminum Plaques.
2. Division 10 Section, "Dimensional Letters" for exterior letters.
3. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
4. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
5. Division 16 Section "Interior Lighting" for illuminated exit signs.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

C. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by signage manufacturer.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
a. Illuminated Exit Signs: Refer to Division 16.
b. Egress Signs: "Low Level" @ Exits.
c. Signs for Accessible Restrooms.
d. Room identification signs as indicated in Schedule.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.

B. Cast-Acrylic Sheet: Manufacturer's standard and as follows:

1. Color: As selected by Architect from manufacturer's full range.

C. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:

1. Edge Condition: Beveled.
2. Corner Condition: Rounded.

D. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

E. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

F. Colored Coatings for Acrylic Sheet: For copy and background colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.

2.2 ACCESSORIES

A. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

2.3 FINISHES, GENERAL

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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within 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, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.4 ACRYLIC SIGN SCHEDULE

A. See Drawings for Signage Schedule

END OF SECTION 10431

SECTION 10433 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cast dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter 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 others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign.

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. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    a. A. R. K. Ramos Signage Systems.
    b. Gemini Incorporated.
2. Character Material: Cast aluminum.
3. Character Height: As indicated.
4. Thickness: Manufacturer's standard for size of character.
5. Finishes:
    a. Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range of RAL colors.
6. Mounting:
    a. Projecting studs @ Exterior signs.
7. Typeface: Helvetica.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. 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 signage, 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.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

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 signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets 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.

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. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. 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.

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 signage 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. 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. 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. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
   a. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10433

SECTION 10522 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire protection cabinets (Fire-rated and Non-Rated) for the following:

a. Portable fire extinguishers.

B. Related Sections:
1. Division 10 Section "Fire Extinguishers."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

1.4 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
1. Verify rating of walls where cabinets are to be installed with Architect prior to installation.

1.5 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 MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.

2.2 FIRE PROTECTION CABINET

1. Subject to compliance with requirements, available manufacturers that may be incorporated into the Work include, but are not limited to, the following:
   a. J. L. Industries, Inc., a division of Activar Construction Products Group.
   b. Larsen's Manufacturing Company
   c. Modern Metal Products, Division of Technico Inc.
   d. Moon-American
   e. Potter Roemer LLC
   f. Watrous Division, American Specialties, Inc.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Nonrated or fire rated depending on wall installation location.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: Stainless-steel sheet.

E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

F. Cabinet Trim Material: Stainless-steel sheet.

G. Door Material: Stainless-steel sheet.

H. Door Style: Solid Stainless steel panel with frame.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide recessed door pull and friction latch.
2. Provide concealed hinge permitting door to open 180 degrees.

J. Accessories:
1. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.

K. Finishes:
1. Stainless Steel: No. 4.

2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for 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 indicated below:

1. Fire Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

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 10522

SECTION 10523 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
b. Larsen's Manufacturing Company.
c. Potter Roemer LLC.

2. Handles and Levers: Stainless steel.
3. 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. Multipurpose Dry-Chemical Type in Aluminum Container 3-A:40-B:C, 6-lb (2.7-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

2.2 MOUNTING BRACKETS FOR EXTINGUISHERS NOT INSTALLED IN CABINETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers:
a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
b. Larsen's Manufacturing Company.
c. Potter Roemer LLC.

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 in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10523

SECTION 12211 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

0.1 RELATED DOCUMENTS

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

0.2 SUMMARY

A. Section Includes:

1. Horizontal louver blinds with polymer slats.

B. Related Requirements:

1. Section 06 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.

0.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long.

C. Window-Treatment Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

0.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

0.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet 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 horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for 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

0.1 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

0.2 HORIZONTAL LOUVER BLINDS, POLYMER SLATS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Slats: Polymers that are lead free, UV stabilized, integrally colored, opaque, and will not crack or yellow; antistatic, dust-repellent treated.

1. Formulation: Manufacturer's standard.
2. Width: 2 inches (51 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Spacing: Manufacturer's standard.
5. Profile: Manufacturer's standard.
6. Features:

    a. Lift-Cord Rout Holes: Minimum size required for lift cord and located near back (outside) edge of slat to maximize slat overlap and minimize light gaps between slats.

D. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrail fully encloses operating mechanisms on three sides and ends.

1. Capacity: One blind per headrail unless otherwise indicated.
2. Manual Lift Mechanism:

    a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within full operating range.
    b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.

3. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.

    a. Tilt: Full.
    b. Operator: Clear-plastic wand.
    c. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.

4. Manual Lift-Operator and Tilt-Operator Lengths and Locations: Manufacturer's standard.

E. Bottom Rail: Secures and protects ends of ladders and lift cords.

1. Type: Hardwood matching slats and trapezoid-shaped bottom angled for minimizing light gaps.

F. Lift Cord: Manufacturer's standard braided cord.

G. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.

1. Type: Braided cord.

H. Valance: Manufacturer's standard.

I. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

1. Type: End.
2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

J. Colors, Textures, Patterns, and Gloss:

1. Slats: As selected by Architect from manufacturer's full range including wood grain patterns.
2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

0.3 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

PART 3 - EXECUTION

0.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

0.2 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 1 inch (25 mm) from interior faces of glass and not closer than 1/2 inch (13 mm) from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

0.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

0.4 CLEANING AND PROTECTION

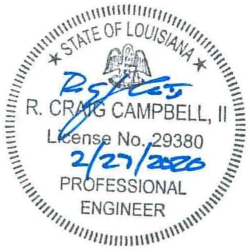
A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 12211

Archives and Central Distribution Facility
Calcasieu Parish Sheriff's Office
Lake Charles, Louisiana



SECTION 15000 - MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions, Division 0) and Division 1 as appropriate, apply to the Work specified in this Section.

B. Refer to Division 15, Mechanical, as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding mechanical work.

1.2 SCOPE OF WORK

A. Furnish all labor and material necessary to provide and install the complete mechanical portion of this Contract, including plumbing, air conditioning, heating and ventilating systems as called for herein and on accompanying drawings. Parts of the mechanical division may be bid separately or in combination, at the Contractor's option; however, it shall be the responsibility of the General Contractor to assure himself that all items covered in the Mechanical Division have been included if he chooses to accept separate bids.

B. It is the intent of this specification that all Division 15 materials with temperatures below ambient conditions or conveying any fluid/gas at temperatures below 70 deg. F be insulated to completely eliminate the potential for condensation. Unless specified elsewhere in these specifications, for materials that do not require access, insulate with 2" thick 1# density fiberglass duct wrap insulation with foil face (seal all joints air and water tight). For materials requiring occasional access, use 2" thick closed cell rubberized insulation with re-sealable fabric joints (hook and loop type).

C. Contractor shall refer to the Architectural and Structural drawings and install equipment, piping, etc. to meet building and space requirements. No equipment shall be bid on or submitted for approval if it will not fit in the space provided.

D. It is the intention of these specifications that all mechanical systems shall be furnished complete with all necessary valves, controls, insulation, piping devices, equipment, etc. necessary to provide a satisfactory installation that is complete and in good working order. The HVAC system shall ensure that under all circumstances, the building shall be kept at temperatures and indoor space relative humidities that when compared to outside temperatures and relative humidities protect building finishes installed under this contract and/or existing floor, wall and ceiling finishes within the building from damage due to

excessive temperature or humidity. HVAC system shall ensure that building remain under a slight positive pressure.

E. Contractor shall visit the site and acquaint himself thoroughly with all existing facilities and conditions which would affect his portion of the work. Failure to do so shall not relieve the Contractor from the responsibility of installing his work to meet the conditions.

F. This Contractor shall protect the entire system and all parts thereof from injury throughout the project and up to acceptance of the work. Failure to do so shall be sufficient cause for the Architect to reject any piece of equipment.

1.3 DEMOLITION

A. The contractor shall visit the site prior to bid to determine the extent of work required to complete the project.

B. Contractor shall coordinate demolition with owner. All equipment shall be salvaged for owner. Locate equipment as directed by owner. All equipment and materials not salvaged by the owner shall be removed from the site and discarded at the contractors expense.

C. Contractor shall coordinate all work with general contractor and phase work as required by project.

D. All equipment piping, etc. required to be removed to accommodate the modifications shall be removed.

E. Contractor shall maintain services to existing facilities which shall remain during and after construction is complete.

F. Contractor shall coordinate any shutdown of services with the owner. It is intended that the building will remain occupied during construction. Contractor shall schedule shut down of services with the owner in order to prevent disruption of building occupancy.

G. Contractor shall be responsible for draining down of existing systems to complete demolition. All work shall be scheduled with the owner. Contractor shall also be responsible for refilling system and removing all air in order to return the systems to proper operating conditions.

H. All shutdown of services shall be done at a time period approved by owner. The systems shall be required to be back up and running each morning unless otherwise approved by the owner.

1.4 GROUNDS AND CHASES

A. This Contractor shall see that all required chases, grounds, holes and accessories necessary for the installation of his work are properly built in as the work progresses; otherwise, he shall bear the cost of providing them.

1.5 CUTTING AND PATCHING

A. Initial cutting and patching shall be the responsibility of the General Contractor, with the Mechanical Contractor being responsible for laying out and marking any and all holes required for the reception of his work. No structural beams or joists shall be cut or thimbled without first receiving the approval of the Architect. After initial surfacing has been done, any further cutting, patching and painting shall be done at this Contractor's expense.

1.6 FILL AND CHARGES FOR EQUIPMENT

A. Fill and charge with materials or chemicals all those devices or equipment as required to comply with the manufacturer's guarantee or as required for proper operation of the equipment.

1.7 BIDDING REQUIREMENTS AND RESPONSIBILITIES

A. Prime bidder is responsible for all work , of all trades and sub-contractors bidding this project. It is the prime bidders responsibility, prior to submitting a bid to ensure that sub-contractors coordinate all aspects of the work between trades, sub-contractors, etc. to the fullest extent possible.

B. Prime bidder shall ensure that all sub-contractors, suppliers, equipment vendors, etc., obtain all necessary and pertinent contract document information pertaining to their work prior to the submission of a bid. Contractor shall realize that different sub-contractors may furnish equipment, accessories, devices, etc. necessary for a complete and working installation, that require provision of services by another sub-contractor or trade.

C. Bidders of all or any portions of this section or division are required to review all contract documents including but not limited to Architectural drawings, Structural drawings, Mechanical drawings, Plumbing drawings, Electrical drawings, etc. to coordinate requirements and responsibilities with and through prime bidder.

D. Bidders of all or any portions of this section or division, by furnishing a bid on a portion of the prime contract are indicating that they have received all contract documents and coordinated services provided under their portion of the work with the prime bidder; they are indicating that they have expressed any pertinent questions (which would result from a

detailed, thorough review of the entire set of contract documents) to the prime bidder in accordance with Division 1 requirements, prior to bidding.

E. All timely, pertinent, questions provided in writing prior to bids, in accordance with Division 1 requirements, will be clarified, defined, or otherwise explained in a written addendum and/or addendums prior to bids, in accordance in Division 1 requirements.

F. It is not the intention of these contract documents to leave any issue relating to coordination between trades or sub-contractors vaguely defined. The intention is to define all issues, coordination matters, equipment requirements, sizes, routing, etc. to the satisfaction of the prime bidder, prior to receipt of bids.

G. Bidders of all or any portions of this section or division, by virtue of the submission of a bid to the prime bidder, are indicating that they have reviewed the entire set of contract documents with due diligence and regard for the Owner's desire for a comprehensive and complete bid proposal; that they have expressed all concerns or questions requiring clarification on matters of coordination between trades and/or sub-contractors; that they have expressed any such concerns or questions in writing in accordance with Division 1 requirements.

H. Prime bidders, by submission of a comprehensive bid on the project are indicating that the subcontractors selected in their bid have complied with all Division 1 requirements, that they have indicated in writing, prior to bidding, all questions or concerns requiring clarification and/or explanation and have documented any and all specific exclusions involving work that would generally be considered to be work of their trade. The prime bidder shall coordinate all work so that anything excluded by the bidder of all or any portions of this section or division, have been addressed prior to bids in one of the following manners:

1. The work has been confirmed, by the prime bidder, to be work of another trade or subcontractor (whose proposal is also being accepted).
2. Clarification of the matter has been made through the prime design professional via written addendum and is clearly and mutually understood by the prime bidder and the party raising the issue/question, or seeking clarification.
3. The work has been accepted as the responsibility of the prime contractor directly.

I. Prime Bidder and bidders of all or any portions of this Section shall review all section 15 equipment submittals and coordinate power requirements, electrical services and identify any equipment that has an operating efficiency of less than that required by ASHRAE 90.1 (current version) or efficiency required by State Energy Code. Use of equipment not meeting or exceeding ASHRAE 90.1 (current version) is strictly prohibited.

1.8 MATERIAL AND EQUIPMENT

A. The term "provide" when used in the Contract Documents includes all items necessary for the proper execution and completion of the Work.

B. Specific reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgement of the Architect expressed in writing is equal to that specified.

C. Coordinate and properly relate all Work of this Division to building structure and work of all other trades.

D. Visit premises and become thoroughly familiar with existing conditions; verify all dimensions in field. Advise Architect of any discrepancies prior to Bid Date in accordance with Division 0.

E. Do not rough-in for any item or equipment furnished by others or noted "Not in Contract" (NIC), without first receiving rough-in information from physically examining the existing equipment, receiving specific cut sheet information from the Owner's representative, other trades and/or Architect. Rough-in services for "NIC" equipment as required, as the work progresses.

F. Provide storage and protection for all equipment and materials in accordance with requirements of Division 0 and Division 1. Replace any equipment and materials damaged by improper handling, storage, or protection, at no additional cost to Owner.

G. Keep premises clean in accordance with requirements of Division 0 and Division 1.

1.9 SUBSTITUTIONS

A. Substitutions are only allowed by approval of the Architect prior to Bid Date as stipulated in Division 0 and/or Division 1.

B. Design of systems is based on specific equipment. If the use of other manufacturer's equipment, even though approved by Architect, involves additional cost due to space requirements, foundation requirements, increased mechanical or electrical services, the cost of such extra work shall be borne by manufacturer of substituted equipment. Even though a manufacturer's name appears in the Contract Documents as having acceptable equipment, their equipment with different model numbers shall be classified as being a substitute to the

equipment originally designed for and named in the Contract Documents. Substitute equipment, materials, etc., will not be allowed to deviate from Contract Document requirements. Furnish all options specified or reasonably implied from the contract documents. Specifically identify any variance is regard to submittal versus specified performance on the cover sheet of each submittal.

1.10 DRAWINGS AND SPECIFICATIONS

A. The specific intent of these Contract Documents is to provide the various systems, equipment, etc. to the Owner complete and in a thoroughly calibrated functional condition.

B. The Drawings shall not be construed as shop drawings. In the event of a possible interference with piping or equipment of another trade, items requiring set grade and elevations shall have precedence over other items. Should any major interference develop, immediately notify the Architect.

C. In laying out Work, refer to mechanical, electrical, structural, and architectural drawings at all times in order to avoid interference and undue delays in the progress of the Work.

D. Furnish all plumbing fixtures (with required accessories) shown on either the plumbing drawings or the architectural drawings. Review Architectural casework elevations and identify fixtures indicated. Provide fixtures indicated. Rough-in for all fixtures as work progress. Verify plumbing fixtures required for review of mechanical and architectural drawings prior to fixture shop drawing submittal.

E. In the event of a conflict between drawings and specifications, the more stringent interpretation shall govern.

1.11 CODES AND REGULATIONS

A. Work shall be in full accord with the most stringent interpretation of the State Sanitary Code, local ordinances, building codes, and other applicable national, local, and state regulations.

B. Equipment shall conform to requirements and recommendations of the National bureau of Fire Underwriters and National Fire Protection Association (NFPA).

C. Items provided under this Division shall comply with the American National Standards Institute (ANSI) "Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People," ANSI A 117.1

D. In the possible event of conflict between codes or regulations and Contract Documents, the most stringent interpretation of either shall govern (provided if exceeds the requirements of

other codes. In the event of an irreconcilable difference between codes or regulations notify the Architect/Engineer immediately.

E. In addition to the codes heretofore mentioned, all mechanical work and equipment shall conform to the applicable portions of the following specifications, codes and/or regulations:

1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
2. National Electrical Code (NEC)
3. National Fire Protection Association (NFPA)
4. American Society of Mechanical Engineers (ASME)
5. American Gas Association(AGA)
6. Southern Building Code (SSBC)
7. Underwriters Laboratories (UL)

F. All materials, equipment and accessories installed under this Contract shall conform to all rules, codes, etc. as recommended by National Associations governing the manufacturer, rating and testing of such materials, equipment and accessories. All materials shall be new and of the best quality and first class in every respect. Whenever directed by the Architect, the Contractor shall submit a sample for approval before proceeding.

G. Where laws or local regulations provide that certain accessories such as gauges, thermometers, relief valves and parts be installed on equipment, it shall be understood that such equipment be furnished complete with the necessary accessories, whether or not called for in these Specifications.

H. All unfired and fired pressure vessels shall be built in accordance with the A.S.M.E. Code and so stamped. Furnish shop certificates for each vessel. Contractor shall provide and pay for first operating certificate as per State Fire Marshal Regulations.

1.12 FEES, PERMITS, AND TAXES

A. Obtain and pay for permits required for the Work of this Division. Pay fees in connection therewith, including necessary inspection fees.

B. Pay any and taxes levied for Work of this Division, including municipal and/or state sales tax where applicable.

C. All permits, fees, certificates, etc. for the installation, inspections, plan review, service connections locations, and/or construction of the work which are required by any authority and/or agencies having jurisdiction, shall be obtained and paid for by the Contractor.

D. The Contractor shall make all tests required by the Architect, Engineer or other governing authorities at no additional cost to the Owner.

E. The Contractor shall notify the Architect and local governing authorities before any tests are made, and the tests are not to be drawn off a line covered or insulated until examined and approved by the authorities. In event defects are found, these shall be corrected and the work shall be retested.

F. Prior to requesting final inspection by the Architect, the Contractor shall have a complete coordination and adjustment meeting of all of his sub-contractors directly responsible for the operation of any portion of the system. At the time of this meeting, each and every sequence of operation shall be checked to assure proper operation. Notify the Architect in writing ten (10) days prior to this meeting, instructing him of the time, date and whom you are requesting to be present.

G. This project shall not be accepted until the above provisions are met to the satisfaction of the Architect.

1.13 MANUFACTURER'S DIRECTIONS

A. Install and operate equipment and material in strict accord with manufacturer's installation and operating instructions. The manufacturer's instructions shall become part of the Contract Documents and shall supplement Drawings and Specifications.

1.14 SUBMITTAL DATA

A. Submit shop drawings, project data, and samples in accordance with requirements of Division 0/and or Division 1.

B. Shop drawings shall consist of published ratings or capacity data, detailed construction drawings for fabricated items, wiring and control diagrams, performance curves, installation instructions, manufacturer's installation drawings, and other pertinent data. Submit drawings showing revisions to equipment layouts due to use of alternate or substitute equipment. Submit shop drawings in binders and bound together.

C. Where approved manufacturers and suppliers of equipment, materials, etc. are unable to fully comply with Contract Document requirements, specifically call such deviations to attention of Architect on submittals. Type deviations on a separate sheet; underlined statements or notations on standard brochures, equipment fly sheets, etc. will not be accepted.

D. Approval of submittals shall not relieve Contractor from furnishing required quantities and verifying dimensions. In addition, approval shall not waive original intent of Contract Documents.

E. Failure to obtain written approval of equipment shall be considered sufficient grounds for rejection of said equipment regardless of the stage of completion of the project.

1.15 REVIEW OF MATERIALS

A. Whenever manufacturers or trade names are mentioned in these Plans or Specifications, the words "or approved equivalent" shall be assumed to follow whether or not so stated. Manufacturers or trade names are used to establish a standard of quality only, and should not be construed to infer a preference. Equivalent products which meet the Architect's approval will be accepted; however, these products must be submitted to the Architect a minimum of ten (10) days prior to the Bid Date.

B. Submission shall include the manufacturer's name, model number, rating table and construction features.

C. Upon receipt and checking of this submittal, the Architect will issue an addendum listing items which are approved as equivalent to those specified. THE CONTRACTOR SHALL BASE HIS BID SOLELY ON THOSE ITEMS SPECIFIED OR INCLUDED IN THE "PRIOR APPROVAL ADDENDUM", AS NO OTHER ITEM WILL BE ACCEPTABLE.

D. Prior approval of a particular piece of equipment does not mean automatic final acceptance and will not relieve the Contractor of the responsibility of assuring himself that this equipment is in complete accord with the Plans and Specifications and that it will fit into the space provided. Shop drawings must be submitted on all items of equipment for approval as hereinafter specified.

E. Before proceeding with work and/or within thirty (30) days after the award of the General Contract for this work, the Mechanical Contractor shall furnish to the Architect complete shop and working drawings of such apparatus, equipment, controls, insulation, etc. to be provided in this project. These drawings shall give dimensions, weights, mounting data, performance curves and other pertinent information.

F. The Architect's approval of shop drawings shall not relieve the Contractor from the responsibility of incorrectly figured dimensions or any other errors which may be contained in these drawings. Any omission from the shop drawings or specifications, even through approved by the Architect, shall not relieve the Contractor from furnishing and erecting same.

G. Seven (7) sets of shop drawings shall be submitted to the Architect for approval. These submittals shall be supplied as part of this Contractor's contract. Any drawings not approved shall be resubmitted until they are approved. SUBMIT ALL SHOP DRAWINGS AT THE SAME TIME. NO SEPARATE ITEMS WILL BE ACCEPTED.

1.16 VALUE ENGINEERING (V/E):

A. Value Engineering (V/E) defined: For purposes of Division 15 and 16 Specifications, in accordance with all Division 1 Requirements and all Terms and Conditions of proposed contract between Owner and Contractor, Value Engineering (V/E) shall be defined as a "post bid" process, whereby the apparent low bidder (having submitted a proposal in strict accordance with Project Contract Documents, that exceeds the Owner's available funds for construction [AFC] for this specified project) offers proposed changes ("Value Engineering") to the work. This proposed value engineering may alter or adjust aforementioned contract document requirements in exchange for financial and/or other consideration (in response to a specific request by the Owner/Owner's Representative).

B. Value Engineering may not be considered, prior to scheduled receipt and review of Bid Proposals by the Owner and an official written request from the Owner/Owner's Representative expressing the Owner's desire to consider value engineering items.

C. While it may be in the project Owner's interest to consider the first cost money saving that may be generated via alternatives and options generated via participation in Value Engineering, Division 15 contractor shall realize that substantive offers of Value Engineering (V/E), if accepted by the Owner, constitute a design-build agreement (offer and acceptance) with the owner, and drastically change the design concept of the project, as developed by the Professional of Record identified on the Contract Documents.

D. Should contractor offer, and the owner accept value engineering options that alter aspects of the system design, equipment, performance and/or performance verification or monitoring of respective systems, Division 15 contractor shall provide duly licensed professional engineering consultants working on behalf of the Division 15 contractor (including sub-contractors and equipment vendors/manufacturers) to review, approve and take professional responsibility for performance and suitability of V/E hybrid systems, materials or operational changes related to respective V/E items. The Division 15 contractor's licensed professional engineering consultants and the Division 15 contractor assume any and all responsibility for the design and suitability in terms of performance, of hybrid systems installed, as Division 15 contractor's Professional of Record, absolving the original project Professional of Record (identified on the original Contract Documents, released for the original project Bid/Negotiation) from responsibility for the V/E hybrid systems portion of the work.

E. Division 15 contractor, via the offer and acceptance of value engineering items on the project agrees to provide professional engineering design services and take full and complete responsibility for the hybrid design. Further, the Division 15 contractor's (V/E Items)professional of record (either employees, or independent consultants to the Division 15 contractor) through the offer and acceptance of V/E items, agree to indemnify and hold harmless the project owner, the owner's original A/E team (Professional of Record on behalf of the owner for the original Contract Documents) their heirs and assigns in regard to the V/E changes and their impact on the Division 15 systems altered, affected or modified, in whole or in part. The Professional of Record shown on the original Contract Documents in regard to the systems altered, adjusted, revised, modified or otherwise affected by the value engineering items implemented, shall be absolved of design responsibility as a result of implementation of V/E items, and their original use of Engineering Seals used for original Contract Documents, shall not apply.

1.17 PROJECT RECORD DOCUMENTS

A. Keep Project Record Documents in accordance with requirements of Division 0 and/or Division 1.

B. Prepare electronic record document set in most current Autocad release available. Furnish one set of electronic record document (Autocad files) to Engineer and one set of Owner's Representative.

C. During construction period, keep accurate records of installations made under this Division, paying particular attention to major interior and exterior underground and concealed piping, ductwork, etc.

D. The Contractor shall obtain at his cost, two sets of blueline prints of the original bid documents by the Architect. One set shall be kept on the site with all information as referenced below, and shall update same as the work progresses. The other set will be utilized to record all field changes to a permanent record copy for the Owner.

E. If the Contractor elects to vary from the Contract Documents and secures prior approval from the Architect for any phase of the work, he shall record in a neat and readable manner, **ALL** such variances on the blueline print in red. The original bluelines shall be returned to the Architect for documentation.

F. All deviations from sizes, locations, and from all other features of the installations shown in the Contract Documents shall be recorded.

G. In addition, it shall be possible using these drawings to correctly and easily locate, identify and establish sizes of all piping, directions and the like, as well as other features of the work which will be concealed underground and/or in the finished building.

H. Locations of underground work shall be established by dimensions to columns, lines or walls, locating all turns, etc., and by properly referenced centerline or invert elevations and rates of fall.

I. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases this may be by dimension. In others, it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. The Architect's/Engineer's decision in this matter will be final.

J. The following requirements apply to all "As-Built" drawings:

1. They shall be maintained at the Contractor's expense.
2. All such drawings shall be done carefully and neatly, and in a form approved by the Architect/Engineer.
3. Additional drawings shall be provided as necessary for clarifications.
4. These drawings shall be kept up-to-date during the entire course of the work and shall be available upon request for examination by the Architect/Engineer; and when necessary, to establish clearances for other parts of the work.
5. "As-built" drawings shall be returned to the Architect upon completion of the work and are subject to approval of the Architect/Engineer.

1.18 EXCAVATING AND BACKFILLING

A. Provide excavating and backfilling necessary for Work of this Division. Comply with provisions of Division 2, Site Work, if applicable.

B. Trenches shall be inspected by Code Authorities and/or Owner's Representative before and after piping is laid. Give Owner' Representative 24-hour notice for each inspection. If any trenches are filled without Owner's Representative inspection and as subsequently found to be deficient, the trenches shall be uncovered, inspected, and then re-filled, if requested by Owner's Representative.

C. Provide minimum 18 inches of cover or in compliance with local published frost line data (if greater than 18 inches) to finish grades or paving at water piping.

D. For piping, provide bell holes at trench bottom to assure uniform bearing. Accurately grade trench bottoms by instrument before laying any pipe.

E. Protect and maintain trenches in dry condition until piping has been inspected and approved. Immediately after approval, backfill trenches in tamped layers.

F. Compact fill to satisfaction of Architect and/or Owner's Representative.

1.19 CUTTING AND PATCHING AND SEALING OF PENETRATIONS

A. Comply with requirements of Division 0 and Division 1 regarding cutting and patching. Locate and timely install sleeves as required to minimize cutting and patching.

B. Cutting, fitting, repairing, patching, and finishing of Work shall be done by craftsmen skilled in their respective trades. Where cutting is required, cut in such a manner as not to weaken structure, partitions, or floors. Holes required to be cut must be cut or drilled without breaking out around the holes. Where patching is necessary in finished areas of the building, the Architect will determine the extent of such patching and refinishing.

C. Where return air plenums above ceilings are utilized, Division 15 Contractor shall ensure that return air openings are provided in walls run to deck, for proper return air flow back to the AHU. Cut walls as required to provide openings sized for maximum 1000 feet per minute air flow velocity through openings above ceiling. Provide a fire damper at openings of fire walls and a smoke damper at openings of smoke walls. Coordinate electric or pneumatic services to smoke dampers via automatic temperature control/EMS Contractor.

D. Repairing Roadways and Walks: Coordinate all roadway work with authorities having jurisdiction. Cut and/or bore under roadways for connection of utilities as required. Coordinate work through General Contractor. Where this contractor cuts or breaks roadways or walks to lay the piping, he shall repair or replace these sections to match existing, unless specifically identified as the responsibility of others.

E. Seal all penetrations of building envelope air and water tight. For complete closure of openings, where necessary, provide 1/8" thick elastomeric barrier anchored to materials penetrating building envelope and adjacent envelope surfaces involved - seal connections with caulk and mechanical fasteners. **Refer to Architectural Sections on Joints and sealants.** Seal all conduit systems communicating between conditioned and unconditioned spaces. Coordinate all work with and through prime bidder and other trades. Unless otherwise directed, caulk sealant shall be long lasting polyurethane based products, resistant to UV exposure, installed in accordance with manufactures instructions. Sealant joints shall withstand building pressure variance with respect to ambient of 0.25 inches water gauge, with no leakage in terms of air and or water vapor.

1.20 CLEANING AND ADJUSTING:

A. Upon completion of his work, the Contractor shall clean and adjust all equipment, controls, valves, etc.; clean all piping, ductwork, etc.; and leave the entire installation in good working order.

1.21 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide the Owner with three (3) copies of printed instructions indicating various pieces of equipment by name and model number, complete with parts lists, maintenance and repair instructions and test and balance report.

B. COPIES OF SHOP DRAWINGS WILL NOT BE ACCEPTABLE AS OPERATION AND MAINTENANCE INSTRUCTIONS.

C. This information shall be bound in plastic hardbound notebooks with the job name, Architect and Engineer names permanently embossed on the cover. Rigid board dividers with labeled tabs shall be provided for different pieces of equipment. Submit manuals to the Architect for approval.

D. In addition to the operation and maintenance brochure, the Contractor shall provide a separate brochure which shall include registered warranty certificates on all equipment, especially any pieces of equipment which carry warranties exceeding one (1) year.

E. The operation and maintenance brochure shall be furnished with a detailed list of all equipment furnished to the project, including the serial number and all pertinent nameplate data such as voltage, amperage draw, recommended fuse size, rpm, etc. The Contractor shall include this data on each piece of equipment furnished under this contract.

1.22 GUARANTEE

A. The Contractor shall guarantee all materials, equipment and workmanship for a period of one (1) year from the date of final acceptance of the project. This guarantee shall include furnishing of all labor and material necessary to make any repairs, adjustments or replacement of any equipment, parts, etc. necessary to restore the project to first class condition. This guarantee shall exclude only the changing or cleaning of filters. Warranties exceeding one (1) year are hereinafter specified with individual pieces of equipment.

B. If the Contractor's office is in excess of a fifty (50) mile radius of the project, he shall appoint a local qualified contractor to perform any emergency repairs or adjustments required during the guarantee period. The name of the contractor appointed to provide emergency services shall be submitted to the Architect for his approval.

1.23 LOCAL CONDITIONS

A. The location and elevation of all utility services is based on available surveys and utility maps and are reasonably accurate; however, these shall serve as a general guide only, and the Contractor shall visit the site and verify the location and elevation of all services to his

satisfaction in order to determine the amount of work required for the execution of the Contract.

B. The Contractor shall contact the various utility companies, determine the extent of their requirements and he shall include in his bid all lawful fees and payments required by these companies for complete connection and services to the building, including meters, connection charges, street patching, extensions from meters to main, etc.

C. In case major changes are required, this fact, together with the reasons therefor, shall be submitted to the Architect, in writing, not less than seven (7) days before the date of bidding. Failure to comply with this requirement will make the Contractor liable for any changes, additions and expenses necessary for the successful completion of the project.

1.24 MINOR DEVIATIONS

A. Plans and detail sketches are submitted to limit, explain and define conditions, specified requirements, pipe sizes and manner of erecting work. Structural or other conditions may require certain modifications from the manner of installation shown, and such deviations are permissible and shall be made as required. However, specified sizes and requirements necessary for satisfactory operation shall remain unchanged. It may be necessary to shift ducts or pipes, or to change the shape of ducts, and these changes shall be made as required. All such changes shall be referred to the Architect for approval before proceeding. Extra charges shall not be allowed for these changes.

B. The Contractor shall realize that the drawings could delve into every step, sequence or operation necessary for the completion of the project, without drawing on the Contractor's experience or ingenuity. However, only typical details are shown on the Plans. In cases where the Contractor is not certain about the method of installation of his work, he shall ask for details. Lack of details will not be an excuse for improper installation.

C. In general, the drawings are diagrammatic and the Contractor shall install his work in a manner so that interferences between the various trades are avoided. In cases where interferences do occur, the Architect is to state which item was first installed.

1.25 VALVE TAGS

A. Secure metal tags to all valves. Labeling on all valve tags shall include type of system the valve controls and the area of building, zone, or equipment number affected by valve operation. Tag shall be 2"minimum diameter brass, engraved with code number, service and size. A framed list of the valves, giving manufacturer's name, model number, type and location shall be mounted in the main basement equipment room.

1.26 MACHINERY GUARDS

A. This Contractor shall provide v-belt guards for each v-belt drive or other hazardous drive. The guard shall enclose the drive entirely and shall have a hole for taking a tachometer reading.

1.27 TEST AND BALANCE:

A. The balancing, testing and adjusting of the air conditioning, heating and ventilating systems shall be performed by an independent balancing company possessing calibrated instruments, qualified engineers and skilled technicians to perform all tests. The balancing agency shall be responsible for inspecting, adjusting, balancing and logging the data on the performance of fans, air handling units, low pressure supply and exhaust ductwork, and heat exchangers. The Mechanical Contractor and the suppliers of the equipment installed shall cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components and shall furnish all labor and material required to calibrate any deficiencies in construction.

B. Results of the investigation shall be submitted in triplicate prior to final inspection of the project and shall include results of the following:

1. A tabulation of all electrical data, including starter type, size, heater rating, amperage and voltage rated and running on all mechanical equipment.
2. Complete air balance report on all air handling units, fans and grilles connected to low pressure rectangular ductwork.
3. Actual operating capacities of all equipment; including, but not limited to refrigerant pressure (high and low), E.A.T. (D.B. and W.B.) at outdoor and indoor sections, etc.
4. Dry bulb temperature at site on day of test.
5. Entering and leaving air temperatures (D.B. and W.B.) on heating and cooling cycle with outdoor air damper closed.
6. Adjust and record pressure drop and temperature drop across all heat exchangers, coils, equipment, etc., giving entering and leaving conditions.
7. Test and adjust each diffuser, grille and register to within 10% of design and requirements.
8. Test and adjust blower rpm to design requirements.
9. In cooperation with manufacturer's representative, set adjustments of automatically operated dampers to operate as specified, indicated or noted. The testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by the Contractor.
10. As part of the work in this Contract, the air conditioning contractor shall make any changes in the pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by the Air Balance Agency, at no additional cost to the Owner.

11. As a part of his contract, the air conditioning contractor shall make any changes in the duct elements, fans, vibration isolators, etc. to comply with the manufacturer's published sound and vibration levels.
12. All equipment furnished in the mechanical section of the Specifications shall be included in the test and balance report.
13. THE TEST AND BALANCE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING OUT AND REPORTING EACH SEQUENCE OF HEATING, COOLING AND CONTROL INTERLOCK OPERATION FOR THE EQUIPMENT REFERENCED ABOVE.
14. A tabulation of all electrical data including starter type, size, heater rating, amperage and voltage rated and running.
15. Complete air balance report on all air handling unitsfans and grilles connected to low pressure ductwork. Refer to temperature controls Section 23 09 00 for proper sequence of operation of equipment.
16. Actual operating capacities of all equipment.
17. Dry bulb temperature at site on day of test and at time of each test.
18. Entering and leaving air temperatures (D.B. and W.B.) on heating and cooling cycle with outdoor air damper closed.
19. Adjust and record pressure drop and temperature drop across all coils, equipment, etc. giving entering and leaving conditions.
20. Mark settings on all valves.
21. Test and adjust each diffuser, grille and register to within 5% of design and requirements.
22. Test and adjust blower rpm to design requirements.
23. In cooperation with control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated or noted. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
24. As a part of the work in this contract, air conditioning contractor shall make any changes in the pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by Air Balance Agency at no additional cost to the owner.
25. Balancing contractor shall check and report calibration test on each thermostat and sensor in temperature control system.
26. Report shall include model numbers and all data from unit name plate.

C. BALANCING CONTRACTOR SHALL CHECK EACH SEQUENCE OF OPERATION CALLED OUT IN THE CONTROL SPECIFICATIONS AND SUBMIT ITEM-BY-ITEM RESULTS ALONG WITH HIS REPORT.

D. Equipment to be included in test and balance report shall include the following: air handlers, fans, motorized damper motors, solenoid valves, and thermosta.

E. The test and balance agency selected shall make a total of three (3) inspections within ninety (90) days after the use of the systems to insure satisfactory conditions are being maintained. During this period the Architect, at his direction, may request a re-check or re-setting of any outlet, supply air fan or exhaust fan as listed in the test report. The agency shall provide technicians to assist the Architect in making any tests he may require during this period of time.

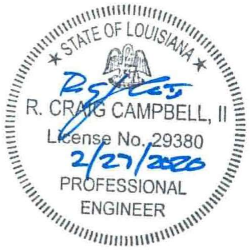
F. All work shall be done in accordance with the "National Standards for Field Measurement and Instrumentation, Total System Balance, Volume I, Number 81266" published by the Associated Air Balance Council.

1.28 LABELING MECHANICAL EQUIPMENT

A. All mechanical equipment (A/C units, condensing units, water heaters, etc.) furnished under Division 15 of contract documents shall be labeled with permanent laminated plate secured to equipment. Units shall be labeled as indicated on plans and schedules.

END OF SECTION 15000

Archives and Central Distribution Facility
Calcasieu Parish Sheriff's Office
Lake Charles, Louisiana



SECTION 15100 - BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.1 PIPE:

A. Sanitary Sewer Waste and Vent Lines:

1. Piping unless otherwise shown or specified, shall be constructed of solid wall Schedule 40 PVC "DWV" plastic pipe and fittings with solvent welded joints.
2. Sanitary sewer pipe penetrating concrete slabs shall be wrapped with Virginia Chemical K-501, Benjamin Manufacturing Model 6200, or equal foam insulation tape.

B. Domestic cold and hot water lines:

1. All such lines shall be Government Type "L", hard copper water tubing of standard weight and thickness as made by Mueller, Chase, Anaconda or equivalent, unless indicted otherwise. Use 95-5 lead-free solder on all piping above slab. Use Silfos 1000° lead-free solder on all piping beneath the slab.
2. In certain areas, type "L" soft copper without joints below slab shall be used only where indicated on the Plans. Piping shall be completely insulated per Section 15200.
3. Domestic cold water lines penetrating concrete slabs shall be wrapped with "Protect-O-Sleeve" vinyl flexible tube as manufactured by Robert H. Harris Co., or equivalent.
4. Domestic hot water lines shall be insulated at all penetrations through slab per insulation (see Section 15200).
5. Domestic cold water piping 5'-0" outside of building may be Schedule 40 PVC plastic pipe with solvent welded joints, or slip joint fittings with EPDM seals. Provide thrust blocks all at changes in direction. Installation shall be in accordance with manufacturer's recommendations.

C. Refrigerant Lines:

1. These shall be Government Type "L" hard copper.

D. Water Heater Relief Lines:

1. These shall be Government Type "L" hard copper

E. Equipment drain lines:

1. These shall be Government Type "L" hard copper.

F. Condensate Drain Lines:

1. All such lines shall be TYPE "L" hard copper and fittings. Install trap at all air handling equipment.

G. Trap Primer Lines:

1. All such lines shall be Type "L" soft copper, without joints.

H. Installation of Piping:

1. All pipe shall be true and straight, without sags or traps.
2. The Contractor shall exercise care in cleaning joints after making cuts on pipe to prevent pipe particles from entering the system.
3. All pipe fittings shall be same as piping specified unless indicated otherwise.

I. Arrange, install piping approximately as indicated, straight, plumb and as direct as possible; form right angles, or parallel lines with building walls. The most practical appearance of piping runs is required. Keep pipes close to walls, partitions, ceilings; off-set only where necessary to follow walls as directed.

J. Before installing piping, check plumbing and HVAC drawings with architectural, mechanical, structural, electrical drawings; make accurate layout of plumbing and HVAC piping. Where interferences may appear and departures from indicated arrangements are required, consult with other trades involved; come to agreement as to changed locations and elevations of piping; obtain approval of proposed changes. Note runs of other contractor's piping and large conduits and cooperate to achieve neat appearance.

K. Unless otherwise indicated, conceal all piping in building construction in finished areas. Install such piping in time so as not to cause delay to work of other trades and to allow ample time for tests and approval; do not cover before approval is obtained.

L. Locate groups of pipes parallel to each other and building lines; space them at distance to permit access for servicing, valves, and to create most practical appearance when racked with conduits, refrigerant, etc., provided by other contractors.

M. Keep fixture branches concealed to points above floor close to fixtures; expose only as much as necessary for final connection. Rigidly support pipes projecting from walls, chases, etc. in wall or chase to make firm, well-braced installation. Loosely supported pipe or accessory is not acceptable.

N. Install horizontal piping to coordinate with other trades and install without sags or humps.

O. Grade inside sewer piping at uniform slope of 1/4 inch per foot, minimum; where this is impossible, maintain slope as directed but in no case less than 1/8 inch per foot. Waste lines 3 inches and smaller must grade at minimum 1/4 inch per foot. See Drawings for fall on exterior sewer lines.

P. Grade other piping as specified under heading or service where used, or as directed.

Q. Keep piping free from scale and dirt, protect open pipe ends wherever work is suspended during construction. To prevent foreign bodies entering and lodging in pipe, use temporary plugs or other approved material.

R. Where changes in pipe sizes occur, do not bush down; use only reducing fittings. For drainage piping changes in direction, use longsweep bends where possible; otherwise, short sweep 1/4 bends or combination Y and 1/8 bends; also Y's in combination with other bends.

S. Provide shut off valves at all supply connections to all equipment. Supplier of equipment shall provide rough-in drawings and this contractor shall fully connect all items, supply necessary piping and fittings as required, unless otherwise noted individually.

T. Do not locate valves with stems below horizontal.

U. Locate valves for easy access and operations. Where concealed, notify General Contractor of exact location in order that he may leave openings for access panels. Provide access panels.

V. Provide unions, screwed or flanged, where indicated, and in following locations even if not indicated.

1. In by-passes around equipment.
2. In connection to equipment requiring disconnection for repairs or replacement. Locate between shut-off and equipment.

W. Weld-O-let fittings shall be used in iron pipe.

X. All screwed fittings and pipe shall have threads cut to standard pipe thread dimensions. Pipe shall be properly reamed after cutting of threads.

Y. Joint compound, Rector Seal Series 100, LACO Series Slick-tite or equal thread lubricant shall be applied to male threads of the screwed pipe and fittings only.

Z. Approved expansion joints or flexible couplings shall be provided as necessary.

AA. Care shall be taken in making up pipe and fittings such that the pipe does not extend into fitting sufficiently to reduce the waterway.

BB. Standard, one-piece reducing fittings of approved design shall be used wherever a change in size is made. Changes in pipe sizes shall not be made by means of reducing flanges.

CC. Bushings may be used only where standard, one-piece reducing fittings are not available and shall be subject to the following:

1. Bushings shall be of the face or flush type.
2. Bushings shall not be used in elbow fittings.
3. Bushings shall not be used when the reduction in size of the outlet is less than ½".
4. Bushings shall not be used in more than one outlet of any tee or two outlets of any cross fitting.

1.2 PIPE SPECIALTIES:

A. Dielectric unions shall be used between copper and iron pipe.

1.3 PIPE HANGERS AND SUPPORTS:

A. This Contractor shall furnish and install all foundations and supports required for his equipment unless indicated otherwise on the Drawings.

B. This Contractor shall furnish and install all escutcheons, inserts, thimbles, hangers, etc. required for the proper support and installation of his equipment and piping and he shall cooperate with other trades in locating and placing these items.

C. Provide sleeves for all pipes passing through walls, floors, beams, etc.: Sleeves passing through structural members or concrete footings shall be of cast iron or Schedule 40 steel pipe. Sleeves passing through nonstructural walls or floors shall be of 26 gauge galvanized iron. Joints between sleeves and pipes passing through floors shall be made weather tight with plastic materials. Where pipes pass through water proofing membrane, flashing sleeves shall be installed.

D. Provide Grinnell, Fee & Mason, or equivalent malleable iron split ring hangers with rod supports throughout. STRAP HANGERS OR WIRE WILL NOT BE ACCEPTED. Maximum spacing of hangers for cast iron pipes shall be 5 ft.; for other than soil, use 10 ft.

E. Provide galvanized iron shields between hangers and pipe covering.

F. Provide Grinnell, Fee & Mason, Crane or equivalent heavy steel riser clamps on vertical risers at floors to support pipes.

G. Provide producer speciality, Jones Manufacturing or equal chrome plated brass escutcheons wherever pipes pass through floors, walls or ceilings in exposed or finished areas.

H. All piping projecting from chases shall be rigidly supported in the wall or chase. Loosely supported fixtures or accessories will not be accepted.

1.4 VALVES AND UNIONS:

A. Furnish and install all valves, unions, stops, connections, etc. shown on plans and necessary to make a complete system in working order. Provide valves on inlet and outlet of all equipment and fixtures and on branch lines to fixtures or groups of fixtures.

B. Ball Valves, 3" and smaller, rated for 150 PSI saturated steam pressure, 600 PSI WOG pressure; shall be 2-piece construction, bronze body conforming to ASTM B-62, conventional port, chrome-plated brass ball, replaceable TFE seats and seals, blow-out proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water and domestic hot and cold water service of NIBCO Design S-580-70, Milwaukee BA-150-S or equal, threaded ends of heating hot water and low pressure steam of NIBCO Design T-580-70, Milwaukee BA-100-S or equal. For chilled water insulated piping systems, provide ball valves with extended stem, insulated handle with protective thermal barrier sleeve to prevent condensate moisture drip and pipe insulation deterioration. At Contractor's option, Victaulic Style 722 or 721 ball valves may be used.

C. All valves, unions, etc. where pipe is chrome plated shall have similar finish. All exposed supplies to plumbing fixtures shall be chrome plated.

D. All gas cocks, valves, etc. on gas lines shall have local utility company and AGA approval.

E. Domestic water valves (below grade): M & H AWWA Series C-509 resilient gate valve with low torque operation, positive shut-off, O- Ring seals, full epoxy coating and square valve stem end. Provide two (2) adjustable "TEE" handle valve wrenches to be turned over to the owner after construction is complete.

F. Select Valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size 2 Inch and Smaller: Solder ends, except provide threaded ends for heating hot water.
2. Steel Pipe Sizes, 2 Inch and Smaller: Threaded or grooved end.
3. Steel Pipe Sizes, 2-1/2 Inch and Larger: Grooved end or flanged.

1.5 INSTALLATION OF VALVES:

A. Use ball and butterfly valves for shut-off duty.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install three-valve bypass around each pressure reducing valve using throttling-type valves.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. All valves, unions, etc. where pipe is chrome plated shall have similar finish. All exposed supplies to plumbing fixtures shall be chrome plated.

H. All valves, on insulated piping shall be complete with extended lever handle stem.

1.6 SHOCK ABSORBERS:

A. All water service to fixtures or groups of fixtures shall have concealed air chambers. Air chambers shall be of the same diameter as the supply or header pipes and 12 inches long on both hot and cold water branches. Locate shock absorbers close to fixture or at end of header.

B. On lines 1-1/4" and above fixtures with quick closing valves (i.e.: Dishwashers, tempered valves, etc.) install "Shock Trol", "Precision Plumbing Products" or equal water hammer arrester properly sized for each unit.

1.7 ESCUTCHEONS:

A. Provide escutcheons for all exposed lines passing through floors, walls, and ceilings. They shall be chrome plated brass and shall be of such flange size as to cover necessary penetrating openings.

1.8 FLASHING:

A. Flash all vent penetrations through roof. Extend flashing approximately 10 inches in all directions at base and turn ends down into top of pipe. Off-set vents where necessary to provide 4 feet minimum clearance from other flashing such as outside walls, curbs, etc. Note: All vents shall be 25 feet from fresh air intakes.

1.9 TEST:

A. Make such tests of work as specified, or required by Architect or by State and Municipal Bureaus having jurisdiction, and under their supervision. Perform tests in presence of Architect's representative. Notify Architect two days prior to testing.

B. Provide apparatus, temporary piping connections, or other requirements necessary for tests. Take precautions to prevent damage to building or contents by tests. Contractor is required to repair and make good at his expense damage so caused.

C. Correct leaks, defects, or deficiencies discovered as result of tests. Repeat tests until test requirements are fully complied with. Caulking of pipe joints to remedy leaks is not permitted, except on lead and oakum joints.

1.10 STERILIZATION:

A. Sterilization all water lines in strict accordance with State Board of Health requirements. After flushing out, obtain approval of water sample analysis from State Board of Health and submit approval report to Architect.

1.11 ACCESS PANELS:

A. Furnish and install access panels where valves, dampers, control boxes, etc. are concealed in walls, ceilings, floors, or otherwise inaccessible or where specifically called for on plans. Panels shall be Milcor Style DW, or Bar-Co. Model 500, J-L Industries Model WB, or equal sized as required and furnished with prime coat finish.

1.12 PIPE MARKERS:

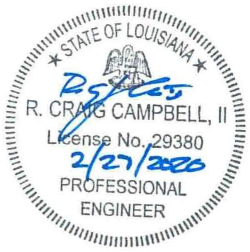
A. Provide pipe markers and directional arrows on all piping in mechanical equipment rooms, or which is exposed in building, and on both sides of all valves located above ceiling. Markers shall be as manufactured by W.H. Bradley Co., or the equivalent. All letters shall be color-coded and sized as recommended by OSHA. Samples of the type of letters to be used shall be submitted with shop drawings.

B. The following pipe and valves shall be identified:

	Piping	Valves
Domestic Cold Water	X	X
Domestic Hot Water Supply	X	X

C. Pipe markers with arrows shall indicate lines content and shall be located 20 feet on center and at each change of direction of line. Identification bands shall be color coded to match pipe markers and shall be provided 10 feet on center. Pipe identification markers shall be taped at each end and shall be taped around the entire circumference of pipe.

END OF SECTION 15100



SECTION 15200 - INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Pipe insulation shall not begin until all work has been tested and found to be tight. All insulation adhesives, sealers, tapes and mastic shall meet the latest NFPA requirements and shall have a flame spread of 25 and a smoke developed of 50.

B. All insulation shall be installed in strict accordance with the manufacturer's recommendations.

C. All pipe insulation where recommended by the manufacturer shall be banded with aluminum bands, three to a section and with one band on each side of each fitting, valve, etc.

D. Insulation shall be continuous through walls and ceilings.

E. All valves, strainers, etc. shall be insulated the same as its adjacent piping and the covering shall extend all the way up to the equipment.

F. USE HIGH DENSITY INSULATION INSERTS AT HANGERS ON ALL PIPING 1-1/2" AND ABOVE TO PREVENT CRUSHING OF INSULATION.

1.2 THERMAL INSULATION

A. After all work has been tested and approved, insulate as follows:

1. INSULATION SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS.

1.3 DOMESTIC WATER PIPING

A. Cover all domestic cold and hot water lines above slab with 1" thick, high density fiberglass insulation with Universal Fire Retardant Jacket, Owens/Corning "25 ASJ/SSL", Knauf ASJ-SSL, or equal. All laps are to be sealed and stapled in place. Fittings are to be mitered segments of insulation held in place with white vapor barrier tape with Zeston 25/50 PVC, Knauf 25/50 rated PVC, pre-molded insulated fitting covers.

B. All water lines exposed in mechanical rooms shall be covered with 0.030 white PVC jacket with solvent welded seams and joints.

C. All water lines on the outside of the building exposed to the weather shall be covered with 0.160 smooth aluminum jacket and elbows.

D. Domestic cold and hot water lines run below slab within building shall be insulated with 3/4" thick closed cell tube insulation. Apply two (2) coats of mastic on insulation.

1.4 HVAC CONDENSATE DRAIN PIPING

A. Insulate with 3/4" Aerotube or Armaflex pipe insulation applied in accordance with manufacturer's recommendations and instructions.

B. All water lines on the outside of the building exposed to the weather shall be covered with 0.160 smooth aluminum jacket and elbows.

1.5 AIR HANDLING ROOM WALLS

A. Furnish and install over entire areas of walls of air handling rooms containing a/c units a 1" thick Manville Linacoustic or equal acoustical or equal acoustical type duct insulation 3# density, applied over Slick-Klips 12" on center. Stick-Klips shall be applied to wall with Miracle Adhesive. Acoustical material shall be applied over Stick-Klips with duct liner adhesive tape EC-104 spotted between pins. Stick-Klips with factor applied adhesive will not be acceptable.

1.6 HVAC DUCTWORK INSULATION

A. Supply, return, transfer, fresh air and exhaust ductwork shall be wrapped on outside with 2.33" thick 3/4# density fiberglass insulation with aluminum foil vapor barrier. Insulation shall be taped at all joints and installed per the manufacturer's recommendations.

1.7 CALIBRATED BALANCING VALVES

A. Insulate calibrated balancing valves with molded insulated furnished with the unit and provide strap bands for access.

1.8 INSULATION THROUGH HANGERS AND SLEEVES

A. The insulation shall be continuous through pipe hangers and pipe sleeves. At hangers where the pipe is supported by insulation, provide a galvanized iron protection shield. Provide pipes 2-inch i.p.s. and larger in insulation inserts at points of hanger supports. The inserts shall be of calcium silicate, cellular glass, prestressed molded glass fiber of minimum 13-pound density, or other approval material of the same thickness as adjacent insulation and not less than 13-pound density. The inserts shall have sufficient compression strength to adequately support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Inserts shall be 180 degrees and not less than the length of the protection shield. vapor barrier facing of the insert shall be the same as the facing

on the adjacent insulation. Where copper clad hanger are used on domestic copper pipe, insulation may cover pipe and hanger. Provide 18 gauge metal saddles between all hangers and insulation.

1.9 WASTE LINE P-TRAPS

A. P-traps receiving HVAC condensate (exposed to weather or above ceilings) shall be insulated with 2.33" thick 3/4 # density fiberglass ductwrap insulation with aluminum foil vapor barrier. Insulation shall be sealed at all seams and joints.

1.10 HVAC FLEX CONNECTORS

A. Shall be wrapped on outside with 2.33" thick 3/4 # density fiberglass insulation with aluminum foil vapor barrier. Insulation shall be taped at all joints and installed per the manufacturer's recommendations.

END OF SECTION 15200

Archives and Central Distribution Facility
Calcasieu Parish Sheriff's Office
Lake Charles, Louisiana



SECTION 15300 - WATER SUPPLY

PART 1 SERVICE

1.1 SUMMARY

A. CONTRACTOR SHALL CONTACT LOCAL UTILITY COMPANY PRIOR TO BID TO DETERMINE THE EXTENT OF THEIR REQUIREMENTS, PAY ALL COSTS FOR CONNECTION AND COMPLETE WORKING INSTALLATION.

B. Contractor shall coordinate any outages with owner prior to connection and schedule as required. Water outage will be accomplished after normal working hours or weekend. Contractor shall have figure in base bid to connect during after hours or weekends.

1.2 GENERAL

A. All water supply piping shall be of materials hereinbefore specified. Make provisions for expansion and contraction of hot water lines by means of expansion bends or loops as required.

B. All water lines shall be disinfected in accordance with the State of Louisiana Sanitary Code, (2013 Louisiana Plumbing Code with latest amendments). Submit three (3) copies of "Certificate of Performance" at completion of the project.

C. Water system shall be tested by lab certified by State Health Officer per Section 12 of the State of Louisiana Sanitary Code. Submit three (3) copies of "Certificate of Performance" at completion of the project.

D. Water lines run underground shall have a minimum of 30" cover to finished grade.

E. Make up the complete water supply system. Connect to all fixtures and outlets requiring water.

F. At each fixture or group of fixtures with lines 1-1/4" or below, furnish and install a 12" high air chamber of same size as branch feed line. On lines 1-1/4" and above and at fixtures with quick closing valves such as dishwashers, tempered water valves, etc., install "Shocktrol", "Precision Plumbing Products" or equal water hammer arrester properly sized for each unit.

G. Domestic water cut-off valves on exterior of building shall be installed with cast iron frame and cover (marked "Water") in concrete pad as detailed on the Drawings.

1.3 TESTING

A. All domestic water lines, unless elsewhere specified, shall be tested under 200 psi hydrostatic pressure for a minimum of five hours.

END OF SECTION 15300



SECTION 15325 - SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 REQUIRED PRE-BID FLOW TESTS

A. Prior to submitting a bid, the Sprinkler Contractor shall perform a flow test utilizing the nearest municipal fire hydrant(s) at the Project site in order to substantiate the basis of the Contractor's design. The flow test shall be performed using gauges which have been calibrated within twelve (12) months of the flow test. The flow test shall be performed in accordance with the recommendations included in NFPA 291.

1. The Contractor shall utilize a five (5) psig reduction/safety factor in the field flow test data (static & residual) and a ten (10) percent reduction/safety factor in the flow in GPM obtained during the flow test for the basis of design in order to calculate and/or perform a hydraulic analysis of the proposed system.

B. All flow test data shall be performed by the Contractor at no cost to Owner.

1. Contractor shall notify the Owner's Representative a minimum of seven (7) days prior to flow tests being performed.
2. Owner's Representative shall witness all flow tests.
3. Provide a report to Owner's Representative stating location, time and duration of test.

1.2 SECTION INCLUDES

A. Wet-pipe and dry-pipe sprinkler systems. Note!: Unless specifically so noted on plan sheets, the utilization of glycol anti-freeze wet-pipe sprinkler systems for freeze protection is not allowed!

B. Sprinkler system design, installation, and certification including site work and insurances.

C. Fire department connections.

1.3 RELATED SECTIONS

A. Division 31, Section - "Excavation, Filling and Grading"

B. Division 22, Section - "Mechanical General Provisions"

C. Division 22, Section - "Electrical Requirements for Mechanical Equipment"

D. Division 21, Section 21 11 00 - "Fire Protection Piping"

1.4 REFERENCES

A. NFPA 13 - Installation of Sprinkler Systems.

B. FM - Factory Mutual Approval Guide.

C. NFPA 70 - National Electrical Code.

D. UL - Fire Resistance Directory.

E. UL 199 - Automatic Sprinklers.

F. Warnock Hersey - Certification Listings.

1.5 SYSTEM DESCRIPTION

A. The sprinkler system is to provide coverage for the entire building.

1. Note: It is not the intent of this specification to design or to construct the sprinkler system in accordance with the "minimum" design criteria allowed by the applicable codes. Where indicated, certain areas, specific equipment or methods may exceed the "minimum" criteria required by applicable codes. Refer to Section - "Mechanical General Provisions", Article 1.3 - "Compliance with National & Local Code Requirements."
2. The contractor shall refer to both plans and specifications in order to accomplish the design intent.

B. Provide a system designed in accordance with NFPA 13 for Light hazard, Ordinary hazard, Group 1, Ordinary hazard, Group 2, or other hazard classification as indicated on the various plan sheet.

C. Interface the sprinkler system with the building Fire and Smoke Alarm Systems and Smoke Evacuation systems. Coordinate electrical power requirements or control interfaces with the various sub-contractors.

D. Provide fire department connections where indicated. Coordinate thread patterns with the local fire department serving the site.

1.6 ELECTRICAL REQUIREMENTS

A. Note: It is the intent of this section that prior to bidding, the fire protection contractor shall coordinate and either provide, or pay to provide, all of the minor electrical power and control services, circuits, wiring and conduit required for the fire protection equipment.

B. It is not the intent of this section that the fire protection contractor provide or pay for the necessary electrical service to the emergency fire pump, jockey pump, controllers or associated wiring and conduit required to connect fire protection devices (such as limit

switches, flow switches, tamper switches, etc.) to the fire alarm system. Other coordination issues and requirements between sub-contractors however, remain.

1.7 PLUMBING REQUIREMENTS

A. Sprinkler Drains: "Note" - Where sewer or storm drains are required for any component of the sprinkler system such as pre-action cabinets, standpipes, risers, etc., the sprinkler contractor shall provide such drains as required to prevent spillage of water onto or within the building. Contractor shall coordinate with other trades and pay for and/or provide at the point of discharge, all floor drains, hub drains, catch basins, etc., needed for the maintenance and draining of the sprinkler system.

1.8 SUBMITTALS FOR REVIEW

A. Refer to Division 1, Section - "Submittal Procedures": for full submittal requirements.

B. Product Data: Provide data on all system components including fire pumps (if applicable), pipes, sprinklers, valves, flow switches, pressure reducing devices, meters, and other specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections. Contractor shall submit a minimum of one (1) printed set of shop drawings, hydraulic calculations, and equipment cut sheets to the Architect/Engineer for review. Architect/Engineer will review the submittal, and if it is found to be acceptable for submittal to the State Fire Marshals office for review, the Architect/Engineer will stamp it with their shop drawing review stamp. This stamped submittal will be scanned and a "PDF" copy will be E-mailed to the contractor for electronic submittal to the State Fire Marshall for review. Contractor shall be responsible for all fees and costs as may be required for final acceptance of system(s) by all Authorities Having Jurisdiction.

C. Shop Drawings: Submittal to the State Fire Marshal shall occur after Contractor has obtained a "No Exception Taken", or "Appears to Comply" comment on the System Shop Drawings from the Architect/Engineer. No payment will be made to the contractor for any automatic sprinkler system work until submittal is forwarded to the AHJ for approval.

1. Provide project name, project address, occupancy and owner on application. Drawings shall include "Preparer of Shop Drawings" indicated on each sheet.
2. Drawing shall be legible and drawn to a scale suitable for proper definition and clarity. In no case shall the scale be less than 1/8" = 1'- 0". Indicate partitions or small enclosures in which no sprinklers are to be installed. Provide graphic representation of the scale used on all plans.
3. Submittal shall include a master list of all materials and equipment which is to be utilized for the project. Include manufacturers model number, size, color, and quantity of each.
4. Provide the number of sprinklers on each riser per floor.
5. Provide the total number of sprinklers on each dry pipe system, pre-action system, combined dry pipe pre-action system, or deluge system.
6. Provide the approximate capacity in gallons of each dry pipe system.

7. Provide the location and electrical characteristics of all air compressors, pre-action cabinets, and any and all other components which require electrical services.
8. Provide type of fittings and joints and location of all welds and bends. The contractor shall specify on the drawing any sections to be shop welded and the type of fittings or formations to be used.
9. Indicate piping provisions for flushing.
10. Provide kind, type and location of alarm bells.
11. Provide size, location, of hose outlets, hand hose, and related equipment if used. The hydraulic reference point shown on plans shall correspond with comparable reference points on the hydraulic calculation sheets.
12. Provide full height cross section of building or schematic diagram.
13. Provide the occupancy class or each area or room identified.
14. All sprinklers shall be identified by make, type, orifice size, temperature rating, thermal sensitivity including if applicable, all existing heads affecting the submitted scope of work.
15. For large storage areas, provide the storage height, method of storage, description of commodities, etc. If the project is a specialized storage design, provide a complete design statement denoting the methodology for arriving at the project area/densities.
16. All piping shall be identified by size, type, inside diameter, and schedule.
17. Submit layout of finished ceiling areas indicating sprinkler head locations and type, fully coordinated with ceiling installation. Provide ceiling information such as heights, architectural profiles, (vaults, coffers, furrings, etc.), construction assembly, (combustible ceiling or framing, significant combustibles in ceiling cavity, etc.).
18. Provide sprinkler obstructions denoted (suspended light fixtures, duct work, fire alarm strobes, fire alarm horns, speakers, motion detectors, or other architectural items.)
19. Show all HVAC openings and all ductwork over 48" in width/height.
20. Indicate the method of maintaining the sprinkler system at or above 40 deg F. Describe all unheated applicable areas and explain the methodology of all sizes, types, locations, etc. of freeze protection devices.
21. Graphically highlight each hydraulic area (perimeter dashed lines, etc.) title each area on the plans with matching title on each calculation sheet.
22. Provide the locations and ratings of fire walls, unprotected vertical openings, and other assemblies affecting sprinkler design.
23. Provide a site plan showing location and size of city mains at street, denoting dead end or circulating or denote private supply system.
24. Provide the total area protected by each system on each floor.
25. Provide and indicate the location, type, and listing of each pipe hanger.
26. Provide the underground pipe size, length, location, type, point of connection to city main, bury depth, thrust blocks, and all appurtenances (valve types, water meters, backflow preventors, valve pits, etc.) with appropriate back-up data sheets denoting manufacturer's fire protection equipment listing and friction/pressure loss for each device.
27. Provide all hydraulic nameplate information.
28. Hydraulic reference points shall coordinate between the drawings and calculations.
29. Provide the setting for pressure reducing devices denoted.

30. Submit hydraulic calculations, building sections, site plan indicating piping layout, detailed building piping layouts, hangers and supports locations, sprinklers, components and accessories. Indicate system controls.

D. Hydraulic Calculations:

1. Verify that the water supply, test location, date (must be 4 months current) of peak demand time (or calculated adjustment) and account for test elevations at calculations. Reduce the static and residual pressures by 5 psig and calculate on this basis.
2. Verify the hazard classification (light, ordinary, special occupancy, etc.).
3. Verify the design criteria (density/sq. ft. over the hydraulic design area).
4. Verify the location of the design area calculated (most hydraulically demanding not always the most physically remote).
5. Verify the physical dimensions of the area calculated (design area shall not extend beyond the designated area served by each sprinkler). Sufficient length parallel to the branch lines or cross mains, as required.
6. Verify the densities (sprinklers flowing at or above minimum required flow rate).
7. Verify the pipe sizes, lengths, equivalent lengths of fittings, and flow paths (account for all pressure losses).
8. Verify the hose demand and provide the total quantity of water and the pressure required for hose streams both inside and outside.
9. Confirm that the system demand is at or less than the available water supply (include demand versus supply graph).
10. Sprinkler Drains: "Note" - Where drains are required for any component of the sprinkler system such as pre-action cabinets, standpipes, etc. the sprinkler contractor shall provide such drains as required to prevent spillage of water onto or within the building. Contractor shall coordinate with other trades and pay for and/or provide floor drains, hub drains, catch basins, etc. needed for the maintenance and draining of the sprinkler system.
11. Samples: Submit two samples of each style of sprinkler head specified.

1.9 SUBMITTALS AT PROJECT CLOSEOUT

A. Section - Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

B. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds code requirements.

C. 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.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

E. Provide a copy of NFPA 25 - "Standard for Inspection, Testing, and Maintenance of Water Based Fire Protection Systems."

1.10 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

D. Design system under direct supervision of a NICET III Certified Technician experienced in design of this work and licensed in the State of Louisiana. The Fire Protection contractor shall be licensed for fire protection work in the State of Louisiana.

1.11 REGULATORY REQUIREMENTS

A. Conform to UL, FM.

B. Perform Work in accordance with NFPA 13.

C. Equipment and Components: Bear UL, FM, label or marking.

D. Products Requiring Electrical Connection: Provide products that are listed and classified by Underwriters Laboratories Inc., or other testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Fire Protection Contractor shall be licensed to perform fire protection systems design and installation in the State of Louisiana.

1.12 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1. Provide seven (7) days advanced notice to Owner's Representative.

1.13 DELIVERY, STORAGE, AND PROTECTION

A. Section - 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.

1.14 EXTRA MATERIALS

A. Provide extra sprinklers under provisions of NFPA 13.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet in location designated.

PART 2 - PRODUCTS

2.1 SPRINKLERS

A. Dry Sprinklers:

1. Manufacturers:

   a. Viking Model M SIN No. VK 194
   b. Victaulic SIN No. V 3302
   c. Reliable SIN RA 5114

2. Type: Quick response, standard coverage, concealed pendant type with push on Cover plate.
3. Finish: Brass
4. Cover Plate Finish: Color by Architect.
5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
6. Guards: Finish to match sprinkler finish.

B. Suspended/Finished Ceilings

1. Manufacturers:

   a. Viking Microfast -Quick Response Concealed Sin No. VK 462
   b. Victaullic Concealed Pendant SIN No. V3802
   c. Reliable SIN RA3415

2. Type: Concealed Quick Response pendant type with push on thread off cover plate.
3. Finish: Color by Architect.
4. Cover Plate Finish: Color by Architect.
5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
6. Location: In center of modular ceiling tile

C. Exposed Area Type:

1. Manufacturers:

   a. Viking Microfast .Model M Sin No. VK 302
   b. Victaullic SIN No. V2708
   c. Reliable SIN RA 1414

2. Type: Standard coverage Quick Response Pendant type.

3. Finish: Brass.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Exposed Area Type:

1. Manufacturers:

a. Viking Microfast .Model M Sin No. VK 300
b. Victaullic SIN No. V2704
c. Reliable SIN RA 1425

2. Type: Standard coverage Quick Response Upright type.
3. Finish: Brass.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

2.2 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve:

1. Manufacturers

a. Viking Easy Riser Swing Check Valve Model E-1, F-1
b. Reliable Model G
c. Victaulic Alarm Check Valve Series 751

2. Check type valve with divided seat ring, rubber faced clapper to automatically actuate electric alarm, with test and drain valve.

B. Electric Alarm Bell:

1. Manufacturers

a. Potter Electric Model MBA-6-24
b. System Sensor Model SSM 24-6

2. Electrically operated red enameled gong.

C. Fire Department Connections:

1. Manufacturers:

a. Potter Roemer Model 5761
b. Guardian Model 6224

2. Type: Free standing type with chrome plated finish.
3. Outlets: Four (4)-way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
4. Drain: 3/4 inch automatic drip, outside.
5. Label: "Auto. Sprinkler - Fire Department Connection".

D. Supervisory Switches:

1. Manufacturers

a. Potter Electric Model OSYSU-2, PCVS
b. System Sensor. Model OSY-2, PIBV2

E. Flow Switches:

1. Manufacturers

a. Potter Electric Model VSR-F
b. System Sensor Model WFD Series

F. Test and Drain Valve

1. Manufacturers

a. AGF Model 1000
b. Guardian Model 9210
c. Reliable Model "TD"
d. Victaulic Style 720 Testmaster II

G. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber face clapper to automatically actuate electric alarm, with tank mounted air compressor, test and drain valve.

1. Manufacturers

a. Viking Model F-1, G-4000
b. Tyco Model No. DPV-1
c. Victaulic Series No. 768N
d. Reliable Model EX

H. Post Indicator Valve

1. Manufacturers

a. Kennedy Style 2945-A
b. Nibco Model NIP-1AJ
c. Victaulic Series 775

I. Alarm Pressure Switches:

1. Manufacturers

a. Potter Electric Model PS10-2A
b. System Sensor Model EPS10-2

J. High/Low Pressure Supervisory Switches:

1. Manufacturers

a. Potter Electric Model PS40-2A
b. System Sensor Model EPS40-2

K. Tank Mounted Air Compressors:

1. Manufacturers

a. General Air Model LT29050A
b. Jenny Model F12S-30UMS
c. C-aire Model S300

L. Flexible Sprinkler Hose Fitting for Fire Protection Service:

1. Manufacturer: FlexHead Industries, Inc. and Victaulic Vic-Flex AH2/AH2CC

a. Substitutions: Allowed if substitute product meets regulatory requirements, performance criteria and material specifications listed below.

2. Description:

a. Regulatory Requirements: Provide flexible stainless steel hose fittings that comply with the following requirements:

i. In accordance with General Requirements contained in specification.
ii. In accordance with NFPA 13.

3. Performance Criteria: Comply with the following to suit project requirements:

a. FM 1637 Approval Standard for Flexible Sprinkler Hose with Treaded End Fittings
b. UL 2443 Standard for Flexible Sprinkler Hose with Fitting for Fire Protection Service.
c. ICC-ES AC-156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and System

4. Materials: Victaulic Vic-Flex Connection

a. Flexible Stainless Steel Sprinkler Drop System (with captured coupling style 108) may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic Firelock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to a sprinkler head.

b. The drop shall include a UL approved Series AH1 with 3" bend radius; AH2 or AH2-CC braided hose with a bend radius to 2" to allow for proper installation in confined spaces.
c. The hose ahll be listed for [(4) bends at 31" length]

5. Materials: FlexHead Superflex Commercial Sprinkler Connection

a. FlexHead Superflex flexible stainless steel hose assemblies:

i. Straight Hose Assembly Lengths (3 ft. length, Model #2036SF-50), (4 ft. length, Model #2048SF-50), (6 ft. length, Model #2072SF-50)

1) ½ inch outlet
2) 175 psi maximum rated pressure.
3) Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter made of 100% 304 stainless steel including end fittings.

b. FlexHead Ceiling Bracket: Direct attachment type having integrated snap-on clip ends positively attached to the ceiling using tamper–resistant screws and removable attachment hub with set screw for attaching and adjusting flexible hose.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13

B. Wrenches used to install the sprinkler heads shall be the wrench called for by the manufacturer of the sprinkler head. The use of any other wrench shall not be acceptable, and contractor shall replace all heads which were improperly installed without the use of the correct sprinkler head wrench.

C. Install equipment in accordance with manufacturers instructions.

D. Install buried shut-off valves in valve box. Provide post indicator.

E. Provide approved double detector check valve assembly at sprinkler system water source connection.

F. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connections to allow full swing of fire department wrench handle.

G. Locate outside alarm gong on building wall as indicated.

H. Place pipe runs to minimize obstruction to other work.

I. Do not install sprinkler heads that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

J. Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) that could damage the bulb in any way, to remove the protector.

K. Place piping in concealed spaces above finished ceilings.

L. Center sprinklers in two directions in ceiling tile and provide piping offsets as required, dependent upon spacing and coordination with ceiling elements.

M. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

N. Flush entire piping system of foreign matter.

O. Install guards on sprinklers where indicated.

P. Hydrostatically test entire system.

Q. Require test be witnessed by Fire Marshal and Architect.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

3.3 PAINTING

A. Refer to Section - "Mechanical General Provisions" for painting requirements and Section 09990 - "Painting". Coordinate the painting requirements of this section with the Contractor. Painting is typically performed by the Division 9 Contractor. This Contractor however, shall either perform specialized painting as called for below in the following conditions or he shall advise the Contractor prior to bidding of these painting requirements set forth as follows:

1. All exposed fire protection piping in normally occupied areas shall be painted.
2. Thoroughly clean all mechanical surfaces, requiring prime painting, of rust, loose scale, oil and grease.
3. Dry all surfaces before painting.
4. Paint only under proper ambient conditions.
5. Do not paint over controls, or on equipment nameplates, factory labels or sprinkler heads.
6. Prepare pipe, fittings, supports, and accessories for finish painting.
7. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

3.4 TRAINING & DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:

1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1, Section- "Closeout Submittals" and Division 22, Section - "Basic Mechanical Requirements."
3. Provide Service Manuals for each sprinkler system specified.

B. Provide three (3) hours of factory authorized training.

1. Refer to Section - "Mechanical General Provisions" for video taping requirements.
2. Provide seven (7) days advanced notice to Owner's Representative.

3.5 INSPECTIONS AND TESTS

A. All fees, etc. for the installation, inspection, or construction of the work which are required by any authority and/or agencies having jurisdiction, shall be obtained and paid for by the contractor.

B. All inspections, examination, and tests required shall be arranged and paid for by the contractor as necessary to obtain complete and final acceptance of the Fire Protection System. The contractor shall deliver certificates of all such inspections to the Architect/Engineer.

C. Maintenance Instructions to the Owners: After installation of this system is completed and before it is accepted by the owner, the sprinkler contractor shall instruct the maintenance personnel on the care and maintenance of this system. Included in these instructions shall be the following:

1. Two (2) original copies of NFPA 25 shall be furnished to the owner's maintenance personnel.
2. Normal conditions of the sprinkler system.
3. Weekly test of alarm valve.
4. Weekly test of waterflow indicator.
5. Semi-Annual test of alarm valve and water flow indicator.
6. Abnormal conditions and corrections.
7. Maintenance.

D. After the above instruction has been completed, this contractor shall notify the Architect/Engineer by letter of such. This letter should state the name(s) of the individuals receiving instructions.

3.6 INSPECTIONS

A. For a period of one (1) year after acceptance, this contractor shall make two (2) inspections on the sprinkler system. One shall be six (6) months after acceptance and the other one (1) year after acceptance. This contractor shall furnish the owner with all inspection certificates after each inspection and furnish the architect with two copies of the inspection certificate. After one year, the owner shall be responsible for arranging for inspections by a qualified sprinkler contractor.

END OF SECTION 15325



SECTION 15326 - FIRE PROTECTION PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, covers, and connections for combination sprinkler and standpipe systems including exterior piping systems.

1.2 RELATED SECTIONS

A. Division 9, Section - "Painting": Preparation and painting of fire protection piping systems.

B. Division 2, Section - "Excavation, Filling and Grading" for further specific trenching and backfilling requirements.

C. Division 22, Section - "Mechanical General Provisions"

D. Division 22, Section - "Mechanical Identification"

E. Division 22, Section - "Mechanical Insulation".

F. Division 21, Section 21 13 19 - "Sprinkler Systems"

1.3 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 250.

C. ASME B16.3 - Malleable Iron Threaded Fittings, Class 300.

D. ASME B16.4 - Cast Iron Threaded Fittings, Class 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 B16.25 - Buttwelding Ends.

I. ASME B36.10 - Welded and Seamless Wrought Steel Pipe.

J. ASTM A135 - Electric-Resistance-Welded Steel Pipe.

K. ASTM A47 - Malleable Iron Castings.

L. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.

M. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

N. AWWA C110 - Ductile Iron and Gray Iron Fittings.

O. AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.

P. NFPA 13 - Installation of Sprinkler Systems.

Q. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

R. UL - Fire Resistance Directory.

S. UL 262 - Gate Valves for Fire-Protection Service.

T. UL 312 - Check Valves for Fire-Protection Service.

U. UL 405 - Fire Department Connections.

1.4 SUBMITTALS FOR REVIEW

A. Section - "Submittal Procedures": Procedures for submittals.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Section - "Closeout Submittals": Record actual locations of components and tag numbering.

B. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and shall be licensed to perform sprinkler work in the State of Louisiana.

1.7 REGULATORY REQUIREMENTS

A. Conform as a minimum to UL and FM.

B. Sprinkler Systems: As a minimum, conform work to NFPA 13.

C. Welding Materials and Procedures: Conform to ASME Code and AWS D10.9.

D. Valves: Bear UL and/or FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Division 1, Section -"Temporary Facilities & Controls": Transport, handle, store, and protect products.

B. Deliver and store valves in shipping containers, with labeling in place.

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. Store all materials a minimum of 12" above grade when stored in exterior environment, 6" when stored on slab. Do not allow materials to contact ground. Provide end caps on all piping to prevent dirt or other construction debris from entering piping while stored.

1.9 EXTRA MATERIALS

A. Provide two sets of valve stem packings for each size and type of valve installed.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTOR ASSEMBLY

A. Backflow Preventors:

1. Provide Reduced Pressure Principal or Double Check Assembly as required by

local governing authority and at a location approved by the Authority Having Jurisdiction.

2. Enclose backflow assembly in a heated enclosure.

B. Heated Valve Assembly Enclosure

1. Provide factory assembled, heated, backflow preventor assembly enclosure. Enclosure shall be constructed and approved to ASSE Standard 1060 as a "Class I Freeze Protection Enclosure".

   a. Acceptable Manufacturers

      i. Hot Box
      ii. Safe - T - Cover

2. Provide insulated valve enclosure on all above ground exposed fire protection piping. Insulate fire protection piping which is NOT located in heated valve box assembly.
3. Insulation shall be polyisocyanurate foam sprayed in place with a minimum of 1-inch thickness average coverage.

   a. Dimensional stability shall be less than 2% linear shrinkage.
   b. Compressive strength shall be 20 psi or greater.
   c. Flame spread rating shall not exceed 25.

4. Enclosure shall be of aluminum.
5. Structural components shall be of aluminum.
6. Multi-sectional enclosures shall be fitted together with overlapping "tongue & groove" joints.
7. The enclosure shall be securely attached to a concrete base with anchor brackets installed on the interior of the enclosure, through the flange base of the enclosure itself or through a stainless steel anchor hinge.
8. Access panels shall be provided to allow access for operations and inspections without the removal of the entire enclosure.
9. Heating equipment shall be furnished by the enclosure manufacturer to maintain a temperature of 40 deg F with an outside temperature of (-) 10 deg. F.

   a. Factory assemble heater shall be ETL, UL, or CSA certified.
   b. Heating equipment shall be installed above the level of the backflow equipment.
   c. Electrical power source shall be GFI protected, with a minimum of 18" clearance from the receptacle base to the top of slab.

2.2 BURIED PIPING

A. Ductile Iron Pipe: AWWA C151.

1. Fittings: AWWA C110, standard thickness.
2. Joints: AWWA C111, rubber gasket.

3. Mechanical Couplings: Shaped composition sealing gasket, stainless steel bolts, nuts, and washers.
4. Listed and internally lined with cement or epoxy coated.

B. PVC Pipe (On exterior of building) - ASTM - D2241; AWWA - C-900, Class 150-DR-18.

1. Fittings - AWWA C110.
2. Joints - ASTM F-477'; AWWA C-111.
3. Mechanical Couplings - Shaped composition sealing gasket, stainless steel bolts, nuts and washers.

C. Refer to Division 2, Section - "Excavation, Filling and Grading" for further specific trenching and backfilling requirements.

2.3 ABOVE GROUND PIPING

A. General: Refer to PART 3 - Article 3.2 "PIPE APPLICATIONS" or on individual plan sheets for identification and type of piping where the below materials are used.

1. All above ground fire protection piping located within non-heated enclosures shall be insulated.

B. Steel Pipe (Galvanized steel pipe manufactured in Korea shall not be accepted): ASTM A53; ASTM A135; ASTM A795; Schedule 40, black and galvanized.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded; ASME B16.25, buttweld ends; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Ductile Iron Fittings: ASME B16.1, flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings
4. Mechanical Roll Grooved Couplings (Cut grooves not acceptable): Two (2) ductile iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe. Anvil and Victaulic:

a. Ridgid: Victaulic Style 009-EZ and 107N
b. Flexible: Victaulic Style 177 Installation Ready and Style 77
c. Listed for dry or wet pipe use.
d. Grooves shall be rolled (cut grooves not allowed).

2.4 PIPE HANGERS AND SUPPORTS

A. Conform to the General Requirements of NFPA 13 and NFPA 14 and the additional design and installation requirements as listed below:

1. Provide hangers and vertical piping restraints within 12 inches on all sprinkler

drops at end of branch where system pressure exceeds 100 psig in accordance with NFPA 13.

2. Provide hangers within 12 inches of each turn of direction (horizontal elbow) in sprinkler piping.
3. Powder- driven Studs are not acceptable.
4. Prime coat all sprinkler pipe hangers where indicated in Part 3 - "Execution"
5. Hangers for Pipe Sizes 1 through 6 Inch: Provide Carbon steel, adjustable swivel, split ring hangers.
6. Multiple or Trapeze Hangers: Steel pipe or steel angles with welded spacers and hanger rods.
7. Vertical Support: Steel riser clamps.
8. Floor Support: Cast iron adjustable pipe saddles, lock nut, nipple, floor flange, and concrete pier or steel support.

2.5 FIRE PROTECTION GATE VALVES

A. Up to and including 2 Inches:

1. Manufacturers:

a.	Nibco	Model T-104-O.
b.	Kennedy	Model KS-FW

2. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 Inches:

1. Manufacturers:

a.	Nibco	Model F-697-0., F-609
b.	Kennedy	Model KS-FW
c.	Victaulic	Series 771

2. Iron body, bronze trim, rising stem, pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged, or grooved ends. 250 psi pressure rated

2.6 BALL VALVES

A. Up to and including 2 Inches (Ball valves are not to be used over 2 inches):

1. Manufacturers:

a. NIBCO KG-505-W-8
b. Victaulic Series 728

2. Bronze two piece body, brass, full port, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends. 300 psi pressure rated.

2.7 AUTOMATIC AIR VENT VALVES

A. Automatic Air Vent:

1. Manufacturers:

a. Potter Model "PAV" with ball valve and Potter Model RBVS tamper switch

2. Manufacturers:

a. Engineered Corrosion Systems Model "PAV-W" Automatic Air Vent with ball valve and Potter Model RBVS tamper switch

2.8 BUTTERFLY VALVES

A. Cast or Ductile Iron Body:

1. Manufacturers:

a. Kennedy Fig. G300 or 01G
b. Victaulic Series 705W

2. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, pressure responsive resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, with handwheel and gear drive and integral indicating device, and internal tamper switches rated 10 amp at 125 volt AC.

2.9 CHECK VALVES

A. Up to and including 2 Inches:

1. Manufacturers:

a. Nibco Model KT403W
b. Victaullic Series717H

2. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 Inches:

1. Manufacturers:

a. Nibco Model G917-W
b. Victaulic Series 717

2. Iron body, bronze trim, spring-assisted swing check for vertical or horizontal installation with rubber disc, renewable disc and seat, grooved or flanged ends with automatic ball check. 250 psi pressure rated

2.10 BACKFLOW PREVENTER VALVE ASSEMBLY

A. Manufacturer

1. Wilkins

a. Model 350 ASTDA with by-pass meter, bypass double check valve assembly, Butterfly valves with integral tamper switches

2. Apollo Valves

a. Model DCDALF 4A with by-pass meter, bypass double check valve assembly, Butterfly valves with integral tamper switches

PART 3- EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends.

1. Remove burrs.
2. Bevel plain end ferrous pipe.
3. Remove scale and foreign material, from inside and outside, before assembly.
4. Prepare piping connections to equipment with flanges or unions.
5. Unions and flangesfor servicing or disconnect are not required in installations using grooved mechanical joint couplings.

3.2 PIPE APPLICATIONS

A. Underground Pipe: Listed, lined, ductile iron pipe and fittings, 250 lb working pressure. Refer to Division 2, Section - "Excavation, Filling and Grading" for further specific trenching and backfilling requirements.

1. Depth of Bury:

a. Minimum 36 inches depth of bury from top of pipe to finished grade in accordance with NFPA 24.

i. Provide pipe tape markers and # 12 copper trace wire over entire length of pipe.

b. Minimum 42 inches depth of bury under driveways, slabs, parking lots, etc., in accordance with NFPA 24.

i. Provide pipe tape markers and # 12 copper trace wire over entire length of pipe.

B. Underground Pipe: Listed CL 900 DR 18 PVC pipe and ductile iron fittings, 150 lb working pressure. Refer to Division 2, Section - "Excavation, Filling and Grading" for further specific trenching and backfilling requirements.

1. Depth of Bury:

a. Minimum 36 inches depth of bury from top of pipe to finished grade in accordance with NFPA 24.

i. Provide pipe tape markers and # 12 copper trace wire over entire length of pipe.

b. Minimum 42 inches depth of bury under driveways, slabs, parking lots, etc., in accordance with NFPA 24.

i. Provide pipe tape markers and # 12 copper trace wire over entire length of pipe.

C. Above Ground Pipe: Provide piping in accordance with the following schedule of systems:

1. Sprinkler pipe (wet pipe - 1 1/4 inches & below): Schedule 40 steel pipe - screwed fittings or with rolled grooves and roll grooved fittings where the fittings are designed to prevent the pipe from rotating.
2. Sprinkler pipe (wet pipe - 1 ½ thru 5 inches): Schedule 40 steel pipe with rolled grooves and roll grooved fittings
3. Sprinkler pipe (wet pipe - 6 inches and larger): Schedule 10 steel pipe with rolled grooves and roll grooved fittings
4. Sprinkler pipe (dry pipe systems 1 1/4 inches and below): Schedule 40, black steel pipe – with screwed fittings or rolled grooves and roll grooved fittings where the fittings are designed to prevent the pipe from rotating.
5. Sprinkler pipe (dry pipe systems - 1 ½ thru 5 inches): Black Steel Schedule 40 steel pipe with rolled grooves and rolled grooved fittings
6. Sprinkler pipe (dry pipe systems - 6 inches and larger): Hot Dipped Galvanized Schedule 10 steel pipe with rolled grooves and rolled grooved fittings
7. Air compressor lines: Schedule 40 steel pipe - screwed fittings
8. Drain lines: Schedule 40 galvanized steel pipe - screwed or grooved fittings

*all exposed sprinkler pipe where indicated to be painted shall be properly prepared for painting

3.3 INSTALLATION

A. Heated Backflow Prevention Device enclosure shall be assembled and mounted on concrete pad in accordance with the manufacturer's published installation instructions.

1. Enclosure shall be installed plumb, level, and square.

B. Install piping in accordance with NFPA 13 for Sprinkler Systems, NFPA 14 for Standpipe and Hose systems, and NFPA 24 for service mains. Refer to Division 2, Section - "Excavation, Filling and Grading" for further specific trenching and backfilling requirements.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Sleeve pipes passing through partitions, walls, and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Pipe Hangers and Supports:

1. Install in accordance with NFPA 13 and NFPA 14 except where specifically indicated in order to raise the minimum standards set by NFPA.
2. Install hangers to provide minimum ½ 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. Prime coat exposed steel hangers and supports or provide factory primed hangers and supports. Refer to Section - "Painting". Hangers and supports located in areas not generally in view of the general public including crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

I. Electrical Service to Fire Protection Systems:

1. Except for high voltage electrical service to fire pumps, jockey pumps, and pump controllers, if electrical circuits or services are required for the operation of the fire protection system(s) at a location selected by sprinkler designer, the sprinkler contractor shall coordinate the location and placement of required electrical circuit(s) with the electrical sub-contractor. It is the responsibility of the sprinkler

contractor to coordinate the number, size, type, and location of electrical circuits in the field with other trades. The fire protection contractor shall be responsible for providing and/or paying for all costs associated with providing electrical service for his equipment prior to bidding.

J. Drains:

1. Where sanitary sewer drains, storm drains, hub drains, floor drains, etc., are required for the draining of fire protection systems at a location indicated or selected by the sprinkler designer, the sprinkler contractor shall coordinate the location and placement of required drains with the plumbing sub-contractor. It is the responsibility of the sprinkler contractor to coordinate the number, type, and location of drains in field with other trades. Contractor shall be responsible for covering all costs associated with providing for and/or paying for drainage piping for his equipment prior to bidding.

K. Slope piping and arrange systems to drain at low points.

1. Use eccentric reducers to maintain top of pipe level.

L. Painting: Refer to Division 9, Section - "Painting". Coordinate the painting requirements of this section with the Contractor. Painting is typically performed by the Division 9 Contractor. This Contractor, however, shall either perform specialized painting as called for below in the following conditions or he shall advise the Contractor prior to bidding of these painting requirements set forth as follows:

1. All exposed fire protection piping in normally occupied areas shall be painted.
2. Thoroughly clean all mechanical surfaces, requiring prime painting, of rust, loose scale, oil and grease.
3. Dry all surfaces before painting.
4. Paint only under proper ambient conditions.
5. Do not paint over controls, or on equipment nameplates, factory labels or sprinkler heads.
6. Prepare pipe, fittings, supports, and accessories for finish painting.
7. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Do not penetrate building structural members unless indicated.

N. Provide sleeves when penetrating building footings, floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance rating equivalent to fire separation required.

O. 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.

P. 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.

Q. Grooved Joints: Install in accordance with the manufacturers latest published installation instructions. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to (and including) the groove. Gasket shall be verified as suitable for the intended service. Contractor shall remove and replace any improperly installed products.

R. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

1. Provide gate or butterfly valves for shut-off or isolating service.
2. Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.4 TRAINING & DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:

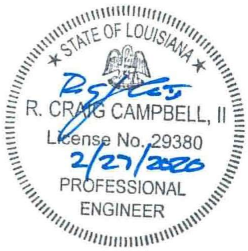
1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1, Section - "Closeout Submittals" and Division 15, Section - "Basic Mechanical Materials & Methods."
3. Provide Service Manuals for each sprinkler system specified.

B. Provide three (3) hours of factory authorized training and demonstration.

1. Refer to Section - "Mechanical General Provisions" for video taping requirements.
2. Schedule training with a minimum of seven (7) days notice to Owner's Representative.

END OF SECTION 15326

Archives and Central Distribution Facility
Calcasieu Parish Sheriff's Office
Lake Charles, Louisiana



SECTION 15350 - WASTE WATER DISPOSAL

PART 1 - GENERAL

1.1 SERVICE

A. CONTRACTOR SHALL VISIT SITE PRIOR TO BID TO DETERMINE THE EXTENT OF THEIR REQUIREMENTS, PAY ALL COSTS FOR CONNECTIONS AND COMPLETE WORKING INSTALLATION.

B. CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF SEWER MANHOLE PRIOR TO ROUGH-IN.

1.2 GENERAL

A. The system of sewage and drainage in general shall be as hereinbefore specified.

B. All work shall be in strict accordance with the Louisiana State Plumbing Code (2013 Edition with latest amendments) and in accordance with all local codes. Piping shall be routed as shown on Plans or in an acceptable manner to meet building conditions. Venting shall be as shown on plumbing riser diagrams.

C. Connections between traps and cast iron pipes are to be made with heavy brass ferrules or cast iron pipe.

D. All p-traps installed below slab shall be deep-seal p-traps.

E. Provide reducers, increasers, special flanges, and fittings where required between piping work and fixtures in order to connect and complete work and render it ready for use. Make any offsets required to avoid construction.

F. All water closets shall be mounted with 4" closet bends.

G. All lines 2" and smaller shall be sloped 1/4" per foot; all lines 3" and larger shall be sloped 1/8" per foot. Piping shall be laid so slope is continuous.

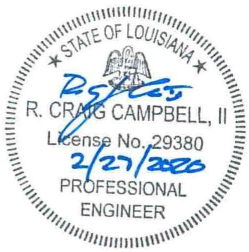
H. All sewer vents shall extend 8" above roof and terminate in an appropriate flashing collar. No vents shall penetrate roof within 48" of an exterior wall. Offset in ceiling as required. All back vents shall be taken off as near trap as possible.

1.3 TESTING

A. Test all sanitary sewer waste and vent lines inside building with a minimum of 10' water head for 15 minutes, in accordance with the International Plumbing Code.

B. All exterior sewer piping shall be air tested under 5 psi for 15 minutes.

END OF SECTION 15350



SECTION 15500 - PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor and materials as hereinbefore specified, indicated or reasonably implied for the complete installation of the following systems:

1. Domestic Cold Water System
2. Domestic Hot Water System
3. Sanitary Drainage System

PART 2 - PRODUCTS

2.1 FLOOR DRAINS:

A. All floor drains shall be constructed of cast iron and shall be complete with clamping devices as required. Equivalent drains as manufactured by Josam, J.R. Smith, Zurn or Wade will be acceptable. NO OTHER MANUFACTURERS WILL BE ACCEPTED WITHOUT PRIOR APPROVAL. All floor drains shall be provided with 2# lead flashing extending a minimum of 24" all around drain except in certain areas where the General Contractor is providing a flashing membrane, in which case that membrane shall be flashed into the drain.

B. All floor drains shall be installed with 6" (six inch) deep seal p-traps.

2.2 CLEANOUTS:

A. Cleanouts other than type listed below as manufactured by J.R. Smith, Josam, Zurn and Wade, will not be acceptable.

B. Cleanouts shall be provided where shown on plans, at each change of direction of the building drain greater than 45 degrees and at or near the foot of each vertical waste or soil stack. Location of all cleanouts for pipe 3" in diameter and less shall be at no more than 50' intervals. Pipe 4" in diameter and larger shall be located at no more than 75' internals. Cleanouts shall be the same size as the piping. Every cleanout shall be installed so that the cleanout opens in the direction of the flow of the drainage line or at right angle thereto.

C. Floor cleanouts shall be an adjustable type with clamping collar and nickel bronze cover.

D. Top of cleanout shall be level with top of finished floor so there is a continuous surface.

E. Floor cleanouts shall be Wade 6000 Series or J.R. Smith 4020 Series.

F. Wall cleanouts shall have chrome plated frame and cover, Wade W-8550-S with W-8480-S access cover, J. R. Smith 4435, or equal.

G. Outside cleanouts shall be as detailed on the Plans.

2.3 FLASHING:

A. Flash around all pipes passing through the roof in connection with this Contract with sheet lead, not less than 2-1/2# to the square foot, built 6" into the waterproofing, running 8" up the pipe and turned over into the pipe cavity, or roof jacket in accordance with roofing manufacturer's recommendations.

2.4 ELECTRIC WATER HEATER:

A. Provide electric water heater with capacities indicated in the specifications and locations as shown on Plans. The heater shall be U.L. approved and listed, and shall have a five (5) year warranty. Heating elements shall be of capacity and electrical characteristics indicated on Plans and shall be heavy-duty emersion type. Heaters shall be complete with fully automatic controls and ASME rated temperature and pressure relief valves.

2.5 PLUMBING FIXTURES:

A. Plumbing Contractor shall furnish and install all plumbing fixtures shown on accompanying Drawings. Refer to both Plumbing and Architectural, and provide all fixtures shown on either. Fixtures shall be complete with all necessary brass and accessories required for a complete installation, including traps, escutcheons, angle supplies, basin cocks, etc. All fixtures shall be new and must be delivered to the building properly crated in perfect condition.

B. All brass must be of the best quality. Lightweight goods will not be accepted.

C. All brass pipe shall be seamless brass tubing and nipples shall be extra heavy.

D. All fittings and trim shall be chromium plated heavy brass unless otherwise specified.

E. "P" traps on lavatories and sinks shall be cast brass with cleanouts.

F. All exposed piping shall be chromium plated.

G. Provide cut-off valves at each fixture in both hot and cold water piping.

H. For the purpose of establishing type and class of fixtures required, the following plate numbers have been taken from the Manufacturer's Catalog as indicated: Fixture manufacturer's and Model numbers with prior approval will be acceptable, however fixtures and accessories shall meet standards and features indicated below.

I. Refer to Architectural Drawings for mounting height and exact location of all plumbing fixtures. Handicapped fixtures shall be installed to meet the latest A.D.A. requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

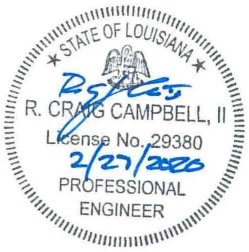
A. All plumbing fixtures shall be installed as per local code authorities, Board of Health and The International Plumbing Code.

B. All tests shall be in accordance with governing authorities.

C. All supply piping (hot and cold) to all sinks, lavatories, water closets, water coolers, etc. shall be installed so that no more than ½" of copper tubing is exposed at the supply/cutoff valves.

END OF SECTION 15500

Archives and Central Distribution Facility
Calcasieu Parish Sheriff's Office
Lake Charles, Louisiana



SECTION 15535 - REFRIGERANT PIPING AND SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure relief valves.

H. Filter-driers.

I. Solenoid valves.

J. Expansion valves.

K. Receivers.

L. Flexible connections.

1.2 REFERENCES

A. ARI 495 - Refrigerant Liquid Receivers.

B. ARI 710 - Liquid Line Dryers.

C. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers

D. ARI 750 - Thermostatic Refrigerant Expansion Valves.

E. ARI 760 - Solenoid Valves for Use With Volatile Refrigerants.

F. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

G. ASHRAE 34 - Number Designation of Refrigerants.

H. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

I. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes.

J. ASME B31.5 - Refrigeration Piping.

K. ASME B31.9 - Building Services Piping.

L. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

M. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

N. AWS A5.8 - Brazing Filler Metal.

O. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

P. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

Q. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASTM B31.5 unless indicated otherwise.

C. Liquid Indicators:

1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

D. Valves

1. Use service valves on suction and discharge of compressors.
2. Use gage taps at compressor inlet and outlet.

3. Use gage taps at hot gas bypass regulators, inlet and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:

1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
3. Use shut-off valve on each side of strainer.
4. Pressure Relief Valves: Use on ASME receivers [and pipe to outdoors].

G. Permanent Filter-Driers:

1. Use in low temperature systems.
2. Use in systems utilizing hermetic compressors.
3. Use filter-driers for each solenoid valve.

H. Solenoid Valves:

1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

I. Receivers:

1. Use on systems where required for proper operation (by manufacturer) and/or 5 tons and larger, sized to accommodate pump down charge.
2. Use on systems with long piping runs.
3. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Submit under provisions of Section 15001.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 15001.

B. Record exact locations of equipment and refrigeration accessories on record drawings.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 15001.

B. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this section.

1.8 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME SEC 9.

C. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

1.10 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of 01700.

B. Provide containers each with refrigerant.

PART 2 PRODUCTS

2.1 PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn.

B. Fittings: ASME B16.22 wrought copper.

C. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F (640 to 805 degrees C).

D. Pipe Supports and Anchors:

1. Conform to ASME B31.5.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
9. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
10. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.2 REFRIGERANT

A. Refrigerant: ASHRAE 34;

1. R-410A

2.3 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum working pressure of 500 psig and maximum temperature of 200 degrees F.

2.4 VALVES

A. Ball Valves:

1. Two piece forged brass body with teflon ball seals and copper tube extensions, brass [bonnet and] seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 300 degrees F.

B. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, [integral ball check valve,] flared or solder ends, for maximum pressure of 500 psig (3450 kPa).

2.5 STRAINERS

A. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psig (2960 kPa).

2.6 CHECK VALVES

A. Globe Type:

1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum working pressure of 500 psig and maximum temperature of 300 degrees F (149 degrees C).

2.7 PRESSURE REGULATORS

A. Brass body, stainless steel diaphragm, direct acting adjustable over 0 to 80 psig (0 to 550 kPa) range, for maximum working pressure of 450 psig.

2.8 PRESSURE RELIEF VALVES

A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; for standard 450 psig setting; selected to ASHRAE 15.

2.9 FILTER-DRIERS

A. Permanent Straight Through Type:

1. ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psig.
2. Rating: ARI 710 moisture rating.

2.10 SOLENOID VALVES

A. Valve: ARI 760, pilot operated, copper or brass [or steel] body and internal parts, synthetic seat, stainless steel stem and plunger assembly, with flared, solder, or threaded ends; for maximum working pressure of 500 psig. Stem shall permit manual operation in case of coil failure.

2.11 EXPANSION VALVES

A. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, non-adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb.

B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F (6 degrees C) superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.12 RECEIVERS

A. Internal Diameter 6 inch (150 mm) and Smaller:

1. ARI 495, UL listed, steel, brazed; 400 psig maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

B. Internal Diameter Over 6 inch (150 mm):

1. ARI 495, welded steel, tested and stamped in accordance with ASME SEC 8D; 400 psig with tappings for liquid inlet and outlet valves, pressure relief valve.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with slab.

G. Pipe Hangers and Supports:

1. Install in accordance with ASTM B31.5.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
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.
8. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
9. Provide clearance for installation of insulation and access to valves and fittings.
10. Provide access to concealed valves and fittings.
11. Flood piping system with nitrogen when brazing.
12. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

13. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.
14. Insulate piping; refer to Section 15000 and Section 15200.
15. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
16. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
17. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
18. Fully charge completed system with refrigerant after testing.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Test refrigeration system in accordance with ASME B31.5.

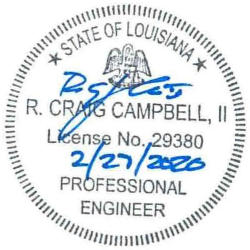
C. Pressure test system with dry nitrogen to 200 psig (1470 kPa).

3.4 SCHEDULES

Pipe Hanger Spacing

PIPE SIZE Inches (mm)	MAX. HANGER SPACING Feet (m)	DIAMETER Inches (mm)
1/2 to 1-1/4 (12 to 32)	6.5 (2)	3/8 (9)
1-1/2 to 2 (38 to 50)	10 (3)	3/8 (9)
2-1/2 to 3 (62 to 75)	10 (3)	1/2 (13)
4 to 6 (100 to 150)	10 (3)	5/8 (15)
8 to 12 (100 to 150)	10 (3)	5/8 (22)

END OF SECTION 15535



SECTION 15700 - AIR CONDITIONING, HEATING AND VENTILATING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The air conditioning system, in general, shall be for the entire building, providing cooling and dehumidification in summer and heating in winter. A constant amount of fresh air shall be taken into the system and all air shall be filtered.

1.2 HIGH EFFICIENCY CONDENSING UNIT - OUTDOOR SECTION:

A. Furnish and install high-efficiency, air-cooled top discharge condensing unit where shown and with capacities scheduled. UNIT SHALL BE COMPLETELY FACTORY ASSEMBLED, PRE-CHARGED AND TESTED, AND SHALL BE SUPPLIED FROM THE FACTORY WITH ALL FEATURES LISTED BELOW. Min. SEER 13.0 for 5 ton and below, 11.0 S.E.E.R. for over 5 tons..

B. Condenser coil shall be constructed of aluminum fins mechanically bonded to an aluminum coil and shall be protected with stamped louvered panels on outside of unit.

C. Condenser fan shall be propeller type, direct driven. Motor shall have inherent protection and be of the permanently lubricated type, resiliently mounted. Fans shall be complete with safety guards.

D. Compressor shall be a single speed serviceable hermetic or sealed hermetic design complete with crankcase heater and external spring isolators and compressors, and shall have a 5-year warranty. Unit shall be equipped with time delay to prevent compressor from starting within five minutes of "off" time.

E. All controls shall be factory wired and shall consist of condenser fan overload devices, hard start kit (single phase only), internal pressure relief valve, filter dryers, pressure taps for refrigerant check, quick connect refrigerant couplings and liquid and suction line service valves. Unit shall also be furnished with outdoor expansion valve or metering valve and check valve, switch-over valve and an evaporator defrost control kit to permit the cooling system to operate down to 30°F outdoor temperature.

F. Casing shall be fully weatherproof for outdoor installation and shall be bonderized steel with baked enamel finish. Panels shall be removable to provide access for servicing. Unit shall be set in place on rubber mounting pads.

G. Contractor shall advise the Electrical Contractor of the manufacturer's recommended fuse size, wire size, etc. if different from that specified on the Electrical Drawings. Mechanical Contractor shall pay any additional costs required to change fuse sizes, wire sizes, etc., require for proper operation.

H. Unit shall be as manufactured by Trane, Lennox, Carrier, York or approved equivalent.

1.3 HIGH EFFICIENCY AIR CONDITIONING UNIT - INDOOR SECTION:

A. Furnish and install vertical discharge/bottom return, or horizontal type (as indicated on plans) air conditioning unit of size, type and capacities as scheduled. Units shall be Trane, Lennox, Carrier, York or approved equivalent.

B. Units shall be complete with fan, multi-speed direct drive blower, motor, direct expansion cooling coil, low voltage control transformer, grease fittings, drain pan, etc. All units shall be factory insulated on the interior with not less than 3/4# density neoprene coated fiberglass cemented in place with waterproof adhesive.

C. Each unit shall be mounted on a suitable base as indicated on plans or 30" high painted angle iron base approved by the Engineer to allow for proper return air. Unit shall also be designed for continuous operation at the maximum rated static pressure. Fan capacities shall be rated with the fans in the units, and the horsepowers specified shall include all losses.

D. Casings shall be suitable for operation at the pressures specified and constructed of bonderized steel.

E. Cooling coils shall be of aluminum or copper and shall be tested at 400 psi air pressure. Cooling coil face velocity shall not exceed that guaranteed by manufacturer for no moisture carry-over.

F. Electric strip heaters shall be as hereinafter specified and shall be mounted inside unit housing. Coordinate electric service to heaters and blower with Electrical Contractor. Heater and air unit shall be internally wired and fused to receive one electrical source of power. Provide internal disconnect switch in unit.

G. Filter shall be 1" thick, pleated, throw-way mounted in an accessible factory filter rack at unit, or in R.A. ductwork as indicated on plans.

H. Contractor shall provide a new set of filters upon completion of project, to turn building over to Owner.

I. If the manufacturer's equipment is not available internally wired to receive one source of power, necessary modifications to electric service shall be the responsibility of the equipment supplier and Mechanical Contractor. Any modifications required shall be submitted in writing ten (10) days prior to the bid date.

1.4 ELECTRIC STRIP HEATERS:

A. Electric strip heaters shall consist of open coils made from Grade "A" resistant wire insulated by floating ceramic bushings and supported in an aluminum steel frame.

B. All terminal studs, nuts and washers shall be stainless steel, insulated with phenolic terminal bushings. Terminals shall be machine crimped to coils and heater shall be tested at 2000 volts before shipment. All voltages and phases shall be as scheduled.

C. Heater shall be provided with built-in contactors, with one terminal block furnished for each circuit and separate contactors for each stage of heating. Heaters shall be internally wired with air unit to receive one electric source of power.

D. An automatic reset thermal cut-off shall be provided to break the heater load directly on over-temperature. In addition, provide manual reset thermal cut-off to break the heater load manually.

E. Control circuit transformer shall be built into heater terminal box and sized to carry full contactor holding coil load.

F. Heaters shall be listed by UL and shall be as manufactured by Chromalox, Electric Heaters, Inc., Industrial Engineering and Equipment Co., or an approved equivalent.

G. Heater shall be equipped with built-in pressure type air flow switch. Heater shall be mounted inside unit housing.

H. Where indicated on drawings, heaters in ductwork shall be provided with duct flanges. Outside of heater shall be wrapped with 2" thick fiberglass ductwrap with aluminum foil vapor barrier.

1.5 EMERGENCY DRAIN PAN (DX Equipment):

A. All vertical split system air handling units shall be installed on welded angle iron support in an emergency drain pan. Allow proper clearance for R.A. duct connection and removal of filters, etc.

B. Drain pans shall be constructed of 20 gauge galvanized metal. Pan shall extend 4" beyond the edge of the unit. The sides of the pan shall be 4" high with drain connection located inside of the pan.

C. Provide 3/4" Type "L" hard copper drain line with valve and pipe to floor drain in mechanical room.

1.6 TESTING REFRIGERANT PIPING SYSTEMS:

A. Refrigerant lines shall be tested under 200 psi carbon dioxide pressure for 5 hours using soap suds at joints to test for leaks. Evacuate system and charge with refrigerant.

1.7 LABELING A/C UNITS:

A. All indoor and outdoor a/c units shall be labeled with permanent laminated plate riveted to unit. Units shall be labeled as indicated in schedules. Plate shall be black with white unit numbers. Height of unit number shall be minimum of one (1) inch. Label shall also indicate area serviced by unit as noted in schedules. Height of letters shall be minimum of one-half (1/2) inch.

1.8 VENTILATING SYSTEM:

A. This Contractor shall furnish and install all exhaust fans shown and scheduled on Plans. Fans shall be of the type indicated and shall be Cook, Greenheck, Acme or approved equivalent.

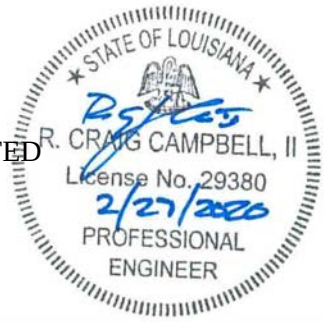
B. All exhaust fans shall be equipped with bird screen, automatic back-draft dampers and integral disconnect switch unless noted otherwise. Fan motors shall be of the 40 ^{deg} C ambient temperature rise type and shall be suitable for continuous duty operation. Direct drive fans shall be complete with solid state speed control switch mounted on unit for balancing. Interlock with remote on/off switch.

C. Roof mounted fans shall be complete with insulated factory roof curb. Coordinate requirements and height with roofing manufacturer's recommendation.

D. In-line exhaust fans shall be mounted with spring isolation hangers and threaded rod supports anchored to structure.

E. Ceiling mounted fans shall be complete with white ceiling mounted grille. Grille shall be removable to provide service access to fan, motor, etc.

END OF SECTION 15700



SECTION 15710- VRF HEAT PUMP RECOVERY AIR CONDITIONING / DESIGNATED OUTSIDE AIR SYSTEM (DOAS)

Part 1 - General

1.01 SYSTEM DESCRIPTION R2-SERIES (SIMULTANEOUS HEAT/COOL)

A. Per the equipment schedule, the variable capacity, heat pump heat recovery air conditioning system basis of design is Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system(s).

B. Acceptable alternative manufacturers, assuming compliance with these equipment specifications, are Daikin, Panasonic, and Hitachi. Contractor bidding an alternate manufacturer does so with full knowledge that that manufactures product may not be acceptable or approved and that contractor is responsible for all specified items and intents of this document without further compensation.

C. Simultaneous heating/cooling (heat recovery) systems shall consist of an outdoor unit, BC (Branch Circuit) Controller (or comparable branch devices), multiple indoor units, and an integral DDC (Direct Digital Controls) system. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes.

D. No additional branch circuit controllers (or comparable branch devices) than shown on the drawings/schedule may be connected to any one outdoor unit. Contractors proposing alternate systems requiring more branch devices than those included as the basis of design are responsible for additional piping & electrical costs and are required to identify additional costs & installation time required of other trades with their bid.

1.02 SYSTEM DESCRIPTION DOAS HEATING/COOLING HEAT PUMP WITH REHEAT

E. The split system (DOAS) shall consist of one VRF (Variable Refrigerant Flow) outside unit connected to one BC Controller (or comparable branch device), and one ducted indoor unit. The DOAS shall be provided with the capability to reheat air using recovered energy from the primary cooling coil or provide a primary cooling coil only. The DOAS shall be of a split system type.

F. Per the equipment schedule, the VRF DOAS system basis of design is Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system(s). Acceptable alternative manufacturers, assuming compliance with these equipment specifications, are Daikin, Pana-

sonic, and Hitachi. Contractor bidding an alternate manufacturer does so with full knowledge that that manufactures product may not be acceptable or approved and that contractor is responsible for all specified items and intents of this document without further compensation.

1.03 QUALITY ASSURANCE

1. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

3. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

4. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.

5. System start-up supervision shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in system configuration and operation. The representative shall provide proof of manufacturer certification indicating successful completion within no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals.

1.04 DELIVERY, STORAGE AND HANDLING

1. Unit shall be stored and handled according to the manufacturer's recommendation.

Part 2 - Warranty

G. The CITY MULTI units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original owner from date of installation.

H. Manufacturer shall have a minimum of fifteen (15) years continuous experience providing VRF systems in the U.S. market.

I. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

J. The CITY MULTI VRF system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

Part 3 - Outdoor Units

3.01 R2-SERIES STANDARD EFFICIENCY (HEAT RECOVERY), AIR COOLED OUTDOOR UNITS

K. General:

The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Part 5 (Controls). The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

1. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc.

2. Outdoor unit shall have a sound rating no higher than 66.5 dB(A) individually or 69.5 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 55 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

3. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.

4. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.

5. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.

6. The outdoor unit shall have a high pressure safety switch, over-current protection, crank-case heater and DC bus protection.

7. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.

8. The outdoor unit shall be capable of operating in heating mode down to -18°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

9. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.

10. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.

11. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature. Systems that keep fans running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.

12. In reverse defrost all refrigerant shall be bypassed in the main branch controller and shall not be sent out to the indoor units, systems that flow refrigerant through indoor units during reverse defrost shall not be allowed.

L. Unit Cabinet:

13. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

14. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.

15. Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.

M. Fan:

16. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG. external static pressure, but capable of normal operation with a maximum of 0.32 in. WG. external static pressure via dipswitch.

17. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

18. All fans shall be provided with a raised guard to prevent contact with moving parts.

N. Refrigerant and Refrigerant Piping:

19. R410A refrigerant shall be required for systems.

20. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

21. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.

22. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.

23. Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

O. Coil:

24. Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil.

25. Outdoor Coil shall be elevated at least 12" from the base on the unit to protect coil from freezing and snow build up in cold climates. Manufacturer's in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12" of height to their stand or support structure to provide equal protection from elements as Mitsubishi Electric basis of design. Any additional support costs, equipment fencing, and tie downs required to meet this additional height shall be responsibility of Mechanical Contractor to provide.

26. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

27. The coil fins shall have a factory applied corrosion resistant blue-fin finish. Uncoated aluminum coils/fins are not allowed.

28. The coil shall be protected with an integral metal guard.

29. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

30. Unit shall have prewired plugs for optional panel heaters when operating below ambient conditions of 1F to prevent any residual ice buildup from defrost.

P. Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to

protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed in markets where the outdoor unit will see temperatures below freezingCompressor:

31. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.

32. Each compressor shall be equipped with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer's that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.

33. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting "belly-band" type crankcase heaters are not allowed. Manufacturer's that utilize belly-band crankcase heaters will be considered as alternate only.

34. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 15%.

35. The compressor shall be equipped with an internal thermal overload.

36. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

37. Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.

Q. Controls:

38. The unit shall be an integral part of the system & control network described in Part 5 (Controls) and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.

39. Each outdoor unit module shall have the capability of 4 levels of demand control based on external input.

R. Electrical:

40. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz or 460 volts, 3-phase, 60 hertz per equipment schedule.

41. The outdoor unit shall be controlled by integral microprocessors.

42. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3.02 BRANCH CIRCUIT (BC) CONTROLLERS AS REQUIRED FOR SIMULTANEOUS HEAT/COOL SYSTEMS

S. General

1. BC (Branch Circuit) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling risk bubbles in liquid supplied to indoor unit LEVs and are not allowed.

2. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.

T. BC Unit Cabinet:

3. The casing shall be fabricated of galvanized steel.

4. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.

5. The unit shall house two tube-in-tube heat exchangers.

U. Refrigerant Piping (specifications in addition to those for outdoor unit):

6. All refrigerant pipe connections shall be brazed.

7. Future changes to indoor unit quantities or sizes served by BC Controller or comparable branch device must be possible with no piping changes except between the branch device and indoor unit(s) changing. Systems which might require future piping changes between branch device and outdoor unit—if changes to indoor unit quantities or sizes are made—are not considered equal and are not allowed.

V. Refrigerant valves:

8. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

W. Condensate Management:

9. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components with removable insulation that allows easy access for future service needs. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

X. Electrical:

10. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).

11. The BC Controller shall be controlled by integral microprocessors

12. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total.

Part 4 - Indoor Units

4.01 MEDIUM STATIC CEILING-CONCEALED DUCTED INDOOR UNIT

Y. General:

1. The ceiling-concealed ducted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. In-door unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

Z. Unit Cabinet:

2. The unit shall be ceiling-concealed, ducted—with a 2-position, field adjustable return and a fixed horizontal discharge supply.

3. The cabinet panel shall have provisions for a field installed filtered outside air intake.

AA. Fan:

4. Indoor unit shall feature multiple external static pressure settings ranging from 0.14 to 0.60 in. WG.

5. The indoor unit fan shall be an assembly with statically and dynamically balanced Sirocco fan(s) direct driven by a single motor with permanently lubricated bearings.

6. The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function

BB. Filter:

7. Return air shall be filtered by means of a standard factory installed return air filter.

8. Optional return filter box (rear or bottom placement) with high-efficiency filter as noted on equipment schedule.

CC. Optional Filter Frame and Filter:

9. Filter frame shall be constructed of 20 gauge G-60 galvanized steel. Knurled thumb screws on access door allow filter replacement. Foam gasket provides air-tight connection to in-door unit and access door. Filter frame shall be configurable for rear or bottom return.

10. Filter shall be rated MERV 13 when tested in accordance with ANSI/ASHRAE 52.2 Standard Rated Class 2 under U.L. Standard 900.

DD. Coil:

11. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.

12. The coils shall be pressure tested at the factory.

13. Coil shall be provided with a sloped drain pan. Units without sloped drain pans which must be installed cockeyed to ensure proper drainage are not allowed.

14. The unit shall be provided with an integral condensate lift mechanism able to raise drain water 27 inches above the condensate pan.

EE. Electrical:

15. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

16. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

FF. Controls:

17. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

18. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

19. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

20. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

Part 5 - Controls

5.01 OVERVIEW

GG. The control system shall consist of a low voltage communication network and a web-based interface. The controls system shall gather data and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

HH. Furnish energy conservation features such as optimal start, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

II. System shall be capable of email generation for remote alarm annunciation.

5.02 ELECTRICAL CHARACTERISTICS

JJ. General:

1. Controller power and communications shall be via a common non-polar communications bus and shall operate at 30VDC.

KK. Wiring:

2. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

3. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.

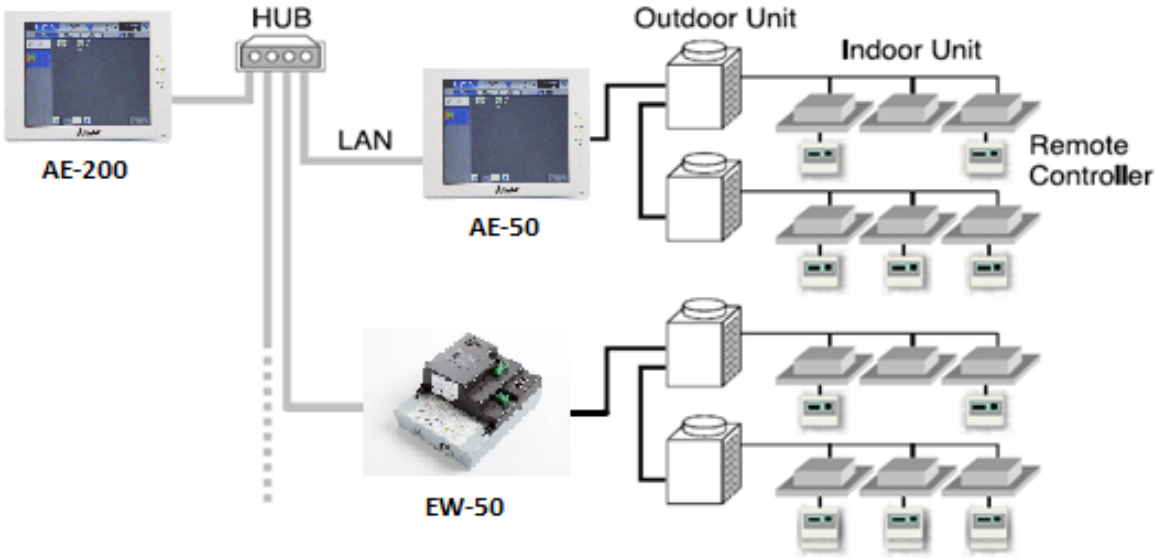
LL. Wiring type:

4. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.

5. Network wiring shall be CAT-5 with RJ-45 connection.

5.03 CITY MULTI CONTROLS NETWORK

1. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.



CMCN System Configuration

5.04 GRAPHICAL USER INTERFACE

MM. The Graphical User Interface (Integrated Centralized Control Web) shall require a field supplied PC or Tablet.

NN. ICCW

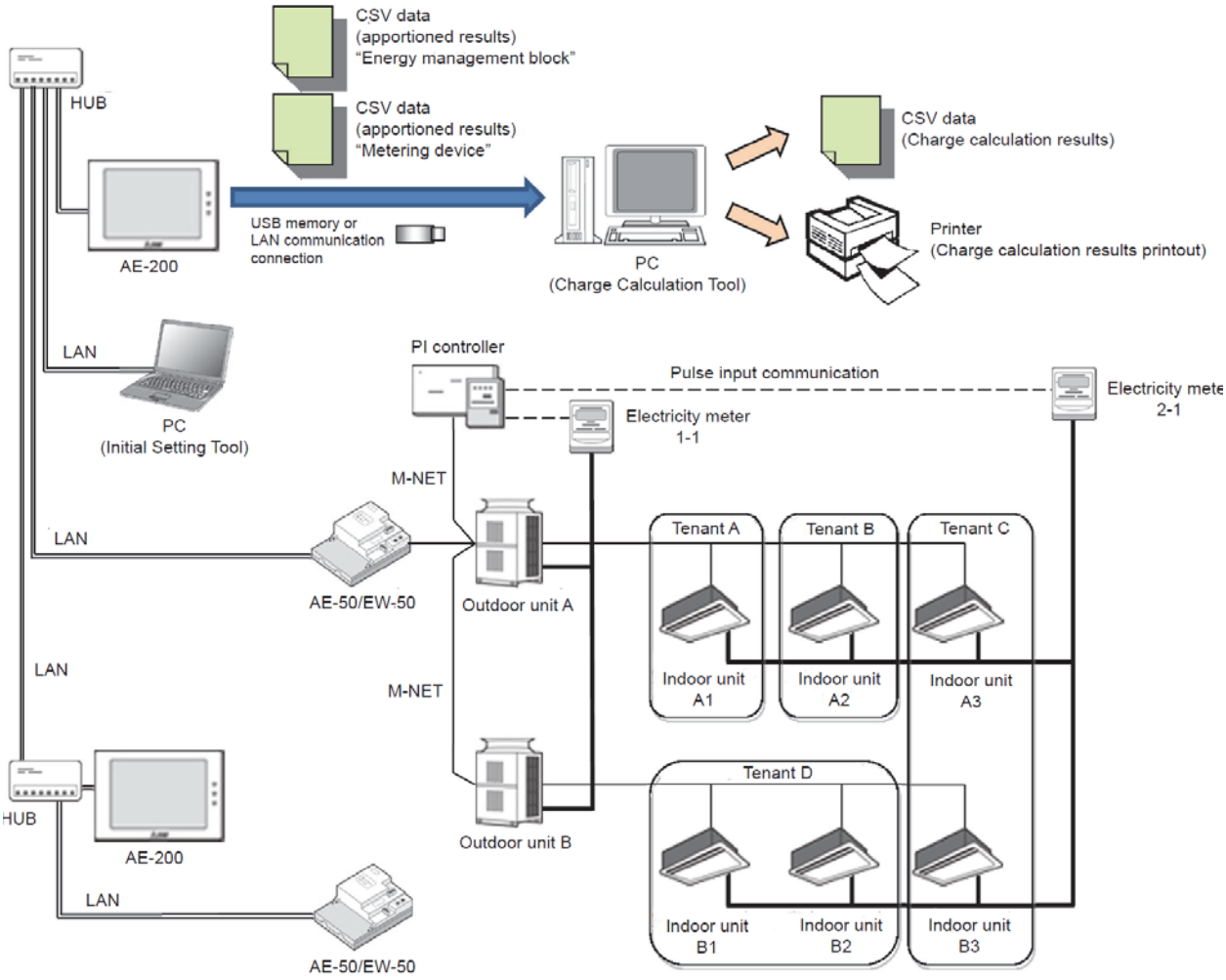
1. The Integrated Centralized Control Web System (ICCW) interface shall enable the user to control multiple AE-200, AE-50, EW-50's and shall provide additional functions such as energy apportionment from a single network PC configured with the Charge Calculation Tool. The ICCW shall be capable of controlling up to forty AE-200/AE-50/EW-50 Centralized Controllers with a maximum of 2,000 indoor units across multiple CITY MULTI outdoor units. The ICCW shall be required if the user wants to simultaneously control more than 1 AE-200/AE-50/EW-50 Centralized Controllers from a single PC or tablet using a single web browser session. Licensing per function, per AE-200/AE-50/EW-50 Centralized Controller shall be required for the ICCW. Optional software features shall be available through the ICCW including energy apportionment and personalized web. These optional software features shall require the ICCW, advance purchase from the customer, and licensing from ICCW.

ICCW (Integrated System Software)	
Item	Details
ON/OFF	The units can turn ON and OFF for all floors or in a block, floor, or group of units.
Operation Modes	The operation mode can be switched between COOL, DRY, FAN, AUTO, and HEAT for all floors or in a block, floor, or group of units
Temperature Setting	Sets the temperature for a single group. Range of Temperature setting from 57°F – 87°F depending on operation mode and indoor unit model. Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.
Fan Speed	The fan speed can be set to four stages for all floors or in a block, floor, or group of units
Air Direction	The air direction can be set in four vertical directions or to swing for all floors or in block, floor, or group of units. (The selectable air direction differs according to the model.)
Interlocked Unit ON/OFF LOSSNAY	If there is an interlocked unit (LOSSNAY), then the unit can be turned ON (strong/weak) or OFF for all floors or in a block, floor, or group of units. (Note that the ventilation mode cannot be selected for interlocked units.)
Local Operation Prohibit	The items for which operation with the local remote controller are to be prohibited can be selected for all floors or in a block, floor, or group of units. (The items that can be prohibited are ON/OFF, operation mode, set temperature and filter sign reset.)
Annual / Weekly Schedule	The annual/weekly schedule function can be used by registering the license. Two settings, such as seasonal settings for summer and winter, can be saved.
Power Rate Apportionment Charging	A watt-hour meter (WHM) with kWH pulse output is connected to calculate the air conditioning charges based on the amount each tenant's air-conditioner has operated. Five charging rates can be applied per day. ***OPTIONAL ENERGY APPORTIONMENT SOFTWARE (SW-CHARGE) and PI Controller (PAC-Y60MCA) REQUIRED
History	Up to 3,000 items for the error history and up to 10,000 items for operation history can be saved. Each history file can be output as a daily report or monthly report in CSV format. (The operation history consists only of the operations carried out with the ICCW and is limited to some limited operation items.)
Operation Time Monitor	The cumulative operation time of each indoor unit can be viewed or output as a CSV format file. (This function is valid only when the charging function license is registered.)
Filter Sign Display Mask	The filter sign display at the remote controllers can be disabled.
Set Temperature Limit	The set temperature lower limit can be set for cooling and the upper limit for heating. (ME remote controller required)

5.05 CMCN: SYSTEM INTEGRATION

OO. The CMCN shall be capable of supporting integration with Building Management Systems (BMS) via industry standard communication protocols including BACnet and LonWorks®.

5.06 ENERGY APPOINTMENT METHOD FOR CITY MULTI CENTRALIZED CONTROLLERS



CMCN System Configuration

PP. System Overview

1. For centralized systems serving multiple tenants for which one-to-one electricity metering is not possible, an apportioned electricity billing function that attributes just the electrical energy consumed by each individual tenant's air conditioner is required. The Energy Apportionment function takes the information on the electrical energy usage gathered from Watt Hour Meters (WHM) connected to dedicated breaker panels serving the system's outdoor units and synthesizes it with the information on the operating status of the indoor units that is collected by the CITY MULTI centralized controller(s).

QQ. Watt Hour Meters

2. Requirements:

- The Watt Hour Meters (WHMs) to be used to read the electrical energy consumption of the outdoor units must be capable of a pulse output, which would be configured based on the current rating of the units. The associated current transformers/ transducers (CTs) must also be sized based on the current rating of either the individual outdoor units or the dedicated air conditioning electrical panels they are to be reading. The proper quantity of meters for a particular sized system must be selected in order to ensure sufficient resolution and hysteresis in the unit pulse output of the meters so as to ascribe an acceptable level of accuracy to the apportionment of energy usage for each tenant's system. The system is designed to work with any WHM capable of a pulse output that meets ANSI C12.20 class 0.2% or 0.5% accuracy standards.

3. Connection:

- The WHMs are to be physically connected to the integrated pulse input module or an external Mitsubishi Electric PI Controller if such an input is not available or if there is a wiring length limitation or installation hardship. The cable type of the interconnecting wiring shall be according to the wiring specifications of the WHM manufacturer.

RR. CITY MULTI Centralized Controller Requirements

4. Licensing:

- Each centralized controller (AE-200/AE-50/EW-50) to which units are assigned that require the energy apportionment function must have the "SW-Charge" software license purchased and properly unlocked in order to enable the operating status of the indoor units to be passed to the energy apportionment tool. The procedure for licensing the centralized controllers with this function and the necessary forms can be found on Mitsubishi Electric's technical documentation repository, mylinkdrive.com. Purchase Order information for the licenses will be required at the time of submission of the licensing request forms.

5. Dedicated AE-200 for apportionment (no MNET connection)

- A dedicated AE-200 centralized controller, for which the SW-Charge license is purchased and the energy apportionment function enabled, must be provided in order to serve as the portal for exporting metering device and energy management data to a USB drive or to a PC via LAN connection. This means that by virtue of selecting this AE-200 to serve this function, the MNET capability of this particular centralized controller will be disabled. All indoor units must be physically wired via MNET to other centralized controllers (AE-50/EW-50), which must be physically wired via LAN with Static IP addresses and a network hub or switch to the AE-200 Apportionment controller.

SS. PC for collecting charge calculation results

- A networked PC, which does not necessarily have to be dedicated to the task of collecting energy apportionment data, can be provided and loaded with the Charge Calculation Tool software for exporting data necessary to generate billing documentation to be performed by a third party. The system requirements of the PC are as follows:

Item	Requirements
CPU	1 GHz or better (at least 2 GHz recommended)
Memory	2GB or more
Screen Resolution	1024 x 768 or better
OS	Windows 7, Windows 8.1 (32bit/64bit)
System requirements	The system should meet the minimum requirement for Windows 7 or Windows 8.1 • Net Framework 4.5 or later
Internal LAN port or LAN card	100 BASE-TX or better
Porting device	Mouse, etc.

5.07 CMCN: REMOTE CONTROLLERS

TT. Simple MA Remote Controller (PAC-YT53CRAU):

1. The Backlit Simple MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group).

2. The Backlit Simple MA Remote Controller shall only be used in same group with Wireless MA Remote Controllers (PAR-FL32MA-E / PAR-FA32MA-E) or with other Backlit Simple MA Remote Controllers (PAC-YT53CRAU), with up to two remote controllers per group.

Simple MA Remote Controller			
Item	Description	Operation	Display
ON/OFF	Run and stop operation for a single group	Each Group	Each Group
Operation Mode	Switches between Cool/Drying/Auto/Fan/Heat/Setback. Operation modes vary depending on the air conditioner unit. Auto and Setback mode are available for the R2/WR2-Series only.	Each Group	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit. Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Display Backlight	Pressing the button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.)	N/A	Each Unit
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit
Test Run	Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display "test run").	Each Group	Each Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group

5.08 CENTRALIZED CONTROLLER (WEB-ENABLED)

UU. AE-200 Centralized Controller:

1. The AE-200A Centralized Controller shall be capable of controlling a maximum of two hundred (200) indoor units across multiple CITY MULTI outdoor units with the use of three (3) AE-50A expansion controllers. The AE-200A Centralized Controller shall be approximately 11-5/32" x 7-55/64" x 2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply. The AE-200A Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the AE-200A Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the AE-200 Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, fan speed setting, and airflow direction setting. Since the AE-200A provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the AE-200A Centralized Controller shall allow the user to define both daily and weekly schedules (up to 24 scheduled events per day) with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

AE-200 (Centralized Controller)			
Item	Description	Operation	Display
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat. (Group of Lossnay unit: automatic ventilation/vent-heat/interchange/normal ventilation) Operation modes vary depending on the air conditioner unit. Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 57°F – 87°F depending on operation mode and indoor unit.	Each Block, Group or Collective	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *1. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Night Setback Setting	The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *3. Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group
Room Temp	Displays the room temperature of the group. Space temperature displayed on the indoor unit icon on the touch screen interface.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *4. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective
Outdoor Unit Status	Compressor capacity percentage and system pressure (high and low) pressure (excludes S-Series)	Each ODU	Each ODU
Connected Unit Information	MNET addresses of all connected systems	Each IDU, ODU and BC	Each IDU, ODU and BC
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between "Hi", "Low" and "Stop". When setting a group of only free plan LOSSNAY units, you can switch between "Normal ventilation", "Interchange ventilation" and "Automatic ventilation".	Each Group	Each Group
Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese are available.	N/A	Collective
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: "Batch start/stop", "Batch emergency stop" By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" *5. Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective

2. All AE-200A Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to up to three AE-50A expansion controllers for display of up to two hundred (200) indoor units on the main AE-200A interface.

3. The AE-200A Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.

4. Standard software functions shall be available so that the building manager can securely log into each AE-200A via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Additional optional software functions of personal browser for PCs and MACs and Energy shall be available but are not included. The Energy Apportionment function shall require TG-2000 Integrated System software in conjunction with the Centralized Controllers.

VV. AE-50A Expansion Controller:

5. The AE-50A Expansion Controller shall serve as a standalone centralized controller or as an expansion module to the AE-200A Centralized Controller for the purpose of adding up to 50 indoor units to either the main touch screen interface of the AE-200A. Up to three (3) AE-50A expansion controllers can be connected to the AE-200A via a local IP network (and their IP addresses assigned on the AE-200A) to the AE-200A to allow for up to two hundred (200) indoor units to be monitored and controlled from the AE-200A interface.

6. The AE-50A expansion controllers have all of the same capabilities to monitor and control their associated indoor units as the features specified above. Even when connected to the AE-200A and configured to display their units on the main controller, the individual indoor units connected to the AE-50A can still be monitored and controlled from the interface of the AE-50. The last command entered will take precedence, whether at the wall controller, the AE-50A or the AE-200A Centralized Controller.

WW. EW-50GU Centralized Controller:

7. The EW-50 Centralized Controller shall be capable of controlling a maximum of 50 indoor units across multiple CITY MULTI outdoor units. The EW-50 Centralized Controller shall be approximately 8-1/2"x10" in size and shall be powered from the external power supply (PAC-SC51KUA). The EW-50 Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, free contact interlock configuration and malfunction monitoring. The EW-50 Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the EW-50 Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, temperature setting, fan speed setting, and airflow direction setting. Since the EW-50 provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the EW-50 Centralized Controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

EW-50 (Centralized Controller)			
Item	Description	Operation	Display
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Indoor unit modes: COOL/DRY/FAN/AUTO/HEAT. Lossnay unit modes: HEAT RECOVERY/BYPASS/AUTO Air to water (PWFY) modes: HEATING/HEATING ECO/HOT WATER/ANTI-FREEZE/COOLING *Operation modes vary depending on the unit model connected. ** Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit model. Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.	Each Block, Group or Collective	Each Group
Set Temperature Range Limit	The range of room temperature setting can be limited by the initial setting depending on the indoor unit connected.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depend on indoor unit model.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	*Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *2. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Hold	Disables scheduled functions for indoor unit groups and their associated remote controller timers. *not available for general equipment	Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Fan Speed, Air Direction and Reset filter). *3. Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group
Room Temp	Displays the room temperature of the group.	N/A	Each Group
Room Humidity	Displays the percent relative humidity in the space as sensed by the Smart ME Remote Controller	N/A	Each Group
Occupancy Sensor	Displays the occupancy icon on the group icon in the condition list page when the room is occupied (blue) or vacant (gray). *The Smart ME Remote Controller Occupancy sensor is required.	N/A	Each Group
Brightness Sensor	Displays the brightness icon on the group icon in the condition list when the space is determined to be bright (yellow) or dark (gray). *The Smart ME Remote Controller Brightness sensor is required.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *4. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between "Hi", "Low" and "Stop". When setting a group of only free plan LOSSNAY units, you can switch between "Normal ventilation", "Interchange ventilation" and "Automatic ventilation".	Each Group	Each Group

Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, German, Italian, Russian, Chinese, and Portuguese are available.	N/A	N/A
External Input / Output	By using accessory cables you can set and monitor the following. Input: By level: "Batch start/stop", "Batch emergency stop"; By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" *5. Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective
M-Net	The "M-NET" LED lights, when AC power supply is turned ON. The LED blinks while M-NET is communicating.	N/A	Each Group (LED)
Collective ON/OFF	All the units can be operated / stopped with a DIP switch.	Collective	N/A
Measurement	Displays the Temperature and Humidity inputs of the AI Board. Supports graph display and data export.	N/A	Each Unit
AHC Status	Displays the status of the of the inputs and outputs of each Advanced HVAC Controller (DC-A2IO)	N/A	Each Unit
Free Contact Status	Displays the input/output status of the Free Contacts on the indoor units	N/A	Each Unit
Free Contact Interlock Control	Operation of indoor groups, general equipment or free contact outputs based on group(s) conditions or free contact(s) input states.	Each Group, Output or Collective	N/A
Data Back-up (PC)	Initial setting data can be exported to a PC.	Collective	N/A

8. All EW-50 Centralized Controllers shall be equipped with two RJ-45 Ethernet port to support interconnection with a network PC and BACnet/IP communication via a closed/direct Local Area Network (LAN). The EW-50 Centralized Controller shall be capable of performing initial settings online via a PC using the EW-50 Centralized Controller's initial setting browser or online/offline with the Initial Setting Tool.

9. Standard software functions shall be available so that the building manager can securely log into each EW-50 via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Standard software functions shall not expire. Additional optional software functions of personal browser for PCs and MACs and Energy Allocation shall be available. The Energy Allocation function shall require AE-200 Energy Allocation Integrated System in conjunction with EW-50 Centralized Controllers.

5.09 CMCN REMOTE CONTROLLERS: SYSTEM INTEGRATION

1. The CMCN shall be capable of supporting integration with Building Management Systems (BMS).

XX. BAC-HD150: BACnet® Interface:

2. The Mitsubishi Electric Cooling & Heating BACnet® interface, BAC-HD150, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support BACnet Broadcast Management (BBMD). The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.

3. Licenses:

- SW-BACnet Master: Master Controller license for AE-200A and EW-50A
- SW-BACnet Expansion: Expansion Controller license for AE-50A and EW-50A

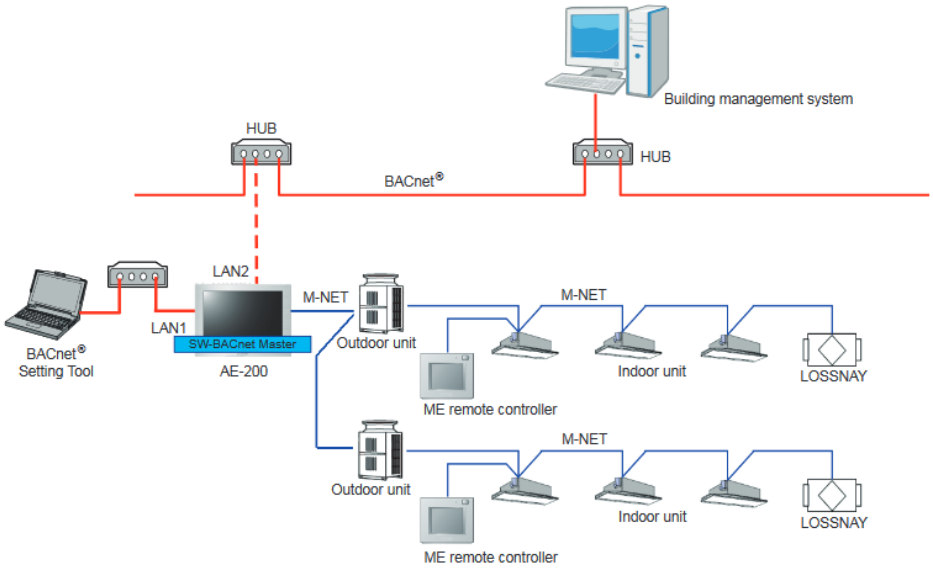
4. SW-BACnet Specifications:

- Control up to 50 groups
- 1 to 16 indoor units can be collectively controlled in a group
- Supports dual set point functionality (connected model dependant)
- BTL Compliant
- BACnet communication specifications are based on ANSI/ASHRAE Standards 135-2010

5. PC Requirements:

- CPU: 1GHz or higher
- Memory: 1GB or more
- HDD Space: 100 MB or more
- Screen Resolution: 1024 x 768 or higher
- OS: Microsoft Windows 7 32-bit/64-bit, Microsoft 8.1 32-bit/64-bit. Not compatible with Windows Vista
- Execution Environment: Microsoft .NET Framework 4.5 or later
- Others: Pointing device such as a mouse, internet connection (required when installing a .NET Framework)

6. SW-BACnet – System Example



7. AE-200/AE-50/EW-50 BACnet Point List

Object List
On Off Setup
On Off State, Number of ON/OFF, Cumulative operation time
Alarm Signal (4-digit error code)
Error Code
Operational Mode Setup
Operational Mode State
Fan Speed Setup
Fan Speed State
Room Temp [Water Temp]
Set Temp [Set Water Temp]
Set Temp Cool
Set Temp Heat
Set Temp Auto
Filter Sign [Circulating Water Exchange Sign]
Filter Sign Reset [Circulating Water Exchange Sign Reset]
Prohibition On Off
Prohibition Mode
Prohibition Filter Sign Reset [Prohibition Circulating Water Exchange Sign Reset]
Prohibition Set Temperature
M-NET Communication State
System Forced Off
Air Direction Setup
Air Direction State
Set High Limit Setback Temp
Set Low Limit Setback Temp
Ventilation Mode Setup
Ventilation Mode State
Air To Water Mode Setup
System Alarm Signal (4-digit error code)
PI Controller Alarm Signal (4-digit error code)
Group Apportioned Electric Energy
Interlocked Units Apportioned Electric Energy
PI controller Electric Energy 1–4
Pulse Input Electric Energy 1–4
Group Apportionment Parameter
Interlocked Units Apportionment Parameter
Night Purge State
Thermo On Off State
Trend Log Room Temp
Trend Log Group Apportioned Electric Energy
Trend Log Interlocked Units Apportioned Electric Energy
Trend Log PI controller Electric Energy 1–4
Trend Log Pulse Input Electric Energy 1–4
Trend Log Group Apportionment Parameter
Trend Log Interlocked Units Apportionment Parameter

YY. LMAP04U: LonWorks® Interface:

8. The Mitsubishi Electric Cooling & Heating LonWorks® interface, LMAP04U, shall support up to fifty indoor units with a variety of network variables on a per indoor unit basis. Input variables include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, and filter sign reset. Output variables include, but are not limited to, model size, alarm state, error code, and error address.

Part 6 - Ventilation Options

6.01 DOAS HEATING/COOLING (HEAT PUMP) WITH REHEAT, AIR-COOLED OUTDOOR UNITS

ZZ. General:

1. The outdoor unit module shall be air-cooled, direct expansion (DX), unit used specifically with VRF DOAS split system indoor unit described in this section. The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

2. Outdoor unit shall have a sound rating no higher than 62 dB(A) individually or 62 dB(A) twinned. Units shall have a sound rating no higher than 51 dB(A) individually or 54 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

3. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.

4. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.

5. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

6. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.

7. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.

8. The outdoor unit shall be capable of guaranteed operation in heating mode down to -4°F ambient temperatures and cooling mode up to 109°F without additional restrictions on line length & vertical separation beyond those published in respective product catalogs. Models with capacity data for required temperature range published as "for reference only" are not considered capable of guaranteed operation and are not acceptable. If an alternate manufacturer is selected, any additional material, cost, and labor to meet ambient operating range and performance shall be incurred by the contractor.

9. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.

10. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.

AAA. Unit Cabinet:

11. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

BBB. Fan:

12. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG external static pressure, but capable of normal operation with a maximum of 0.24 in. WG external static pressure via dipswitch.

13. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

14. All fan motors shall be mounted for quiet operation.

15. All fans shall be provided with a raised guard to prevent contact with moving parts.

CCC. Refrigerant and Refrigerant Piping

16. R410A refrigerant shall be required for systems.

17. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

18. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.

19. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.

20. Refrigerant line sizing shall be in accordance with manufacturer specifications.

DDD. Coil:

21. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing. The coil fins shall have a factory applied corrosion resistant blue-fin finish. Uncoated aluminum coils/fins are not allowed

22. Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend "no or reduced heating" periods shall not be allowed. The coil shall be protected with an integral metal guard.

EEE. Compressor:

23. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.

24. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting "belly-band" type crankcase heaters are not allowed.

25. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 20%.

26. The compressor shall be equipped with an internal thermal overload.

FFF. Controls:

27. The unit shall be an integral part of the system & control network and react to heating/cooling demand as communicated from indoor unit over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.

28. The outdoor unit shall have the capability of 4 levels of demand control for each refrigerant system based on external input.

GGG. Electrical:

29. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz or 460 volts, 3-phase, 60 hertz per equipment schedule.

30. The outdoor unit shall be controlled by integral microprocessors.

31. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system controls.

6.02 BRANCH CIRCUIT (BC) CONTROLLERS AS REQUIRED FOR SIMULTANEOUS HEAT/COOL SYSTEMS

HHH. General

1. BC (Branch Circuit) Controller (or comparable branch devices) shall allow heating, cooling, or cooling with hot gas reheat at DOAS indoor unit

2. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. This unit shall be mounted indoors, with access and service clearance provided for each controller.

III. BC Unit Cabinet:

3. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.

4. The casing shall be fabricated of galvanized steel.

JJJ. Condensate Management:

5. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components with removable insulation that allows easy access for future service needs. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

KKK. Electrical:

6. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).

7. The BC Controller shall be controlled by integral microprocessors

8. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

6.03 DOAS VRF DUCTED INDOOR UNIT WITH MODULATING HOT GAS REHEAT

LLL. General:

1. The DOAS indoor unit shall be a ducted indoor fan coil that mounts with a fixed rear return and a horizontal discharge supply, primary coil, and three modulating linear expansion devices. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

2. The indoor unit shall be factory assembled, wired and run tested. Indoor units which require field-mounted and/or configured controllers which are not tested as an assembly are not allowed. Contained within the unit shall be all factory wiring, cooling/heating coil, temperature and humidity sensors, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

MMM. Unit Cabinet:

3. The cabinet shall be ducted on both the supply and return

4. The cabinet panel shall have provisions for a field installed filtered outside air intake.

NNN. Fan:

5. The indoor unit fan shall be a statically and dynamically balanced assembly with two Sirocco fan(s) direct driven by a single motor with permanently lubricated bearings.

6. To allow for proper balancing, indoor unit shall include multiple external static pressure settings up to 0.80 in. WG.

OOO. Filter:

7. Outside air shall be filtered by a field-supplied filter. Unit shall have sufficient external static pressure to operate with a MERV-13 filter installed.

PPP. Coil:

8. The indoor coils shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange and all tube joints shall be brazed with phos-copper or silver alloy.

9. The coils shall be pressure tested at the factory.

10. A sloped condensate pan and drain shall be provided under the coil. Units without sloped condensate pan which must be installed cockeyed to ensure proper drainage are not allowed.

11. A condensate lift mechanism shall be factory installed capable of providing up to 21-11/16" of lift.

QQQ. Electrical:

12. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

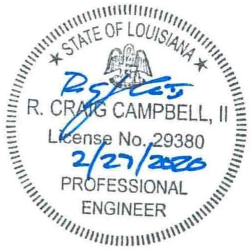
RRR. Controls:

13. The system shall utilize VRF heating/cooling with intake air temperature ranging from -4° F WB up to 95° F WB (109 ° F DB).

- In order to maximize efficiency of VRF (reverse cycle) heating operation, unit shall be capable of intake of unmixed or untreated -4° F WB air directly to the primary coil.
- Leaving air temperature set point range shall be adjustable from 50° F to 83° F in one degree increments. The unit shall be capable of providing active coil operation in cooling mode down to 50° F WB. Unit must not allow for fan mode or thermal off operation when the entering air is more than 2° F off the primary coil cooling mode set point; thermal off range between active cooling and active heating operation shall vary based on LAT set point.
- Dehumidification (cooling) coil shall have adjustable settings to allow for target air temperature of 50, 55, or 60° F DB or converted temperature from the leaving air temperature set point and relative humidity of 45% (45% RH Control)
- Indoor unit shall be shipped with a wall-mountable controller to define set point control. Unit shall also be capable of scheduling and set point control via manufacturer centralized controllers or BACnet interfaces.

END OF SECTION 15710

Archives and Central Distribution Facility
Calcasieu Parish Sheriff's Office
Lake Charles, Louisiana



SECTION 15750 - AIR DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Furnish and install all ducts for Air Conditioning, Heating and Ventilating System as shown on the plans and as may be required to provide complete system. Ductwork shall be complete with grilles, vanes, flashings, hangers, flexible connections at equipment (A.H.U.'s, fans, etc.,), splitters, manual dampers, fresh air inlets, louvers, reinforcing angles, etc. All ductwork shall be concealed and insulated as hereinafter specified.

B. ALL DUCTWORK SIZES INDICATED ON DRAWINGS ARE METAL-TO-METAL OUTSIDE DIMENSIONS.

1.2 DUCT HANGERS AND SUPPORTS

A. All ductwork shall be properly braced to prevent rattling, breathing or other unnecessary noise. No sharp edges or obstructions shall project into the air stream. (1" wide x 16 gauge minimum)

1.3 LOW PRESSURE DUCTWORK

A. All ductwork shall be galvanized steel and shall be of gauges and construction as recommended by ASHRAE Guide and Data Book. Gauges are as follows, with longest side governing. (Duct dimensions on Plans are metal-to-metal dimensions).

Dimensions of longest side	Sheet Metal Gauge
0"-12"	26 Gauge
13"-30"	24 Gauge
31"-54"	22 Gauge
55"-84"	20 Gauge

B. All ductwork shall be sealed at seams and joints with tape and hardcast duct sealant material.

C. Joints and reinforcing shall be as per ASHRAE Guide and Data Book and all slips shall be installed without edge of internal part of slip facing downstream.

D. Construction standards of Article 110 of the National Board of Fire Underwriters, Bulletin 90, latest edition, shall apply throughout.

E. Flashings shall be sheet copper, and shall be furnished and installed around all outside openings used for ducts of fans and wherever required. Roof flashings shall extend at least 8" above roof.

F. All ducts shall be straight and true and installed in a neat and workmanlike manner.

G. All edges shall be straight and true, and all bends shall be made with vaned turns. Where long radius turns cannot be used, the Contractor shall use square turns and use air splitters spaced not more than 3" center to center, and of a length so air will be properly distributed over the ducts.

1.4 ROUND DUCTWORK (CONCEALED ABOVE CEILINGS)

A. Shall be constructed of 26 gauge galvanized sheet metal with screwed and taped joints. At contractor's option , pre-insulated flexible ductwork as manufactured by Thermaflex Model MKE, Omniaire 1200 or equal may be used to connect to ceiling diffusers (maximum 5'-0" length).

1.5 DOUBLE-WALL ROUND DUCTS AND FITTINGS

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

1. Lindab Inc.
2. McGill AirFlow LLC
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Round Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Fabricate round ducts larger than 90 inches (2286 mm in diameter with butt-welded longitudinal seams.

H. Fabricate flat-oval ducts larger than 72 inches (1830 mm in width (major dimension) with butt-welded longitudinal seams.

I. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

J. Inner Duct: Minimum 0.028-inch (0.7-mm perforated galvanized sheet steel having 3/32-inch- (2.4-mm- diameter perforations, with overall open area of 23 percent.

K. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

L. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.

M. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation..

N. Cover insulation with polyester film complying with UL 181, Class 1.

1.6 DUCTWORK SEALANT

A. All ductwork shall be air tight. All seams, both shop made and field installed, and shall be sealed with a mastic system. All transverse joints shall be sealed as well as spin takeoffs and rough duct connections. All duct connections and seams shall be sealed with a UL approved non-flammable mastic system. Strict adherence to manufacturers installation instruction is required. The duct sealant shall be equal to Hardcast, United McGill, or 3M Company Sealing System.

1.7 DUCT ACCESSORIES

A. Dampers of the fusible link operated type shall be provided in all ductwork passing through the floor or firewalls. In all cases, the time rating of damper shall be equal to or greater than the time rating of the wall.

B. Provide quadrant or adjustable splitters and mark shaft to give position of splitter damper in duct.

C. Provide vanes behind every supply grille or diffuser. Splitters shall be provided where shown on Plans and where located in concealed, non-accessible space, provide Young Regulators to operate splitter. Vanes shall be Tuttle and Bailey "Ducturns", Barber Coleman Uniflo or equivalent. Shop fabricated vanes will be acceptable. All dampers shall be constructed of 14 gauge steel.

1.8 SPIN COLLARS

A. All round take-offs to round branch duct shall be made with 26 gauge spin-type collars with 26 gauge balancing dampers. These spin-collars shall be as manufactured by Flexmaster Model FLD, Champagne model SD, or approved equivalent.

B. The mounting groove shall be die-formed to assure constant fit control. Balancing dampers shall be factory-installed with spring loaded, retractable bearings and a positive locking wing-nut for easy adjustment.

1.9 REGISTERS, GRILLES AND DIFFUSERS:

A. Square or rectangular ceiling supply outlets, unless noted otherwise, shall be Anemostat, Price, Titus, Metalaire, or equal, as indicated in schedules. Color shall be white. Grilles shall be of aluminum construction with baked enamel finish. Where noted on plans, grilles with fire dampers in ceiling shall be steel construction with fire rated blanket behind grille as required by grille type scheduled.

B. All wall supply grilles shall be complete with horizontal and vertical adjustable deflectors and opposed blade volume control damper. Grilles shall be manufactured by Titus, Price, Metalaire, Anemostat, or prior approved equivalent.

C. Return air grilles shall be as manufactured by Anemostat, Metalaire, Price, Titus or equivalent, and shall be of the style called for on the Plans. Provide filters in filter back grilles.

D. All supply and return outlets shall be sealed to interior finish with a sponge rubber gasket.

E. All grilles, diffusers and registers shall be of sizes and type as indicated on Plans or scheduled on Drawings.

F. Unless otherwise shown on Drawings, all grilles installed in walls and doors shall be furnished with prime coat finish suitable for painting by painting sub-contractor.

1.10 FIRE DAMPERS

A. Furnish and install, at locations shown on Plans, fire dampers constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have fire protection label in accordance with established UL labeling procedures. Damper manufacturer's literature submitted for approval prior to installation shall include comprehensive performance data developed from testing in accordance with AMCA Standard 500, and shall illustrate pressure drops for all sizes of dampers required at all anticipated air flow rates. Fire dampers shall be equipped for vertical or horizontal installation as required by the location shown.

B. Fire dampers shall be 100% free area and installed in wall openings utilizing steel sleeves, angles or other materials and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers are tested by UL. Installation shall be in accordance with the damper manufacturer's instructions. Fire dampers shall be Ruskin Type DIBD, Style B, Air Balance or approved equivalent.

1.11 DUCT ACCESS PANELS

A. Access panel shall be Flexmaster "Inspector Series" Model SDSM low leakage spin-in access door. Door shall be 1" insulated type and shall be 24 gauge steel with 24 gauge steel frame. A continuous 3/8" wide by 3/16" thick open cell adhesive neoprene gasket shall be installed in the door frame to provide a positive seal upon insertion and locking of door. The door shall be held secure with every spaced cast aluminum cam latches for even pressure against the gasket.

1.12 MOTORIZED DAMPERS

A. Mechanical Contractor shall furnish and install motorized dampers at outdoor intakes as indicated on mechanical and architectural drawings. Damper shall be parallel blade motorized type equivalent to Ruskin CD36/PB, Arrow Series 1770, or equal. Motorized dampers shall be operated by 120/1/60 electric actuator as indicated on plans. Damper shall be complete with outboard support bearing, blade and jamb seals. Dampers shall be low - leakage type. Dampers shall go to closed position when units are off.

1.13 MANUAL DAMPERS

A. Mechanical contractor shall furnish and install manual dampers at outdoor air intakes and in other rectangular ductwork as indicated on plans. Damper shall be complete with outboard support bearing, and manual locking quadrant lever for balancing, blade and jamb seals. Dampers shall be low - leakage type as manufactured by Ruskin Model CD36 or equal.

END OF SECTION 15750

SECTION 15900 – BUILDING AUTOMATION SYSTEM



PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified. This scope is for Calcasieu Parish Sheriff's Office Distribution Facility. The BAS must tie back seamlessly into the existing Siemens Insight "Apogee" workstation located in the correction center.

Provide open communications system. The system shall be an open architecture with the capabilities to support a multi-vendor environment. To accomplish this effectively, system shall be capable of utilizing standard protocols as follows as well as be able to integrate third-party systems via existing vendor protocols. System shall be capable of BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2001. System shall be capable of OPC server communications according to OPC Data Access 2.0 and Alarms and Events 1.0. The system shall not be limited to only use open communication protocols, but also be able to integrate a wide variety of third-party devices and applications via existing vendor protocols and through the latest software standards.

The intent is to either use the Operator Workstation provided under this contract to communicate with control systems provided by other vendors or to allow information about the system provided in this contract to be sent to another workstation. This allows the user to have a single seat from which to perform daily operation. The BAS Contractor shall also provide 9 client licenses in order for other workstations to be able to logon and operate the BAS system.

B. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer. The installing manufacturer shall certify in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer has supervised their installation. In addition, the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.

C. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

D. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes.

1. 2 WORK BY OTHERS

A. the VRF HVAC equipment (Mitsubishi or equal) will be provided with VRF building automation system. The Siemens system shall integrate the VRF system BAS abd provide all graphics to display VRF HVAC syste. Refer to VRF equipment point list at the end of this specification section.

B. Products integrated to but not furnished or installed under this section

1. Any equipment required by the equipment manufacturer to provide the BAS contractor with a BACnet interface point.

1.3 RELATED WORK

A. Division 01000 General and Special Conditions

B. Division 15000 Mechanical

1.4 QUALITY ASSURANCE

A. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Distributors or licensed installing contractors are not acceptable.

The manufacturer shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the B.M.S.

The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of BMS systems and shall have a minimum of five (5) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of B.M.S. systems similar in size and complexity to this project. A maintained service organization consisting of at least ten (10) competent servicemen for a period of not less than ten years and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX. and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 91 6category PAZX; Standard UL 864, categories UDTZ, and QVAX. and be so listed at the time of Bid.

D. The BAS peer-to-peer network controllers and local user display shall also comply with the Australian Electromagnetic Compatibility (EMC) Framework, and bear the C-Tic Mark to show compliance. The purpose of the regulation is to minimize electromagnetic interference between electronic products, which may diminish the performance of electrical products or disrupt essential communications.

E. DDC peer-to-peer controllers shall be compliant with the European EMC Directive, Standards EN 50081-2 and EN 50082-2, at the Industrial Levels. Additionally the equipment shall be compliant with the European LVD Directive and bear the CE mark in order to show compliance to both Directives."

F. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

G. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

H. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.

Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1. 5 SUBMITTALS

A. Submit 4 complete sets of documentation in the following phased delivery schedule:

1. Valve and damper schedules
2. Equipment data cut sheets
3. System schematics, including:
    - sequence of operations
    - point names
    - point addresses
    - interface wiring diagrams
    - panel layouts
    - system riser diagrams
4. Auto-CAD compatible as-built drawings

B. Upon project completion, submit operation and maintenance manuals, consisting of the following:

- Index sheet, listing contents in alphabetical order
- Manufacturer's equipment parts list of all functional components of the system
- Auto-CAD disk of system schematics, including wiring diagrams
- Description of sequence of operations
- As-Built interconnection wiring diagrams
- Operator's Manual

- Trunk cable schematic showing remote electronic panel locations and all trunk data
- List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
- Conduit routing diagrams

1.6 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after beneficial use.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

C. The on-line support services shall allow the local BAS subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility. If the problem cannot be resolved with on-line support services, the BAS manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within 3 hours of the time that the problem is reported.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Siemens Industry, Inc.

B. Approved equal.

2.2 NETWORKING COMMUNICATIONS

A. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of multiple levels for communication efficiency, a campus-wide (Management Level Network) Ethernet network based on TCP/IP protocol, high performance peer-to-peer building level network(s) and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.

B. The design of BAS shall allow the co-existence of new DDC Controllers with existing DDC Controllers in the same network without the use of gateways or protocol converters.

1. System shall have the capability to communicate with a BACnet network over Ethernet backbone (network switch and static IP addresses provided by owner) or BACnet/IP (according to Annex J). The intent is to use the system provided under this contract to communicate with control systems provided by other vendors. A PICS must be provided describing the BACnet, ANSI/ASHRAE 135-2001 implementation. Minimum system functionality

must include monitoring, commanding, and alarming for daily operator functions from a common workstation.

2. System shall have the capability to be an OPC Client and Server for dynamic communication with OPC Clients or Servers over an Ethernet network. At a minimum, the following must be supported:
3. The system must be of the Native BACNet open protocol. It must tie seamlessly into the existing Siemens DESIGO CC workstation in place. The system must be able to process reports with the existing system with no third party integration.
    a. Data Access 1.0 (96), 1.0A (97) and 2.0 (11/98)
    b. Alarms & Events 1.0 (1/99)

C. Peer-to-Peer Building Level Network:

1. All operator devices either network resident or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
2. The peer-to-peer network shall support a minimum of 100 DDC controllers and PC workstations
3. Each PC workstation shall support a minimum of 4 peer to peer networks hardwired or dial up.
4. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for interprocess control. All exchange points shall have full system functionality as specified herein for hardwired points.
5. Field panels must be capable of integration with open standards including Modbus, BACnet, and Lonworks as well as with third party devices via existing vendor protocols.
6. The peer-to-peer Building Level Network shall use the TCP/IP over Ethernet. All devices must:

    a. Auto-sense 10/100 Mbps networks.

    b. Receive an IP Address from a Dynamic Host Configuration Protocol (DHCP) Server or be configured with a Fixed IP Address.

    c. Resolve Name to IP Addresses for devices using a Domain Name Service (DNS) Server on the Ethernet network.

    d. Allow access using Telnet.

2.3 DDC CONTROLLER FLOOR LEVEL NETWORK:

A. This level communication shall support a family of application specific controllers and shall communicate with the peer-to-peer network through DDC Controllers for transmission of global data.

2.4 DDC & HVAC MECHANICAL EQUIPMENT CONTROLLERS

A. The DDC & HVAC Mechanical Equipment Controllers shall reside on the Building Level Network.

B. DDC & HVAC Mechanical Equipment Controllers shall use the same programming language and tools. DDC & HVAC Mechanical Equipment

Controllers which require different programming language or tools on a network are not acceptable.

C. DDC & HVAC Mechanical Equipment Controllers which do not meet the functions specified in Section 2.4.1 and Section 2.5 for DDC Controllers or Section 2.4.2 and Section 2.5 for HVAC Mechanical Equipment Controllers are not acceptable.

2.4.1 DDC CONTROLLER

A. DDC Controllers shall be a 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three (3) Floor Level Application Specific Controller Device Networks.

B. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Password-protected Operator I/O
8. Dial-up communications
9. Manual override monitoring

C. Each DDC Controller shall support firmware upgrades without the need to replace hardware.

D. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

E. DDC Controllers shall provide a RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

F. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

G. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

H. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

I. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:

1. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V

2. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact

3. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power

4. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)

5. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:

a. IEEE Standard 587-1980

b. UL 864 Supply Line Transients

c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

J. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

K. Provide a separate DDC Controller for each AHU or other HVAC system as indicated in Section 3.02. It is intended that each unique system be provided with its own point resident DDC Controller.

2.4.2 HVAC MECHANICAL EQUIPMENT CONTROLLERS

A. HVAC Mechanical Equipment Controllers shall be a 12-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors.

B. Each HVAC Mechanical Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Remote communications

C. HVAC Mechanical Equipment Controllers shall provide a RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.

D. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

E. Each HVAC Mechanical Equipment Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

F. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:

- RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V
- Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
- Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
- Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)

Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:

- IEEE Standard 587-1980
- UL 864 Supply Line Transients
- Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

G. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the HVAC Mechanical Equipment Controller shall automatically resume full operation without manual intervention.

2. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

2.5 DDC & HVAC MECHANICAL EQUIPMENT CONTROLLER RESIDENT SOFTWARE FEATURES

A. General:

1. The software programs specified in this Section shall be provided as an integral part of DDC and HVAC Mechanical Equipment Controllers and shall not be dependent upon any higher level computer for execution.

2. All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.

3. All digital points shall have user defined two-state status indication (descriptors with minimum of 8 characters allowed per state (i.e. summer/winter)).

B. Control Software Description:

1. The DDC and HVAC Mechanical Equipment Controllers shall have the ability to perform the following pre-tested control algorithms:

a. Two-position control

b. Proportional control

c. Proportional plus integral control

d. Proportional, integral, plus derivative control

e. Automatic tuning of control loops

C. DDC and HVAC Mechanical Equipment Controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.

1. Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period, and still maintain desired comfort conditions.

a) The SSTO program shall operate in both the heating and cooling seasons.

1) It shall be possible to apply the SSTO program to individual fan systems.
2) The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.

b) The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.

2. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.

a) It shall be possible to individually command a point or group of points.

b) For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start or stop within that group.

c) The operator shall be able to define the following information:

1. Time, day
2. Commands such as on, off, auto, and so forth.
3. Time delays between successive commands.
4. There shall be provisions for manual overriding of each schedule by an appropriate operator.

d) It shall be possible to schedule events up to one year in advance.

1. Scheduling shall be calendar based.
2. Holidays shall allow for different schedules.

4. Temperature-compensated duty cycling.

a) The DCCP (Duty Cycle Control Program) shall periodically stop and start loads according to various patterns.

b) The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.

5. Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.

6. Night setback control: The system shall provide the ability to automatically adjust setpoints for night control.

7. The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.

a) PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.

b) PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.

c) If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.

d) Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.

D. DDC and HVAC Mechanical Equipment Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.

2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.

3. DDC and HVAC Mechanical Equipment Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task orientated information from the user manual.

4. DDC and HVAC Mechanical Equipment Controller shall be capable of comment lines for sequence of operation explanation.

E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC Mechanical Equipment Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC and HVAC Mechanical Equipment Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC and HVAC Mechanical Equipment Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hours destinations) or based on priority.

4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.

5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary. The entire collection process shall be automated so that the data collection definition, amount of data to be collected, collection report and scheduling take the form a wizard, or online assist utility, in order to complete this process within a short amount of time for a large group of points. Ability to produce a summary of changes in a log file.

1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC and HVAC Mechanical Equipment Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC and HVAC Mechanical Equipment Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing data samples. All trend data shall be available for transfer to a Workstation without manual intervention.

   a. Time-interval based trending shall have the capability of synchronizing the trend sampling of discrete points. This allows for the comparison of values of several different points at the same moment in time.
   b. Trended points shall have the option of sampling data values based on the condition of a “trigger” point. (i.e., conditional trending). Options for sampling shall include: always sampling as defined, only sampling when the trended point is in the alarm condition, or not sampling.

2. DDC and HVAC Mechanical Equipment Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.

   a. Loop tuning shall be capable of being initiated either locally at the DDC and HVAC Mechanical Equipment Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

G. DDC and HVAC Mechanical Equipment Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output

points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.

H. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC Mechanical Equipment Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC and HVAC Mechanical Equipment Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer to peer network shall also allow any DDC and HVAC Mechanical Equipment Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

I. The peer-to-peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to assign a minimum of 50 passwords access and control priorities to each operator individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.

1. Passwords shall have the option to be configured to expire within a selected timeframe (1-365 days).
   a. Configuring the password expiration shall also enable the functionality to lock-out a user account after three failed log-on attempts.

2.6 FLOOR LEVEL NETWORK APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through Floor Level LAN Device Networks.

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

C. Terminal Equipment Controllers:

1. Provide for control of each piece of equipment, including, but not limited to, the following:

   a. DX AHUs

   b. Exhaust Fans

2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 psi pneumatic, 0-10v, allowing for interface to a variety of modulating actuators.

3. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the FLN, BLN or MLN is not acceptable.

2.9 PERSONAL COMPUTER OPERATOR WORKSTATION HARDWARE

A. Personal computer operator workstation is in place at site. No workstation is to be furnished in this project.

2.10 WORKSTATION OPERATOR INTERFACE

A. Basic Interface Description

1. Operator workstation interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 30-character English language point identification, on-line help, and industry standard Windows application software. Interface software shall simultaneously communicate with and share data between any combination of dedicated, modem autodial, and Ethernet-connected building level networks. The software shall provide, as a minimum, the following functionality:

a. Real-time graphical viewing and control of the BAS environment
b. Reporting
c. Scheduling and override of building operations
d. Collection and analysis of historical data
e. Point database editing, storage and downloading of controller databases.
f. Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system
g. .Alarm reporting, routing, messaging, and acknowledgment
h. “Collapsible tree,” dynamic system architecture diagram application:
    1. Showing the real-time status and definition details of all workstations and devices on a management level network
    2. Showing the real-time status and definition details of all DDC and HVAC Mechanical Controllers at the building level
    3. Showing the status and definition details of all field-level application controllers
i. Definition and construction of dynamic color graphic displays.
j. Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
k. On-screen access to User Documentation, via online help or PDF-format electronic file.
l. Automatic database backup at the workstation for database changes initiated at DDC Controller operator interface terminals
    1. Backups shall produce a configuration file that contains pertinent details regarding the specific backup. This log file shall be created each time a backup is run and be stored in the backup directory.
    2. Restore dialog box shall list detailed information to facilitate the restore of the correct database.
    3. Ability to restore selected components of a backup.
    4. Delete old backup directories automatically or individually from a detailed list.

m. Display dynamic trend data graphical plot. Must be able to run multiple plots simultaneously
    a. Each plot must be capable of supporting 10 pts/plot minimum
    b. Must be able to command points directly off dynamic trend plot application.
    c. Must be able to plot both real-time and historical trend data
n. Program editing
o. Transfer trend data to 3rd party spreadsheet software
p. Scheduling reports Operator Activity Log Open communications via OPC Server
q. Open communications via BACnet Client & Server

1. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a “drag and drop” approach to inter-application navigation. Selection of applications within the workstation software shall be via a graphical toolbar menu – the application toolbar menu shall have the option to be located in a docked position on any of the four sides of the visible desktop space on the workstation display monitor, and the option to automatically hide itself from the visible monitor workspace when not being actively manipulated by the user.

2. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run on a Windows XP, 2000 or Server 2003 operating system. System database parameters shall be stored within an object-oriented database, which is compliant with the Open Database Connectivity (ODBC) or Structured Query Language (SQL) standards. Standard Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information

a. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):

    1. Dynamic color graphics application
    2. Alarm management application
    3. Scheduling application
    4. Dynamic trend graph data plotter application
    5. Dynamic system architecture diagram application
    6. Control Program and Point database editing applications
    7. Reporting applications

b. Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.

4. Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator/manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BAS workstation application. And each BAS workstation user account shall use a Windows user account as a foundation.

    a. The workstation software shall also include an application to track the actions of each individual operator, such as alarm acknowledgement, point commanding, schedule overriding, database editing, and logon/logoff. The application shall list each of the actions in a tabular format, and shall have sorting capabilities based on parameters such as ascending or descending time of the action, or name of the object on which the action was performed. The application shall also allow querying based on object name, operator, action, or time range.

5. Dynamic Color Graphics application shall include the following:

    a. Must include graphic editing and modifying capabilities
    b. A library of standard control application graphics and symbols must be included
    c. Must be able to command points directly off graphics application
    d. Graphic display shall include the ability to depict real-time point values dynamically with animation, picture/frame control, symbol association, or dynamic informational text-blocks
    e. Animation status indicators shall give you a quick visual indication of a point's value, priority or status in the form of an icon.
    f. Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure or view recently opened graphics through a backward and forward paging.
    g. Graphics viewing shall include zoom capabilities
    h. Graphics shall automatically display the HAND status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.
    i. Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls, etc.), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.

6. Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:

    a. A general listing of all or selected points in the network
    b. List of all points currently in alarm
    c. List of all points currently in override status
    d. List of all disabled points
    e. List of all points currently locked out
    f. List of user accounts and access levels
    g. List all weekly schedules and events

h. List of holiday programming
i. List of control limits and deadbands
j. Custom reports from 3rd party software
k. System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points
l. List of programs
m. List of point definitions
n. List of logical point groups
o. List of alarm strategy definitions
p. List of DDC Control panels
q. Point totalization report
r. Point Trend data listings
s. Initial Values report
t. User activity report

7. Scheduling and override

Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation, DDC Controller, and HVAC Mechanical Equipment Controller to ensure time equipment scheduling when PC is off-line -- PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:

a. Weekly schedules
b. Zone schedules
c. Event schedules – an event consists of logical combinations of equipment and/or zones
d. Report schedules
e. Ability to schedule for a minimum of up to 365 days in advance

Additionally, the scheduling application shall:

f. Provide filtering capabilities of schedules, based on name, time, frequency, and schedule type (event, zone, report)
g. Provide sorting capabilities of schedules, based on name, time and type of schedule (zone, event, report)
h. Provide searching capabilities of schedules based on name – with wildcarding options

8. Collection and Analysis of Historical Data

a. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

b. The entire collection process shall be automated so that the data collection definition, amount of data to be collected, collection report and

scheduling take the form a wizard, or online assist utility, in order to complete this process within a small amount of time for a large group of points. Ability to produce a summary of changes in a log file.

c. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.

d. Provide additional functionality that allows the user to view real-time trend data on trend graphical plot displays. A minimum of fifteen points may be plotted, of either real-time or historical data. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of plot screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed. A minimum of 8 true graphs shall run simultaneously. Operator shall be able to command points directly on the trend plot by double clicking on the point. Operator shall be able to zoom in on a specific time range within a plot. The dynamic trend plotting application shall support the following types of graphs, with option to graph in 3D: line graph, area graph, curve graph, area-curve graph, step graph, and scatter graph. Each graph may be customized by the user, for graph type, graph text, titles, line styles and weight, colors, and configurable x- and y-axes.

B. Dynamic Color Graphic Displays

1. Create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems and hot water boiler systems, and room level terminal units, shall be provided by the BAS contractor as indicated in the point I/O schedule of this specification to optimize system performance, analysis and speed alarm recognition.

2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of Autocad or scanned pictures for use in the system.

3. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.

a. Provide the user the ability to display real-time point values by animated motion or custom picture control visual representation. Animation shall depict movement of mechanical equipment, or air or fluid flow. Picture Control shall depict various positions in relation to assigned point values or ranges. A library (set) of animation and picture control symbols shall be included within the workstation software's graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed. Animation shall also indicate the priority and alarm status of the point.

b. Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.

c. Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.

d. Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or setpoint.

e. State text for digital points can be user-defined up to eight characters.

4. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.

5. Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls, etc.), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.

6. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

7. Off the shelf graphic software, Microgafx Designer or Corel Draw software shall be provided to allow the user to add, modify or delete system graphic background displays.

4. A clipart library of HVAC application and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams and laboratory symbols. The user shall have the ability to add custom symbols to the clipart library. The clipart library shall include a minimum of 400 application symbols. In addition, a library consisting of a minimum of 700 graphic background templates shall be provided.

5. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal

Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.

6. A hierarchy of graphics that allow an operator viewing a site map to see the general location of alarm activity on the system shall be created. By selecting the highlighted area, an operator shall be able to "drill-down" repeatedly to the next most specific graphic, until the exact area of incident is displayed.

7. When adding a new point to a graphic all higher level graphics on the hierarchy, the location of the new point shall be automatically associated with the location of the new point, such that graphics higher up the hierarchy do not have to be modified or resaved in order to associate them with the new point.

C. System Configuration & Definition

1. A "Collapsible tree" dynamic system architecture diagram/display application of the site-specific BAS architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, DDC Controllers or HVAC Mechanical Equipment controllers, as well as 3rd-party integrated components. Symbols/Icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons representing 3rd-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration and diagnostics of dial-up modems to DDC Controllers.

2. Network wide control strategies shall not be restricted to a single DDC Controller or HVAC Mechanical Equipment controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.

3. Provide automatic backup and restore of all DDC controller and HVAC Mechanical Equipment controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller or HVAC Mechanical Equipment Controller. Changes made at the user-interface of DDC Controllers or HVAC Mechanical Equipment Controllers shall be automatically uploaded to the workstation, ensuring system continuity.

4. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back-up must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.

5. Point database configuration shall be available to the user within a dedicated point database editor application included in the workstation software. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database. The point editor shall also allow the user to configure the alarm management strategy for each

point. The editor shall provide the option for editing the point database in an online or offline mode with the DDC Controllers.

a. The workstation software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points. This function shall allow the user to choose the properties to copy from a selected point to another point or set of points. The selectable attributes shall include, but are not limited to, Alarm management definitions and Trend definitions.

6. Control program configuration shall be available to the user within a dedicated control program editor application included in the workstation software. The editor shall allow for creation, modification and deletion of control programs. The editor shall include a programming assistance feature that interactively guides the user through parameters required to generate a control program. The editor shall also include the ability to automatically compile the program to ensure its compatibility with the DDC Controllers. The editor shall provide the option for editing the control programs in an online or offline mode, and also the ability to selectively enable or disable the live program execution within the DDC Controllers.

D. Alarm Management

1. Alarm Routing shall allow the user to send alarm notification to selected printers or workstation location(s) based on time of day, alarm severity, or point type.

2. Alarm Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each alarm point: name, value, alarm time & date, alarm status, priority, acknowledgement information, and alarm count. Each alarm point or priority shall have the ability to sound a discrete audible notification.

3. Alarm Display shall have the ability to list & sort the alarms based on alarm status, point name, ascending or descending alarm time.

4. Directly from the Alarm Display, the user shall have the ability to acknowledge, silence the alarm sound, print, or erase each alarm. The interface shall also have the option to inhibit the erasing of active acknowledged alarms, until they have returned to normal status. The user shall also have the ability to command, launch an associated graphic or trended graphical plot, or run a report on a selected alarm point directly on the Alarm Display.

5. Each alarm point shall have a direct link from the Alarm Display to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each alarm which can be viewed from the alarm display screen, graphic display screen, and anytime the point is being commanded to a new value or state.

6. Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm. Alarm messages shall also have the optional ability to

individually enunciate on the workstation display via a separate pop-up window, automatically being generated as the associated alarm condition occurs.

7. Alarm Display application shall allow workstation operators to send and receive real-time messages to each other, for purposes of coordinating Alarm and BAS system management.

E. Audit Trail of User Actions

1. To protect against inadvertent changes damaging critical system functions, and to enable audit-trail tracking on selected database objects, optional functionality shall be provided to configure selected objects for increased supervision. The additional supervision functionality shall allow for designation of points, control programs, trend collection reports, panels on a building level network and user account objects for detailed tracking of user modifications and deletions. Display an icon which indicates the level of supervision for an object within specified applications.

    a. The minimal setting for additional supervision shall warn the user that he is attempting to modify or delete a supervised object, and will require the user to input a reason-for-change in order to proceed. The warning shall be customizable for each object.
    b. Additional supervision levels shall be optional to require the user to re-enter his user password, and/or require that a “supervisor” enter his user password, in order to proceed with the modification or deletion of the supervised object.
    c. Supervised objects shall be assigned a dedicated “revision number,” and the revision number shall be incremented automatically by the system upon each user modification. This revision number may serve as a method for tracking changes to objects.
    d. Point in an alarm state can have annotations added which can be viewed from the alarm display screen, graphic display screen, and anytime the point is being commanded to a new value or state. For supervised objects, the point annotation will automatically populate the reason for change field.

2. Audit Trail tracking of supervised objects shall record the following:
    a. The property of the object that was changed
    b. The value of the property before the change
    c. The value of the property after the change
    d. Who made the change
    e. The reason for change (entered by the operator)
    f. Who the change was authorized by (if configured for this level of supervision)

2.11 FIELD DEVICES

A. Provide instrumentation as required for monitoring, control or optimization functions.

B. Room Temperature Sensors
Digital room sensors shall have LCD display, day / night override button, and setpoint slide adjustment override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment.

1) Temperature monitoring range +20/120°F -13° to 49°C)
Output signal Changing resistance
Accuracy at Calibration point ±0.5°F (+/- 0.3°C)
Set Point and Display Range 55° to 95° F (13° to 35°C)

2) Liquid immersion temperature:
Temperature monitoring range +30/250°F (-1°/121°C)
Output signal Changing resistance
Accuracy at Calibration point ±0.5°F (+/-0.3°C)

3) Duct (single point) temperature:
Temperature monitoring range +20/120°F (-7°/49°C)
Output signal Changing resistance
Accuracy at Calibration point ±0.5°F (+/-0.3°C)

4) Duct Average temperature:
Temperature monitoring range +20° ±120°F(-7°/+49°C)
Output signal 4 – 20 mA DC
Accuracy at Calibration point ±0.5°F (±03°C)
Sensor Probe Length 25' L (7.3m)

5) Outside air temperature:
Temperature monitoring range -58°±122° F(-50ºC to +50ºC)
Output signal 4 – 20 mA DC
Accuracy at Calibration point ±0.5°F (+/-0.3°C)

C. Liquid Differential Pressure Transmitter

Ranges 0-5/30 inches H20
0-25/150 inches H20
0-125/750 inches H20

Output 4 – 20 mA DC
Calibration Adjustments Zero and span
Accuracy ±-0.2% of span
Linearity ±-0.1% of span
Hysteresis ±-0.05% of span

D. Differential pressure:

1. Unit for fluid flow proof shall be Penn P74.
Range 8 to 70 psi
Differential 3 psi
Maximum differential pressure 200 psi
Maximum pressure 325 psi

2. Unit for air flow shall be Siemens Building Technologies SW141.
Set point ranges: 0.5" WG to 1.0" WG (124.4 to 248.8 Pa)
1.0" WG to 12.0" WG (248.8 to 497.6 Pa)

E. Static pressure sensor:

Range	0 to .5” WG (0 to 124.4 Pa) 0 to 1” WG (0 to 248.8 Pa) 0 to 2” WG (0 to 497.7 Pa) 0 to 5” WG (0 to 1.2 kPa 0 to 10” WG (0 to 2.5 kPa)
Output Signal	4 – 20 mA VDC
Combined static error	0.5% full range
Operating Temperature	-40º to 175º F (-40C to 79.5ºC)

F. Air Pressure Sensor:

Range:	0 to 0.1 in. water (0 to 24.9 Pa) 0 to 0.25 in. water (0 to 63.2 Pa) 0 to 0.5 in. water (0 to 124.5 Pa) 0 to 1.0 in. water (o to 249 Pa) 0 to 2.0 in water 90 to 498 Pa) 0 to 5.0 in. water (0 to 1.25 kPa) 0 to 10.0 in.water (0 to 2.49 kPa)
Output signal	4 to 20 mA
Accuracy	±1.0% of full scale

G. Humidity Sensors:

Range	0 to 100% RH
Sensing Element	Bulk Polymer
Output Signal	4 – 20 mA DC
Accuracy	At 77°F(25ºC) ± 2% RH

H. Insertion Flow Meters (Equal to Onicon Series F-1200)

Sensing Method	Impedance Sensing
Accuracy	± 2% of Actual Reading
Maximum Operating Pressure	400 PSI
Output Signal	4 – 20 mA

Bi-directional where required.

I. Pressure to Current Transducer

Range	3 to 15 psig (21 to 103 kPa) or 3 to 30 psig (21 to 207 kPa)
Output signal	4 – 20 mA
Accuracy	± 1% of full scale (± 0.3 psig)

K . Damper Actuators

1. Electric control shall be direct coupled actuators.

2. Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.

   a) The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½” diameter shaft or damper blade.

3. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.

4. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator's output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.

5. All actuators having more than a 100 lb-in torque output shall accept a 1" diameter shaft directly, without the need for auxiliary adapters.

6. All actuators shall be designed and manufactured using ISO900registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 I.

2.12 MISCELLANEOUS DEVICES

A. Thermostats
1. Room thermostats shall be of the gradual acting type with adjustable sensitivity.
2. They shall have a bi-metal sensing element capable of responding to a temperature change of one-tenth of one degree. (Provide all thermostats with limit stops to limit adjustments as required.)
3. Thermostats shall be arranged for either horizontal or vertical mounting.
4. In the vertical position thermostat shall fit on a mullion of movable partitions without overlap.
5. Mount the thermostat covers with tamper-proof socket head screws.

B. Firestats:

1. Provide manual reset, fixed temperature line voltage type with a bi-metal actuated switch.

a) Switch shall have adequate rating for required load.

C. Current Sensing Relay:

1. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
2. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor.
3. Provide for status device for all fans and pumps.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

Provide a designated project manager who will be responsible for the following:

Construct and maintain project schedule
On-site coordination with all applicable trades, subcontractors, and other integration vendors
Authorized to accept and execute orders or instructions from owner/architect
Attend project meetings as necessary to avoid conflicts and delays
Make necessary field decisions relating to this scope of work
Coordination/Single point of contact

3.2 SEQUENCE OF OPERATION

EXHAUST FANS
Provide start/stop/status for each exhaust fan. Exhaust Fans shall operate in occupied/unoccupied mode.

3.3 POINT SCHEDULE MATRIX - I/0 SCHEDULE

POINT NAME	**I/O**	**ALARM**
DX AHUs		
Fans Start/Stop	Binary Output	
Fans Status	Binary Input	
Discharge Air Temperature	Analog Input	
Zone Temperature	Analog Input	
Zone Temperature Set Point	Analog Input	
DX Cooling	Binary Output	
Electric Heat	Binary Output	
Exhaust Fans		
Exhaust Fan Start/Stop	Binary Output	
Exhaust Fan Status	Binary Input	

All alarms shall be programmable via the workstation software and sent to the building's PBX system. The contractor shall collaborate with the owner directly to determine the owner's preference for naming conventions, etc. before entering the data in to the system.

3.4 START-UP AND COMMISSIONING

A. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the manufacturer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

B. Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

C. After manufacturer has completed system start-up and commissioning. Joint commissioning of integrated system segments shall be completed.

3.5 ELECTRICAL WIRING AND MATERIALS

A. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings, and related wiring accessories. All wiring shall be installed in conduit in open ceiling, plenum wire can be used and must be concealed and tie wrapped to be done in workmanship form.

B. Provide wiring between thermostats, aquastats and unit heater motors, all control and alarm wiring for all control and alarm devices for all Sections of Specifications.

C. Reuse existing provided 120 volt, power at existing panels.

D. Provide status function conduit and wiring for equipment covered under this Section.

E. Provide wiring between the B.M.S. panels and the temperature, humidity, or pressure sensing elements, including low voltage control wiring in conduit.

F. Provide control wiring for devices specified in this Section.

I. All wiring to be compliant to local building code and the NEC.

J. Provide electrical wall box and conduit sleeve for all wall mounted devices.

3.7 PERFORMANCE

A. Unless stated otherwise, control temperatures within plus or minus 2°F humidity within plus or minus 3% of the set point and static pressure within 10% of set point.

3.8 COMMISSIONING, TESTING AND ACCEPTANCE

A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the owner and construction manager to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.

1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:

a. Sensor accuracy at 10, 50 and 90% of range.

b. Sensor range.

c. Verify analog limit and binary alarm reporting.

d. Point value reporting.

e. Binary alarm and switch settings.

f. Actuator ranges.

g. Fail safe operation on loss of control signal, electric power, network communications.

B. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BMS program shall be put on line and commissioned. The contractor shall, in the presence of the owner and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.

C. After all BMS programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:

1. Data communication, both normal and failure modes.
2. Fully loaded system response time.
3. Impact of component failures on system performance and system operation.
4. Time/Date changes.
5. End of month/ end of year operation.
6. Season changeover.
7. Global application programs and point sharing.
8. System backup and reloading.
9. System status displays.
10. Diagnostic functions.
11. Power failure routines.
12. Battery backup.
13. Smoke Control, stair pressurization, stair, vents, in concert with Fire Alarm System testing.
14. Testing of all electrical and HVAC systems with other division of work.

D. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.

E. Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate all system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.

F. The contractor shall supply all instruments for testing and turn over same to the owner after acceptance testing.

3.10 TRAINING

A. The manufacturer shall provide factory trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The manufacturer shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

B. Provide 4 hours of training for Owner's designated operating personnel. Training shall include:

Explanation of drawings, operations and maintenance manuals
Walk-through of the job to locate control components
Operator workstation and peripherals
DDC controller and ASC operation/function
Operator control functions including graphic generation and field panel programming
Operation of portable operator's terminal
Explanation of adjustment, calibration and replacement procedures
Student binder with training modules

C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Manufacturer. If such training is required by the Owner, it will be contracted at a later date.

VRF Points List

Objects that can be used with the AE-200/AE-50/EW-50 are shown in the table below.

Object	Object type	Instance number	Units					Remarks
			Inactive(0)*23	Active(1)				
			Text-1(1)*23	Text-2(2)	Text-3(3)	Text-4(4)	Text-5(5)	
On Off Setup	BO	01xx01	Stop	Run				*20
On Off State	BI	01xx02	Stop	Run				*20
Alarm Signal	BI	01xx03	Normal	Error				
Error Code	MI	01xx04	01: Normal 02: Other errors 03: Refrigeration system fault 04: Water system error 05: Air system error		06: Electronic system error 07: Sensor fault 08: Communication error 09: System error			
Operational Mode Setup	MO	01xx05	01: Cool 02: Heat 03: Fan		04: Auto 05: Dry 06: Setback			*1 *16 *18 *22
Operational Mode State	MI	01xx06	01: Cool 02: Heat 03: Fan		04: Auto 05: Dry 06: Setback			*1 *3 *16 *18 *22
Fan Speed Setup	MO	01xx07	01: Low 02: High 03: Mid 2		04: Mid 1 05: Auto			*4 *5 *18
Fan Speed State	MI	01xx08	01: Low 02: High 03: Mid 2		04: Mid 1 05 Auto			*4 *5 *18 *21
Room Temp [Water Temp]	AI	01xx09	ºF/ºC					*16 *25
Set Temp [Set Water Temp]	AV	01xx10	ºF/ºC					*16 *25
Filter Sign [Circulating Water Exchange Sign]	BI	01xx11	OFF	ON				
Filter Sign Reset [Circulating Water Exchange Sign Reset]	BV	01xx12	Reset	Void				
Prohibition On Off	BV	01xx13	Permit	Prohibit				*20
Prohibition Mode	BV	01xx14	Permit	Prohibit				*16
Prohibition Filter Sign Reset [Prohibition Circulating Water Exchange Sign Reset]	BV	01xx15	Permit	Prohibit				

Object		Object type	Instance number	Units					Remarks
				Inactive(0)*23	Active(1)				
				Text-1(1)*23	Text-2(2)	Text-3(3)	Text-4(4)	Text-5(5)	
Prohibition Set Temperature		BV	01xx16	Permit	Prohibit				*16
Prohibition Fan Speed		BV	01xx17	Permit	Prohibit				
M-NET Communication State		BI	01xx20	Normal	Error				
System Forced Off	individual	BV	01xx21	Reset	Execute				*10 *11
	collective		019921						
Air Direction Setup		MO	01xx22	Horizontal	Downblow 60%	Downblow 80%	Downblow 100%	Swing	*14 *16 *18
Air Direction State		MI	01xx23	Horizontal	Downblow 60%	Downblow 80%	Downblow 100%	Swing	*8 *14 *16 *18
Set Temp Cool		AV	01xx24	ºF/ºC					*16 *18
Set Temp Heat		AV	01xx25	ºF/ºC					*16 *18
Set Temp Auto		AV	01xx26	ºF/ºC					*16 *18
Set High Limit Setback Temp		AV	01xx27	ºF/ºC					*16 *18 *19
Set Low Limit Setback Temp		AV	01xx28	ºF/ºC					*16 *18 *19
Ventilation Mode Setup		MO	01xx35	Heat Recovery	Bypass	Auto			*15 *18
Ventilation Mode State		MI	01xx36	Heat Recovery	Bypass	Auto			*15 *18 *21
Air To Water Mode Setup		MO	01xx37	Heating	Heating ECO	Hot Water	Anti-freeze	Cooling	*15 *16 *17
Air To Water Mode State		MI	01xx38	Heating	Heating ECO	Hot Water	Anti-freeze	Cooling	*15 *16 *17
Group Apportioned Electric Energy		AC	01xx39	0.1 [kWh]					*2
Interlocked Units Apportioned Electric Energy		AC	61aa39	0.1 [kWh]					*2 *7
PIcontroller Electric Energy 1–4		AC	41mm40–43	0.1 [kWh]					*2 *6 *13 *15 *16 *17 *18
Pulse Input Electric Energy 1–4		AC	410040–43	0.1 [kWh]					*2 *12 *13 *15 *16 *17 *18
Group Apportionment Parameter		AC	01xx44	No Units					*2
Interlocked Units Apportionment Parameter		AC	61aa44	No Units					*2 *7
Night Purge State		BI	01xx46	OFF	ON				*15 *18
Thermo On Off State		BI	01xx47	OFF	ON				*16
System Alarm Signal		BI	010048	Normal	Error				
Error Code Detail		AI	01xx49	No Units					
External Heat Source State		BI	01xx50	OFF	ON				
PIcontroller Alarm Signal		BI	41mm03	Normal	Error				*6
Trend Log Room Temp		LOG	01xx80						*9 *16 *24 *25

Object	Object type	Instance number	Units					Remarks
			Inactive(0)*23	Active(1)				
			Text-1(1)*23	Text-2(2)	Text-3(3)	Text-4(4)	Text-5(5)	
Trend Log Group Apportioned Electric Energy	LOG	01xx83						*2 *24
Trend Log Interlocked Units Apportioned Electric Energy	LOG	61aa83						*2 *7 *24
Trend Log PIcontroller Electric Energy 1–4	LOG	41mm84–87						*2 *6 *13 *15 *16 *17 *18 *24
Trend Log Pulse Input Electric Energy 1–4	LOG	410084–87						*2 *13 *15 *16 *17 *18 *24
Trend Log Group Apportionment Parameter	LOG	01xx88						*2 *24
Trend Log Interlocked Units Apportionment Parameter	LOG	61aa88						*2 *7 *24

*1 “Dry” can be used only when the “Use Dry Mode” setting is enabled (checked) on the BACnet® Setting Tool. (The default setting is disabled (unchecked).)

*2 “Charge” license is required for AE-200/AE-50/EW-50.

*3 When the “Operational Mode State” received from the indoor unit is “Auto Cool”, “Cool” can be selected; when it is “Auto Heat”, “Heat” can be selected, or “Auto” can be selected for both.

*4 “Use Fan Speed Mid1/Mid2” setting of the BACnet® Setting Tool, and effective fan speeds from indoor unit, LOSSNAY, and OA Processing Unit fan speed switching steps are shown in the table below. (The default setting of “Use Fan Speed Mid1/Mid2” of the BACnet® Setting Tool is disabled (unchecked).)
(In the automatic wind velocity compatible model, “Auto” is valid in addition to the fan speed in this table.)

V: Available

Unit type	“Use Fan Speed Mid1/Mid2” setting	Number of available fan speeds	Available fan speed			
			Low	Mid 2	Mid 1	High
Indoor unit	Enabled	2		V		V
		3		V	V	V
		4	V	V	V	V
	Disabled	2–4	V			V
LOSSNAY and OA Processing Unit	Enabled	1				V
		2	V			V
		3	V	V		V
		4	V	V	V	V
	Disabled	1				V
		2–4	V			V

*5 Low < Mid 2 < Mid 1 < High

*6 mm: PI controller address (01–50)

*7 Can be used only for the interlocked units.
aa: Interlocked unit address (01–50)

*8 When the air direction received from the indoor unit is “Downblow 20%” or “Auto”, “Horizontal” will be output to BACnet®.

*9 The value of the “Present_Value” in the “Room Temp” (AI_01xx09) object is logged in as the log record.

*10 Batch commands are made for the “System Forced Off” instance number (019921) for all groups.

*11 When the “System Forced Off” (individual/collective) from BACnet® communication is used, do not set the “External Input Setting” for AE-200/AE-50/EW-50 to “ON/OFF (Level signal)”. “External Input Setting” can be configured on the Initial Setting Tool, Web Browser for Initial Settings, or AE-200/AE-50’s LCD. (Refer to the AE-200/AE-50/EW-50 Instruction Book (Initial Settings) for settings methods.)

*12 Electric energy for the electricity meter connected to the Pulse Input (PI) of AE-50/EW-50

*13 Electric energy 1 to 4 correspond to signal lines Ch1 to 4 on the PI controller or metering devices 1 to 4 connected to Pulse Input (PI) of AE-50/EW-50.

*14 It may differ from the actual air direction depending on the type of indoor unit (Ceiling-concealed Ducted, Wall-mounted, Floor-standing). An example of a Floor standing PFFY-P VKM-E is as follows.

	Setting/Status				
Air direction on the BACnet®	Horizontal	Downblow 60%	Downblow 80%	Downblow 100%	Swing
Actual air direction	Upblow 100%	Upblow 80%	Upblow 60%	Horizontal	Swing

*15 Cannot be used with an indoor unit model.
Differences in supported/not supported objects depending on whether it is an indoor unit, LOSSNAY or the Air To Water model are indicated on the following page.

*16 Cannot be used with a LOSSNAY which is not interlocked with an indoor unit.
Differences in supported/not supported objects depending on whether it is an indoor unit, LOSSNAY or the Air To Water model are indicated on the following page.

*17 Cannot be used with an OA Processing Unit which is not interlocked with an indoor unit.
Differences in supported/not supported objects depending on whether it is an indoor unit, LOSSNAY or the Air To Water model are indicated on the following page.

*18 Cannot be used with an Air To Water model.
Differences in supported/not supported objects depending on whether it is an indoor unit, LOSSNAY or the Air To Water model are indicated on the following page.

*19 It can only be used if the system controller is AE-200A/AE-50A/EW-50A and the indoor unit is a Setback mode supported model.

*20 Do not use this when “External Input Setting” for AE-200/AE-50/EW-50 is set to “ON/OFF (Level signal)”. “External Input Setting” can be configured on the Initial Setting Tool or AE-200/AE-50’s LCD. (Refer to the AE-200/AE-50/EW-50 Instruction Book (Initial Settings) for settings methods.)

*21 During Night Purge state, this operates using a specific fan speed and ventilation mode, but these are not reflected in the status display. As a result, the read status from BACnet® communications may differ from actual fan speeds and ventilation modes. Additionally, carrying out fan speed and ventilation mode settings during Night Purge state will not change actual operation, and these will only be reflected in the status display.

*22 “Setback” is available only when the “Old model compatibility mode” is set to “OFF” on the Initial Setting Tool or AE-200/AE-50’s LCD.

*23 “Inactive(0),Active(1)” is applied when the object type is BO/BI/BV, and “Text-1(1),Text-2(2),⋯” is applied when the object type is MO/MI.

*24 Use the BACnet® Trial Run Tool to check or set the “Log_Interval” property. (Refer to the AE-200/AE-50/EW-50 Instruction Book (BACnet® Trial Run Tool) for settings methods.)

*25 When E-OA model unit is connected, outlet air measurement temperature is used for “Room Temp/Trend Log Room Temp,” and outlet air preset temperature is used for “Set Temp.”



SECTION 16001 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions as appropriate, apply to the Work specified in this Section.

B. Refer to all Electrical Divisions of the Specifications as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

1.2 BIDDING REQUIREMENTS AND RESPONSIBILITIES

A. Prime bidder is responsible for all work, of all trades and sub-contractors bidding this project. It is the prime bidder's responsibility, prior to submitting a bid to ensure that sub-contractors coordinate all aspects of the work between trades, sub-contractors, etc. to the fullest extent possible.

B. Prime bidder shall ensure that all sub-contractors, suppliers, equipment vendors, etc., obtain all necessary and pertinent contract document information pertaining to their work prior to the submission of a bid. Contractor shall realize that different sub-contractors may furnish equipment, accessories, devices, etc. necessary for a complete and working installation, that require provision of services by another sub-contractor or trade.

C. Bidders of all or any portions of this section or division are required to review all contract documents including but not limited to Architectural drawings, Structural drawings, Mechanical drawings, Plumbing drawings, Electrical drawings, etc. to coordinate requirements and responsibilities with and through prime bidder.

D. Bidders of all or any portions of this section or division, by furnishing a bid on a portion of the prime contract are indicating that they have received all contract documents and coordinated services provided under their portion of the work with the prime bidder; they are indicating that they have expressed any pertinent questions (which would result from a detailed, thorough review of the entire set of contract documents) to the prime bidder in accordance with the general provisions of the Specifications requirements, prior to bidding.

E. All timely, pertinent, questions provided in writing prior to bids, in accordance with the general provisions of the Specifications requirements, will be clarified, defined, or otherwise explained in a written addendum and/or addendums prior to bids, in accordance with the general provisions of the Specifications requirements.

F. It is not the intention of these contract documents to leave any issue relating to coordination between trades or sub-contractors vaguely defined. The intention is to define all issues, coordination matters, equipment requirements, sizes, routing, etc. to the satisfaction of the prime bidder, prior to receipt of bids.

G. Bidders of all or any portions of this section or division, by virtue of the submission of a bid to the prime bidder, are indicating that they have reviewed the entire set of contract documents with due diligence and regard for the Owner's desire for a comprehensive and complete bid proposal; that they have expressed all concerns or questions requiring clarification on matters of coordination between trades and/or sub-contractors; that they have expressed any such concerns or questions in writing in accordance with contract document's General Provisions requirements.

H. Prime bidders, by submission of a comprehensive bid on the project are indicating that the subcontractors selected in their bid have complied with all contract document's General Provisions requirements, that they have indicated in writing, prior to bidding, all questions or concerns requiring clarification and/or explanation and have documented any and all specific exclusions involving work that would generally be considered to be work of their trade. The prime bidder shall coordinate all work so that anything excluded by the bidder of all or any portions of this section or division, have been addressed prior to bids in one of the following manners:

1. The work has been confirmed, by the prime bidder, to be work of another trade or subcontractor whose proposal is also being accepted.
2. Clarification of the matter has been made through the prime design professional via written addendum and is clearly and mutually understood by the prime bidder and the party raising the issue/question, or seeking clarification.
3. The work has been accepted as the responsibility of the prime contractor directly.

1.3 MATERIAL AND EQUIPMENT

A. The term "provide" when used in the Contract Documents includes all items necessary for the proper execution and completion of the work.

B. Specific reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgement of the Architect expressed in writing is equivalent to that specified.

C. Coordinate and properly relate all work of this Division to building structure and work of all other trades.

D. Visit premises and become thoroughly familiar with existing conditions; verify all dimensions in field. Advise Architect of any discrepancies prior to Bid Date in accordance with contract document's General Provisions.

E. Do not rough-in for any item or equipment furnished by others or noted "Not in Contract" (NIC), without first receiving rough-in information or determining rough-in requirements from other trades and/or Architect.

F. Provide storage and protection for all equipment and materials in accordance with requirements of contract document's General Provisions. Replace any equipment and materials damaged by improper handling, storage, or protection, at no additional cost to the Owner.

G. Keep premises clean in accordance with requirements of contract document's General Provisions.

1.4 SUBSTITUTIONS

A. Substitutions are allowed under La. R.S. 38:2291 and La R.S. 38:2292. Any requests for prior approval (as provided for under La. R.S. 38:2295) including any re-submitted data, shall be received by the Architect/Engineer a minimum of ten (10) working days prior to bid date. Submittals sent via facsimile and/or electronic mail will not be accepted. The Contractor shall recognize that it may be necessary to submit certain requests for prior approval sooner than the final date listed in the Instructions to Bidders, depending upon the complexity and completeness of the submittal. If, in the opinion of the Architect/Engineer, there is neither sufficient time available nor adequate descriptive data attached to the submittal, the submittal will not be considered. Except as otherwise specified, materials and equipment shall be new and bear the approval label of the Underwriters Laboratories, Inc. for the type of installation required.

B. Basis of design of systems is based on specific equipment for performance, size, shape, color, construction material, etc... If the use of other manufacturer's equipment, even though approved by Architect, involves additional cost due to space requirements, foundation requirements, increased mechanical or electrical services, the cost of such extra work shall be borne by the contractor. Even though a manufacturer's name appears in the Contract Documents as having acceptable equipment, his equipment shall be classified as being a substitute to the equipment originally designed for and named in the Contract Documents. Substitute equipment, materials, etc., will not be allowed to deviate from basis of design requirements.

C. All requests for prior approval shall identify where proposed material matches or exceeds the performance of the equipment specified. In addition, such submittal shall also clearly identify all deficiencies compared to specified product. Submittal of general cut sheets will be returned rejected.

1.5 DRAWINGS AND SPECIFICATIONS

A. The specific intent of these Contract Documents is to provide the various systems, equipment, etc. to the Owner complete and in a thoroughly calibrated and functional condition.

B. The Drawings shall not be construed as shop drawings. In the event of a possible interference with piping or equipment of another trade, items requiring set grade and elevations shall have precedence over other items. Should any major interference develop, immediately notify the Architect.

C. In laying out Work, refer to mechanical, electrical, structural, and architectural drawings at all times in order to avoid interference and undue delays in the progress of the Work.

1.6 CODES AND REGULATIONS

A. Work shall be in full accord with the LA State Sanitary Code, 2017 N.E.C. (NFPA 70), local ordinances, building codes, and other applicable national, state, and local regulations.

B. Equipment shall conform to requirements and recommendations of the National Bureau of Fire Underwriters and National Fire Protection Association (NFPA).

C. Items provided under this Division shall comply with the American National Standards Institute (ANSI) "Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People," ANSI A 117.1, and the Americans with Disabilities Act (A.D.A.).

D. Work called for in these Plans and Specifications shall be executed by competent workmen.

E. In the possible event of conflict between codes or regulations and Contract Documents, notify the Architect/Engineer immediately.

F. The drawings show approximate locations only of feeders, branch circuits, outlets, etc., except where specific routing or dimensions are indicated. The Architect reserves the right to make reasonable changes in locations indicated, before roughing-in, without additional cost to the Owner.

G. Because of the small scale of the drawings, it is not possible to indicate all of the offsets, fittings, and accessories required. The Contractor shall investigate the structural and finish conditions affecting his work and shall arrange such work accordingly, fittings, bends, junction boxes, pull boxes, access panels, and accessories required to meet such conditions at no additional costs to the Owner.

1.7 FEES, PERMITS, AND TAXES

A. Obtain and pay for permits required for the Work of this Division. Pay fees in connection therewith, including necessary inspection fees.

B. Pay any and all taxes levied for Work of this Division, including municipal and/or state sales tax where applicable.

1.8 MANUFACTURER'S DIRECTIONS

A. Install and operate equipment and material in strict accord with manufacturer's installation and operating instructions. The manufacturer's instructions shall become part of the Contract Documents and shall supplement Drawings and Specifications.

1.9 SUBMITTAL DATA

A. Submit shop drawings, project data, and samples in accordance with requirements of the General Provisions of the contract documents. Submittals shall be received no later than thirty (30) consecutive calendar days from effective date of "Notice to Proceed".

B. Shop drawings shall consist of published ratings or capacity data, detailed construction drawings for fabricated items, wiring and control diagrams, performance curves, installation instructions, manufacturer's installation drawings, and other pertinent data. Submit drawings showing revisions to equipment layouts due to use of alternate or substitute equipment.

C. Where manufacturers and suppliers of equipment, materials, etc. are unable to fully comply with Contract Document basis of design requirements, specifically call such deviations to attention of Architect/Engineer on submittals. Typed deviations on a separate sheet; underlined statements or notations on standard brochures, equipment fly sheets, etc. will not be accepted. Submittals shall clearly indicate where material submitted meets and/or exceeds the performance criteria of the equipment used as the basis of design of the project. Failure to note compliance with the basis of design material/equipment shall result in rejection of submittals.

D. Approval of submittals shall not relieve Contractor from furnishing required quantities and verifying dimensions. In addition, approval shall not waive original intent of Contract Documents.

E. Failure to obtain written approval of equipment shall be considered sufficient grounds for rejection of said equipment regardless of the stage of completion of the project.

F. Contractor shall submit Submittals/Shop Drawings on all equipment listed below. In addition, contractor shall refer to subsequent sections of the Electrical portion of the specifications for additional shop drawing submittal requirements.

1. Lighting Fixtures
2. Electrical Gear (Panelboards, Safety Switches, Circuit Breakers). This includes Short-Circuit Study, Coordination Study and Arc-Flash Study.
3. Dimmer Switches
4. Fire Detection and Alarm System
5. Receptacles
6. Toggle Switches
7. Wiring Device Box Support Brackets
8. Cover Plates
9. Pull Boxes
10. Wire
11. Occupancy/Motion Sensors

12. Generators
13. Transfer Switches
14. Generator Fuel System
15. Floor Boxes
16. Transient Voltage Surge Suppressors (TVSS)/Surge Protective Devices (SPDs)

G. Shop Drawings/submittals shall be submitted in individual books as grouped together and stated below and shall be submitted simultaneously. Electrical gear shop drawings shall not be submitted until approval is obtained for all HVAC and plumbing equipment. Prior to submission of electrical gear shop drawings, contractor shall obtain a copy of the approved mechanical and plumbing submittals. Any modifications required to be made to the electrical gear due to changes in electrical requirements (increases and/or decreases) of the mechanical and plumbing equipment shall be clearly notated in the electrical gear submittals.

1. Light Fixtures, Occupancy/Motion Sensors
2. Electrical Gear, Overcurrent Protective Device Studies
3. Fire Detection and Alarm System
4. Dimmer Switches, Receptacles, Toggle Switches, Cover Plates, Device Box Support Brackets, Pull Boxes, Floor Boxes, and Wire
5. Generator(s), Transfer Switches, Generator Fuel Systems
6. Transient Voltage Surge Suppressors (TVSS)/Surge Protective Devices (SPDs)
7. Lightning Protection System

1.10 PROJECT COORDINATION

A. Refer to applicable Electrical Specification Sections for products work of this Division.

B. Refer to all plumbing, mechanical and fire protections specifications sections for related products affecting work of these electrical sections.

C. Coordinate handling of all products, materials, etc., through the Contractor. Coordinate space, access, clearances, etc., through the Contractor prior to preparation of shop drawing submittal.

D. The Contractor is herein cautioned to note that the work involved is a complicated renovation and a new addition project requiring continuous owner occupancy. The Contractor should review the phasing plans/descriptions and visit the project site to determine existing conditions. The Contractor will be held responsible for allowing for these conditions in his bid.

1.11 SERVICE CONTINUITY

A. At all times during the construction of the project, electric service shall be maintained to all portions of the site and existing facility, except with prior written approval from the Architect/Engineer of interruptions. It shall be the responsibility of the contractor to provide, install and maintain (fuel included) any required rental generators to accomplish said task. Any required interruptions of electric service due to work being performed under this Contract shall be scheduled in writing a minimum of forty-eight (48) hours in advance

after consultation with the Architect/Engineer and the Owner, and shall occur when permitted by the Architect/Engineer. The Contractor shall be responsible for any overtime pay required to meet these requirements, at no additional cost to the Owner.

1.12 VALUE ENGINEERING (V/E):

A. While it may be in the Owner's interest to consider the first cost money saving that may be generated via alternatives and options generated via participation in Value Engineering, contractor shall realize that substantive offers of Value Engineering (V/E), if accepted by the Owner, constitute a design-build agreement (offer and acceptance) with the owner, and drastically change the design concept of the project, as developed by the Professional of Record identified on the Contract Documents.

B. Should contractor offer, and the owner accept value engineering options that alter aspects of the system design, equipment, performance and/or performance verification or monitoring of respective systems, the contractor shall provide duly licensed professional engineering consultants working on behalf of the contractor (including sub-contractors and equipment vendors/manufacturers) to review, approve and take professional responsibility for performance and suitability of V/E hybrid systems, materials or operational changes related to respective V/E items. The contractor's licensed professional engineering consultants and the contractor assume any and all responsibility for the design and suitability in terms of performance, of hybrid systems installed, as contractor's Professional of Record, absolving the original project Professional of Record (identified on the original Contract Documents, released for the original project Bid/Negotiation) from responsibility for the V/E hybrid systems portion of the work.

C. The contractor, via the offer and acceptance of value engineering items on the project agrees to provide professional engineering design services and take full and complete responsibility for the hybrid design. Further, the contractor's (V/E Items) professional of record (either employees, or independent consultants to the contractor) through the offer and acceptance of V/E items, agree to indemnify and hold harmless the project owner, the owner's original A/E team (Professional of Record on behalf of the owner for the original Contract Documents) their heirs and assigns in regard to the V/E changes and their impact on the systems altered, affected or modified, in whole or in part. The Professional of Record shown on the original Contract Documents in regard to the systems altered, adjusted, revised, modified or otherwise affected by the value engineering items implemented, shall be absolved of design responsibility as a result of implementation of V/E items, and their original use of Engineering Seals used for original Contract Documents, shall not apply.

1.13 PROJECT RECORD DOCUMENTS

A. Keep Project Record Documents in accordance with general provision requirements of the specifications.

B. During construction period, keep accurate records of installations paying particular attention to major interior and exterior underground and concealed piping, ductwork, etc.

C. The Contractor shall obtain a minimum of one (1) set of the contract documents including all addenda and change orders as prepared by the Architect/Engineer.

D. If the Contractor elects to vary from the Contract Documents and secures prior approval from the Architect/Engineer for any phase of the work, he shall record in a neat and readable manner all such variances on the contract documents in red ink. Prior to requesting substantial completion the marked-up set of contract documents shall be returned to the Architect/Engineer for approval.

E. All deviations from sizes, locations and from all other features of the installation shown in the Contract Documents shall be recorded.

F. In addition, it shall be possible using these drawings to correctly and easily locate, identify and establish sizes of all piping, directions, and the like, as well as other features of work which will be concealed underground and/or in the finished building.

G. Locations of underground work shall be established by dimensions to columns, lines or walls, locating all turns, etc. and by properly referenced centerline or invert elevations and rates of fall.

H. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases this may be by dimension. In others, it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. The decision of the Architect/Engineer in this matter will be final.

I. The following requirements apply to all Record Drawings:

1. They shall be maintained at the Contractor's expense.
2. All such drawings shall be done carefully and neatly.
3. Additional drawings shall be obtained at the Contractor's expense.
4. They shall be kept up-to-date during the entire course of the work and shall be available upon request for examination by the Architect/ Engineer and when necessary, by other trades, to establish clearances for other parts of the work.
5. Record Drawings shall be returned to the Architect/Engineer upon completion of the work and are subject to approval of the Architect/ Engineer.
6. Revit files can be provided upon request (proper release forms must be completed). Contractor shall update Revit files to reflect As-Built conditions and shall submit revised file back to Architect/Engineer as part of the close-out documents.

1.14 OPERATION AND MAINTENANCE DATA

A. Refer to the specification Sections related to PROJECT CLOSEOUT or OPERATION AND MAINTENANCE DATA for procedures and requirements for preparation and submittal of maintenance manuals.

B. Provide the Owner with three (3) copies of printed instructions indicating various pieces of equipment by name and model number, complete with parts lists, maintenance and repair instructions and test and balance report.

C. COPIES OF SHOP DRAWINGS WILL NOT BE ACCEPTABLE AS OPERATION AND MAINTENANCE INSTRUCTIONS.

D. This information shall be bound in plastic hardbound notebooks with the job name, Architect and Engineer names permanently embossed on the cover. Rigid board dividers with labeled tabs shall be provided for different pieces of equipment. Submit manuals to the Architect for approval.

E. In addition to the operation and maintenance brochure, the Contractor shall provide a separate brochure which shall include registered warranty certificates on all equipment, especially any pieces of equipment which carry warranties exceeding one (1) year.

F. As part of the O & M binders, contractor shall include copies of all studies and test reports performed as part of this project, including but not limited to, the following:

1. Acceptance Testing Reports

    a. Grounding Tests
    b. Thermographic Tests
    c. Equipment Tests
    d. Torque Values
    e. Rotation Tests

2. Fire Alarm System 100% Test Report
3. Generator Start-up Tests
4. Short Circuit Study Report
5. Coordination Study Report
6. Arc Flash Study Report
7. Lightning Protection System Certifications

G. The operation and maintenance brochure shall be furnished with a detailed list of all equipment furnished to the project, including the serial number and all pertinent nameplate data such as voltage, amperage draw, recommended fuse size, rpm, etc. The Contractor shall include this data on each piece of equipment furnished under this contract including but not limited to those items listed below.

1. Lighting Fixtures
2. Electrical Gear (Panelboards, Safety Switches, Circuit Breakers). This includes Short-Circuit Study, Coordination Study and Arc-Flash Study.
3. Dimmer Switches
4. Fire Detection and Alarm System
5. Receptacles
6. Toggle Switches
7. Wiring Device Box Support Brackets
8. Cover Plates
9. Pull Boxes
10. Wire
11. Occupancy/Motion Sensors
12. Generators
13. Transfer Switches
14. Generator Fuel System

15. Floor Boxes
16. Transient Voltage Surge Suppressors (TVSS)/Surge Protective Devices (SPDs)

1.15 EXCAVATING AND BACKFILLING

A. Provide excavating and backfilling necessary for Work of this Division. Comply with provisions of specification section pertaining to Site Work, if applicable.

B. Trenches shall be inspected by Code Authorities and/or Owner's Representative before and after piping is laid. Give Owner' Representative 24-hour notice for each inspection. If any trenches are filled without Owner's Representative and/or authority having jurisdiction inspection and as subsequently found to be deficient, the trenches shall be uncovered, inspected, and then re-filled, if requested by Owner's Representative. Prior to covering any and all underground facilities, including but not limited to conduit, ground rods, terminations, etc., Contractor shall take clear and concise digital photos and shall forward said photos to Engineer prior to covering said utilities.

C. Provide minimum 24 inches of cover to finish grades or paving at raceways.

D. Protect and maintain trenches in dry condition until piping has been inspected and approved. Immediately after approval, backfill trenches in tamped layers. Repeat backfill and tamping 6 months after initial coverage has been accomplished to avoid swale development from sinking soils.

E. Compact fill to satisfaction of Architect and/or Owner's Representative.

F. Prior to any excavating, Contractor shall be responsible for having all utilities in the area of excavation located and marked by an approved company with a minimum of five (5) years' experience locating underground facilities. This includes all owner owned utilities on their site.

G. Approximate locations shown on the drawings shall not be used. Any facility damaged by the Contractor's underground work shall be repaired and/or replaced at no additional cost to the Owner

1.16 CUTTING AND PATCHING

A. Comply with requirements of the Specifications regarding cutting and patching. Locate and timely install sleeves as required to minimize cutting and patching.

B. Cutting, fitting, repairing, patching, and finishing of Work shall be done by craftsmen skilled in their respective trades. Where cutting is required, cut in such a manner as not to weaken structure, partitions, or floors. Holes required to be cut must be cut or drilled without breaking out around the holes. Where patching is necessary in finished areas of the building, the Architect will determine the extent of such patching and refinishing.

C. Repairing Roadways and Walks: Where this contractor cuts or breaks roadways or walks to lay the piping, he shall repair or replace these sections to match existing, unless specifically identified as the responsibility of others.

1.17 PAINTING

A. Painting shall be provided under the Specification section regarding painting, unless specified otherwise. Leave exposed piping, materials, and equipment clean and free of rust, grease, dirt, etc. before and after painting.

B. Factory finished equipment, fixtures, and materials which are marred, chipped, scratched, or otherwise unacceptable shall be repaired or replaced under this Division to Architect satisfaction, at no additional cost to Owner.

C. Coordinate all painting requirements with prime bidder prior to bids.

D. All exposed conduit, materials, hangers, anchors, etc., are to be primed and painted. Color shall match adjacent surfaces where not specifically designated otherwise. All galvanized materials shall be suitably treated prior to painting to ensure adhesion.

E. All exterior electrical gear (panels, meter cans, CT can, switchboards, safety switches, etc.) shall be painted to match adjacent wall surface(s). All interior panels (flush mount) shall have their covers painted to match adjacent wall surface(s).

F. All exterior receptacles, junction boxes, shall be painted to match adjacent wall surface(s).

1.18 EXISTING CONDITIONS

A. The Electrical Contractor shall visit the building site to determine existing conditions and will be held responsible for allowing for these conditions in his bid.

B. Note that this area of work will have storm drainage, mechanical and electrical utilities located underground and within and under the buildings. It is part of this work for the Contractor to determine the scope and location of all utilities to be installed with this project and arrange his work around others. There will be no extra consideration for work discovered as being hidden after the bid, and no change orders for extra cost that may be caused by unknown after bid conditions. The drawings show approximate locations only of feeders, branch circuits, outlets, etc., except where specific routing or dimensions are indicated. The Architect reserves the right to make reasonable changes in locations indicated, before roughing-in, without additional cost to the Owner.

1.19 PROTECTION OF APPARATUS

A. The Contractor shall take precautions necessary at all times to properly protect his apparatus from damage. Failure on the part of the Contractor to comply with the above to the Architect's satisfaction shall be sufficient cause for the rejection of the particular piece of apparatus in question.

1.20 MINOR DEVIATIONS

A. The Contractor shall realize that the drawings cannot delve into every step, sequence, or operation necessary for the completion of the project without drawing on the Contractor's experience. Only typical details are shown on the plans. In cases where the Contractor is

not certain about the method of installation of his work, he shall ask for details. Lack of details will not be an excuse for improper installation.

1.21 SALVAGED MATERIALS

A. The Owner shall have priority for the selection of salvaged material and equipment. Any equipment, light fixtures, devices, ballasts, materials, etc. selected to remain property of the Owner shall be removed and delivered to a location on the site as designated by the Owner. Material and equipment not retained by the Owner shall become the property of this Contractor and shall be removed from the site by him.

B. The Contractor shall obtain written approval of all material and equipment determined not to be salvaged by the Owner.

1.22 SAFETY PRECAUTIONS

A. Work methods and project safety are the Contractor's sole responsibility.

B. Contractor shall furnish and place proper guards for prevention of accidents. He should provide and maintain any other necessary construction required to secure safety of life or property, including maintenance of sufficient lights during all day and night hours as required to secure such protection.

C. Temporary electrical services during construction should be maintained in perfect condition. Frayed, lose or opened connections should not be used for temporary services. The Contractor should use only equipment in first class working condition for construction services.

1.23 TEMPORARY CONSTRUCTION LIGHTING

A. The Contractor should provide and install construction lighting as required by General Contractor and other trades. The installation shall conform to requirements of the National Electrical Code.

1.24 SUPERVISION

A. Contractor shall personally, or through an authorized and competent representative, constantly supervise the work done from beginning to completion and final acceptance. To the best of his ability he shall keep the same foreman and workmen throughout the project duration. Foreman shall be present at project site at all times while work under this section of the contract documents is being performed. Foreman shall be accessible by cellular phone at all times. Respective telephone numbers shall be forwarded to Architect/Engineer prior to commencement of work on this project.

1.25 CAD FILES

A. ADG will provide, upon request, AutoCAD files to the contractors for use in preparing submittals and record drawings. Plans will be provided at a cost of $10.00 per drawings sheet requested. By submitting request for CAD files, contractors automatically consent to the verbiage contained in the CAD release form contained in the plans. This includes any all limitations, restrictions, indemnifications, etc… contained therein.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Panelboards, safety switches, equipment cabinets, motor starters and other equipment shown on the drawings and furnished and/or installed under this section of the Specifications shall be labeled with laminated plastic nameplates inscribed to identify equipment with description shown on the drawings for panels, the name of the equipment controlled for motor starters or the system or function involved for other equipment. Provide typewritten panelboard directories indicating the equipment served and its location using final approved room numbers, etc., as directed by the Architect. Refer to specification section – Electrical Distribution System for additional requirements.

PART 3 - EXECUTION

3.1 COORDINATION OF TRADES

A. Where work is in close proximity to the work of other contractors, the Contractor shall review plans of other contractors and coordinate his work with theirs. The Electrical Contractor shall verify the location of lighting fixtures, beams, structural members, conduit, ductwork, pipes or other obstructions before beginning his work in the area. Notify the Architect where proper clearances do not occur or where the work of others would interfere with the safe and/or proper operation of this work.

3.2 HARMONIC DISTORTION

A. IEEE 519-1992 - Harmonic Control in Electrical Power Systems shall be a requirement of this project. Harmonic filters (passive or active), phase multiplication devices, or any other components required to mitigate harmonic voltage THD to 5% and current THD to 8% maximum levels shall be an integral part of the VFD system. Compliance measurement shall be based on THD added (during VFD full load operation compared to across-the-line operation) at the VFD circuit breaker terminals or actual THD measurement at the VFD circuit breaker terminals during full load VFD operation. Designs which employ shunt tuned filters must be designed to prevent the importation of outside harmonics which could cause system resonance or filter failure. Calculations supporting the design, including a system harmonic flow analysis, must be provided as part of the submittal process for shunt tuned filters. Any filter designs which cause voltage rise at the VFD terminals must include documentation in compliance with the total system voltage variation of plus or minus 10%.

Documentation of Power Quality compliance shall be part of the commissioning required by the VFD supplier. Actual job site measurement testing shall be conducted at full load and documented in the operation and maintenance manuals. Harmonic measuring equipment utilized for certification shall carry a current NiTS calibration certificate. The final test report shall be reviewed and compliance certification stamped by a licensed professional engineer (PE).

3.3 SUPPORTS AND FOUNDATIONS

A. Support all items covered by this Specification directly from building structural members independent of any ceilings or any other installed item. Panelboards and switches may be attached to suitably reinforced walls. Ground or slab mounted equipment shall be mounted on a separate four inch high concrete slab. Extending 6" beyond equipment footprint on all sides

B. Do not attach items of this Specification to HVAC ductwork, ceiling grids and ceiling support members, piping or other equipment unless specifically shown otherwise. Where applicable, all equipment including conduit shall be supported from overhead wall, floor or roof structures using galvanized channel or angle members for a rigid support. Position supports and equipment such that access through lay-in ceilings or panels is not impaired and all Code required clearances are maintained.

C. Where applicable, under no circumstances is the Contractor to attach to or support from any bar joist bridging. Any supports to the bar joists or any structural systems shall be approved by the Architect. All supplemental angle or channel iron required to support equipment of this Specification shall be furnished by the Electrical Contractor.

3.4 EQUIPMENT LAYOUT

A. The physical location and arrangements of electrical equipment is shown on the Plans and is to be used by the Contractor as a guideline in construction. It is the responsibility of the Contractor to review the Plans with the proposed equipment and equipment of other contractors that are affected, and to ensure that all Code required clearances, wiring distances and maintenance accesses, including equipment heights, of all items are maintained. Alternate arrangements to accomplish the above due to field conditions or changes in physical size of the equipment proposed for the project are to be submitted to the Architect for review before any work is begun or equipment ordered.

B. All electrical gear arrangements shall be presented in a 1/4 inch scaled drawing showing all equipment, including those of other contractors. This includes all electrical rooms, mechanical rooms, mechanical yards, electrical yards, service platforms, boiler rooms, etc… Include shop drawing cut sheets and applicable information. Indicate on the drawing by dimension all required Code clearances, wiring distances and maintenance access requirements. Where equipment heights are required to be coordinated with architectural or other items, indicate revised heights. Refer to "MOUNTING HEIGHTS."

3.5 GUARANTEE

A. The Contractor shall guarantee all materials, equipment and workmanship for a period of one (1) year from the date of final acceptance of the project. This guarantee shall include furnishing of all labor and material necessary to make any repairs, adjustments or replacement of any equipment, parts, etc. necessary to restore the project to first class condition. This guarantee shall include the replacement of lamps. Warranties exceeding one (1) year are hereinafter specified with individual pieces of equipment.

B. If the Contractor's office is in excess of a fifty (50) mile radius of the project, he shall appoint a local qualified contractor to perform any emergency repairs or adjustments required during the guarantee period. The name of the contractor appointed to provide emergency services shall be submitted to the Architect/Engineer for approval.

3.6 CLEANING

A. Refer to the Specification Section relating to PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

B. Clean all light fixtures, and lenses prior to final acceptance.

END OF SECTION 16001



SECTION 16030 - ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract apply to the Work specified in this Section.

B. Refer to all Electrical Sections of the Specifications, as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

1.2 SUMMARY

A. This section outlines the acceptance testing requirements and division of responsibility.

1.3 SCOPE

A. Contractor shall engage the services of a recognized independent NETA Certified testing firm or professional electrical engineering firm for the purpose of performing inspections and tests as herein specified.

B. The testing firm shall provide all materials, equipment, labor and technical supervision to perform such test and inspections.

C. It is the intent of these tests to assure that all electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

D. The tests and inspections shall determine suitability for energization.

1.4 REFERENCES

A. All inspections and tests shall be in accordance with the latest editions following applicable codes and standards except as provided otherwise herein.

1. National Electrical Code – NEC
2. National Electrical Manufacturer's Association - NEMA.
3. American Society for Testing and Materials - ASTM
4. Institute of Electrical and Electronic Engineers – IEEE
5. National Electrical Testing Association – NETA
6. American National Standards Institute – ANSI
7. State Codes and Ordinances

8. Insulation Cable Engineers Association – ICEA
9. National Electrical Safety Code – NESC

B. All inspections and tests shall utilize the following references:

1. Project Design Specifications
2. Project Design Drawings
3. Manufacturer's Instruction Manuals applicable to each particular apparatus.

1.5 QUALIFICATIONS OF TESTING AGENCY

A. The testing/engineering firm shall be a corporately independent testing organization that can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers and installers of equipment or systems evaluated by the testing firm.

B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations and systems.

C. The testing firm shall have been engaged in such practices for a similar size project.

D. The testing firm shall utilize only full-time technicians who are regularly employed by the firm. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and/or linemen may assist, but may not perform testing and/or inspection services.

E. The testing firm shall submit the "on site" foreman's qualifications and experience through the Contractor at the pre-construction conference for review and approval by the Engineer.

F. Contractor shall submit statement of qualifications of proposed testing firm at the pre-construction conference for approval and acceptance by the Engineer.

1.6 DIVISION OF RESPONSIBILITY

A. Testing firm shall perform the following tests as outlined in these specifications:

1. Equipment Tests
2. Ground Resistance Tests
3. Thermographic Survey

B. Contractor shall perform the following tests as outlined in these specifications:

1. Low Voltage Cable
2. Phasing and Rotation Tests

1.7 TEST REPORT

A. The test report shall include the following:

1. Summary of project.
2. Description of project.
3. Description of test
4. Test results.
5. Conclusions and recommendations.
6. Appendix, including appropriate test forms.
7. Identification of test equipment used.
8. Signature of responsible test organization authority.

B. Furnish three (3) copies of the complete report to the Engineer prior to requesting substantial completion and no later than thirty (30) days after completion of testing procedures unless directed otherwise. After acceptance of the report, Contractor shall submit an electronic copy of the report in PDF format.

C. All tests shall be performed with apparatus de-energized except where otherwise specifically required.

D. The testing firm shall have a designated safety representative on the project to supervise operations with respect to safety.

E. The testing firm shall have a calibration program that assures that all applicable test instrumentation is maintained within rated accuracy. The accuracy shall be directly traceable to the National Bureau of Standards. Instruments shall be calibrated in accordance with the following frequency schedule:

F. Field Instruments: Analog - 6 months maximum
Digital - 12 months maximum

G. Laboratory Instruments: 12 months

H. Leased specialty equipment: 12 months

I. Dated calibration labels shall be visible on all test equipment.

J. Records must be kept up to date which show date and results of instruments calibrated or tested.

K. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.

L. Calibrating standard shall be of higher accuracy than that of the instrument tested.

1.8 GENERAL

A. An outline of tests required is included in this section. Refer to applicable NETA, ANSI, NEMA, IEEE and other test standards for exact procedures, methods and requirements.

PART 2 - PRODUCTS

2.1 Not Applicable

PART 3 - EXECUTION

3.1 TESTS

A. Upon completion of the work, the entire electrical system shall be tested and shall be shown to be in perfect working condition, in accordance with the intent of the specifications.

3.2 EQUIPMENT TESTS

A. The Contractor shall provide the service of equipment manufacturer's field staff for inspection and testing of equipment installed under this contract. The Contractor shall coordinate and schedule test with Owner, Engineer, User Agency and Equipment Manufacturer. Adequate field tests shall be conducted to ensure Engineer, Owner and User Agency that equipment will operate in accordance with these specifications. Specific equipment requiring manufacturer field-testing shall be as follows:

1. Generators
2. Automatic Transfer Switches

B. Testing Agency shall perform thermographic study of all terminations in the new electrical system prior to acceptance. Thermographic study shall be performed after load is placed on the system

C. All 600 volt and below cables shall be tested as specified after being installed but prior to being terminated.

D. Ground resistance tests shall be performed at the pad mounted transformer, at the Service Entrance and at each step-down/step-up transformer as specified.

E. All terminations (lugs, split-bolts, etc.) shall have their "tightness" torque values measured and verified against NEC and manufacturer's requirements.

3.3 GROUND RESISTANCE TESTS

A. Inspect ground system for compliance with plans and specifications.

B. Perform 3-point fall-of-potential test per IEEE Standard No. 81, Section 9.04 on the main grounding electrode or system.

C. The main ground electrode system resistance to ground shall be no greater than one (1) ohm at the pad mounted transformer at the Service Entrance.

3.4 LOW VOLTAGE CABLE, 600 V MAXIMUM

A. Compare cable data with drawings and specifications. Inspect exposed sections of cables for physical damage and correct connection in accordance with one-line diagram.

B. Verify tightness of accessible bolted connection by calibrated torque wrench in accordance with manufacturer's published data. Perform thermographic survey.

C. Inspect compression-applied connectors for correct cable match and indentation.

D. Verify cable color-coding with applicable Engineer's specifications.

E. For all service entrances, switchboards, MCC and all panelboard feeders, perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for one minute.

F. Perform continuity test to insure correct cable connection.

G. Bolt-torque levels shall be in accordance with manufacturer's requirements. Measure and record results.

H. Minimum insulation-resistance values shall be not less than 50 mega-ohms.

I. Investigate and report on all deviations between adjacent phases.

3.5 PHASING AND ROTATION:

A. Perform phasing test on each circuit tie section energized by separate sources.

B. Perform tests from permanent source.

C. Damage caused due to omission of this test shall be corrected at Contractor's expense.

3.6 THERMOGRAPHIC SURVEY:

A. Thermographic survey shall be performed with equipment utilizing long wave technology that provides photo record of deficient areas.

B. Equipment to be inspected shall include all current-carrying devices installed under this contract, generally, all new high and low voltage cable terminations and splices. Specific equipment to be surveyed includes the following.

1. Panelboards
2. TVSS Units
3. Transfer Switches
4. Safety Switches (fused and non-fused)
5. Generators and it's terminations

C. Inspect physical, electrical and mechanical condition. Remove all necessary covers prior to thermographic inspection.

D. Provide report including the following:

1. Discrepancies.
2. Temperature difference between the area of concern and the reference area.
3. Cause of temperature difference.
4. Areas inspected. Identify inaccessible and/or unobservable areas and/or equipment.
5. Identify load conditions at time of inspection.
6. Provide photographic thermograms of all equipment (non-deficient and deficient areas). Provide corresponding digital photograph (non-thermal image) of electrical equipment scanned.
7. Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 degree C at 30 degrees C.
8. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
9. Thermographic surveys should be performed during periods of maximum possible loading but not less than 40 percent of rated load of the electrical equipment being inspected. Refer to NFPA 70B-1994, Section 18-16 (Infrared Inspection).
10. Temperature differences for 1 degree C to 3 degrees C indicate possible deficiency and warrant investigation.
11. Temperature differences of 4 degrees C to 15 degrees C indicated deficiency; repair as time permits.
12. Temperature differences of 16 degrees C and above indicate major deficiency; repair immediately.

END OF SECTION 16030



SECTION 16050 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions; as appropriate, apply to the work specified in this section.

B. Refer to all portions of the Contract Documents as well as the plans and specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

PART 2 - PRODUCTS

2.1 WIRE (600 VOLT AND BELOW)

A. All conductors used in the work shall be soft drawn annealed copper having a composition of not less than 98% of pure copper. Conductors shall be standard code gauge in size, insulated, and shall have insulation rated for use at 600 volts. The contractor's bid shall reflect the use of all copper conductors. When aluminum conductors are used as part of the V.E. process, their use shall be limited to circuits, feeders and services rated 200 Amperes and larger and shall be of the high alloy, compact stranded type, Southwire SIM pull THHN, SIM pull THWN or equivalent. It shall be the contractor's responsibility for properly upsizing the conductors and associated conduit to achieve the equivalent ampere rating of the circuit/feeder/service as specified for copper conductors.

B. Unless otherwise noted or specified, insulation shall be Type THWN. Wires shall be of the single conductor type and shall be stranded. Wire insulation shall not contain any asbestos materials.

C. Wire #8 AWG and smaller may be type MC-cable.

D. Throughout the system, conductors shall be identified as to phase and voltage of system by color-coding. Color-coding shall be continuous the full length of wire for all wire sizes. Identification by permanent paint bands or tags at outlets will not be acceptable. Surface printing at regular intervals on all conductors shall indicate manufacturer, size, voltage, and insulation type. White and/or gray colored insulation shall be used for grounded conductors and only for grounded conductors.

E. The color code assigned to each phase wire shall be consistently followed throughout the project. The following systems of color-coding shall be strictly adhered to:

1. 208/120 V Systems

    a. Grounding leads green
    b. Grounded neutral leads white
    c. Ungrounded phase wires black, red and blue

F. Where multiple neutral conductors are installed in a common raceway, the neutral conductor for each circuit shall be separately identified in accordance with the National Electric Code (NEC).

2.2 CONDUIT

A. Unless otherwise specified or shown on the drawings, all conduit shall be rigid galvanized steel (RGS), electrical metallic tubing (EMT), or rigid nonmetallic conduit (PVC) as allowed in the paragraphs below.

B. RGS may be used for conduit shown run underground (red concrete encasement required), may be used in concrete slabs, and shall be used for conduit run exposed to the weather (locations defined as damp locations and wet locations in Article 100 of the NEC) and shall be run in hazardous areas.

C. EMT shall be used for conduit not encased in concrete, not exposed to the weather, not run underground, and not run in hazardous areas.

D. PVC may be used for conduit run in concrete slabs or may be run underground (underground only where permitted by NEC and local ordinances). Concrete encasement will not be required on underground runs unless specifically noted or specified elsewhere. PVC shall not be run exposed nor concealed in walls nor above ceilings nor in hazardous areas. When rigid nonmetallic conduit (PVC) is installed underground, it shall be Schedule 80 at all underground road crossings, at all underground driveway crossings, and when required by the NEC or local ordinance or specified otherwise. PVC Schedule 40 may be used at all other underground locations. The only use of exposed above ground PVC conduit shall be for telephone service entrance use up utility poles (schedule 80 required), for CATV service entrance use up utility pole (schedule 80 required) or for power utility service entrance use up utility pole (scheduled 80 required).

E. Where PVC is utilized for underground installations, RGS 90º elbows and conduit shall be utilized to turn conduit vertical and to rise up to above grade/slab. Red concrete encasement shall be required for all elbows and vertical conduits. Refer to detail on plans.

F. All conduit shall be new and shall bear the inspection label of the Underwriters Laboratories, Inc. (U.L.).

G. Where multiple conduits are installed underground in the same trench, carlon snap-n-stac spacers, or approved equivalent, shall be utilized and spaced a maximum of 5'-0" apart. Provide pre-cast, 4" thick, concrete bases at each spacer and where conduits are turned to be installed in a vertical orientation. Provide spacers immediately before and after all elbows and where conduit transitions from underground to above ground.

H. Fittings for rigid steel conduit and EMT shall be hot-dipped galvanized and shall be of an approved type specially designed and manufactured for their purpose.

I. All flexible conduit, where installed indoors and outdoors, shall be of the flexible liquid tight metallic type. Flexible weatherproof electrical conduit is prohibited from use on this project.

J. Metallic conduit shall be metallized, sheradized, or hot-dipped galvanized.

K. Where conduit is installed exposed in finished spaces (excluding mechanical, equipment and electrical rooms), conduit shall be painted to match adjacent surfaces (color as selected by the Architect/Engineer). All other conduit installations shall be complete with factory applied paint finish as manufactured by Allied Tube and Conduit (True Color EMT) or Wheatland Tube Company (Color Check Conduit). All fittings, couplings, boxes, covers, etc. shall match color of conduit. Color of conduit shall comply with color code noted below.

Power and Lighting - Non-Emergency	Standard Conduit Finish
Fire Alarm	Red
Tele/Data/CATV	Green
Security/CCTV	Purple

2.3 METAL-CLAD CABLE (600 VOLTS AND BELOW)

A. Where permitted by NEC and local codes and ordinances, metal-clad (MC) cables may be used in lieu of conduit and wiring specified elsewhere herein.

B. Installation of MC cables shall be in compliance with the National Electric Code (NEC).

C. Conductors shall be softdrawn annealed copper having a composition of not less than 98% of pure copper.

D. Conductors shall be solid -type, standard Code gauge in size, insulated, and shall be rated for use at 600 volts or below. Minimum size shall be No. 12.

E. Conductor insulation shall be of a type listed in the NEC and be rated for 75 deg. C (167 deg. F) as a minimum and shall be of a type approved for use in MC cable.

2.4 EXPANSION FITTINGS

A. Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each long run of exposed conduit that may be subject to excessive stresses shall be provided with an expansion fitting. Expansion fittings shall be made of hot-dipped galvanized malleable iron and shall have a factory-

installed packing, which will prevent the entrance of water, a pressure ring, and a grounding ring.

B. In addition to the grounding ring, a separate grounding conductor shall be provided. This grounding conductor shall be an external flexible copper ground securely bonded by approved grounding straps on each end of the fitting. Grounding conductor may be omitted when expansion fitting includes an approved integral grounding conductor or device.

C. Where conduits are buried in concrete, they shall cross the building expansion joints at right angles. Ends of conduit shall be provided with insulated bushings.

2.5 OUTLET BOXES

A. Outlet boxes in concealed conduit systems shall be flush mounted. Boxes shall be galvanized steel of sufficient size to accommodate devices shown and shall have raised covers. Requirements of the NEC shall be minimum.

B. Boxes for lighting fixtures shall be four-inch (4") octagon, not less than 1-1/2" deep. Where boxes are installed in concrete, boxes designed for this application shall be used.

C. Outlet boxes for switches and receptacles in concealed work shall be 4" square, and not less than 1-1/2" deep. Flush mounted outlet boxes shall be installed with plaster rings.

D. Outlet boxes for switches and receptacles installed in exposed conduit system shall be cast iron or cast aluminum Type FD or approved equivalent.

E. Where multiple outlet boxes are shown to be installed at the same location, they shall be installed using B-Line Series BB8 mounting bracket or approved equivalent. Where single boxes are shown to be installed, the B-Line Series BB2 mounting bracket or approved equivalent shall be used.

F. Outlet boxes for adjacent rooms shall not be installed in the same stud space to minimize sound transmission.

G. Outlet boxes used for lighting toggle switches shall have outlet box stabilizer(s) installed.

2.6 PULL BOXES

A. Furnish and install pull boxes. Boxes shall be code gauge galvanized steel with screw attached access panels unless noted otherwise in top, side or bottom as required.

2.7 OUTLET COVER PLATES

A. Unless otherwise noted, all outlets including telephone outlets, television outlets, computer outlets, etc. shall be fitted with cover plates of the type indicated below.

B. Cover plates shall be uniform in design and finish for switches, receptacles, and other outlets requiring cover plates. Plates shall be one (1) piece of the required number of gangs. Sectional plates shall not be used.

C. Cover plates shall be smooth nylon with gray, white, black, brown or ivory finish. Color shall be selected by the Architect/Engineer to suit the wall finish.

D. Provide blank coverplates for all un-used/empty device boxes including, but not limited to tele/data, CATV, access controls, etc....boxes.

2.8 WIRING DEVICES

A. Wiring devices shall be as listed in the following table, except that color of device shall match color of outlet cover plate. The "*" in the model numbers indicate color selection to be made.

1. Leviton / Hubbell (or equivalent by Pass and Seymour)
   Single Pole-20A (5621-2* / DS120*)
   Rocker or Paddle Switch

2. Three Way-20A (5623-2* / DS320*)
   Rocker or Paddle Switch

3. Four Way-20A (5624-2* / DS420*)
   Rocker or Paddle Switch

4. 20A 125V 2P 3W Duplex (16342-* / DR020)
   Decora Style
   Grounded Receptacle

5. 20A 125V 2P 3W Duplex (G5262*/ GFRST20SNAP*)
   GFCI Receptacles (Indoor)

6. 20A 125V 2P 3W Duplex (G5262*/ GFTWRST20SNAP*)
   GFCI Receptacles (Outdoor)

7. 20A 125V 2P 3W Duplex (T5833/USB20AC5)
   Grounded Receptacle with USB-A & USB-C Charging Ports

2.9 WEATHERPROOF RECEPTACLES

A. Weatherproof receptacles shall be duplex receptacles of the ground fault current interrupting type as specified under WIRING DEVICES, mounted in a cast iron or cast aluminum Type FD (or approved equivalent) conduit fitting with Leviton No. 5977-DCL, (or approved equivalent) clear, extra deep GFCI Style weather resistant cover. Weatherproof receptacles shall be flush mounted in exterior walls whenever possible.

2.10 PHOTOELECTRIC CONTROLS

A. Unless otherwise noted on the drawings, photoelectric controls shall be Tork 2100 Series or equivalent by Precision Multiple or Paragon to suit voltage and power requirements of circuits controlled.

2.11 DIMMER SWITCHES

A. Dimmer switches shall be Pass and Seymour Radient series or approved equivalent. Ratings shall be of appropriate wattage for the circuits to be controlled. Provide and install all required 0-10V. control interface units for all LED lighting circuits. Dimmer loading shall not exceed 80% of the dimmer rating. Dimmers shall be UL listed.

2.12 FLOOR OUTLETS/FLOOR BOXES

A. Floor outlets shall consist of the assembly of wiring devices, floor boxes and fittings. Floor boxes shall be16 gauge galvanized sheet metal complete with fusion-banded epoxy paint. Boxes shall be fully adjustable before concrete pour.

B. Contractor shall adjust box such that coverplate is flush against floor surface. When multiple floor outlets are shown directly adjacent to each other, multiple gang type boxes with separating partitions between each gang shall be utilized. Provide separate conduit for each function.

C. Floor boxes shall be round with threads for conduits or hubs as required and be of suitable height for concrete slab use. Box shall be capable of accepting the duplex receptacle or other wiring device or usage as indicated.

D. Each floor box shall be Hubbell System One (or equivalent) with round covers. Quantity of gangs/size of box shall be individually determined by each location's requirements. Provide fire-rated poke-thrus as required by floor assemblies.

E. Color by Architect during shop drawing submittal. Color choices shall include brushed aluminum, black power-coated, brass-plated, bronze-plated and/or satin nickel-plated.

F. As a minimum, provide and install two (2) 120V duplex convenience receptacles, two (2) RJ-11 telephone outlets, four (4) RJ-45 data outlets in each floor box, four (4) USB charging ports and two (2) HDMI ports.

PART 3 - EXECUTION

3.1 MOUNTING HEIGHTS

A. Unless otherwise noted on the drawings or required by the Architect/Engineer, the mounting heights set forth below shall apply. Dimensions given are from finished floor to the top of the device.

1.	Toggle Switches	4'-0"
2.	Receptacles	1'-6"
3.	Panelboards	6'-7" to top of can
4.	Tele/Data Outlets	1'-6"
5.	Electric Water Cooler	Concealed behind unit **

** Contractor shall be responsible for coordinating exact location in field with the plumbing contractor.

B. Where overcurrent or safety switch devices are shown to serve exterior equipment, the Contractor shall review in detail with the Architect/Engineer proposed exterior mounting locations, mounting heights, conduit routing, etc., and receive approval prior to rough-in.

C. Where overcurrent or safety switch devices are shown to serve condensing units, the top of the overcurrent device shall be 3'- 0" AFG or level with the top of the condensing unit(s) whichever is lower. Refer to detail on plans for additional requirements.

3.2 WIRE (600 VOLT AND BELOW)

A. Service entrance, feeders, and motor circuit conductors shall be run their entire length without joints or splices. Splices and joints in branch circuit wiring shall be only at outlets or in accessible junction boxes.

B. Joints and splices in branch circuit wiring shall be made with compression type solderless connectors. Connectors of the nonmetallic screw on type are not acceptable.

C. Terminations or splices for conductors # 6 AWG and larger shall utilize Burndy Unitap, Polaris Black or equivalent connectors.

D. Unless otherwise specified, all wiring shall be installed in conduit.

E. No wire shall be smaller than No. 12 for power or lighting service, fixture whips or for switch legs. Wire for each branch circuit shall be of a single size and type from the branch circuit protective device to the last outlet on the circuit unless noted otherwise.

F. Not more than three (3) branch circuits shall be installed in a raceway for three-phase electrical systems. For single phase electrical systems, the number of circuits in any one raceway shall be limited to two (2).

G. Type THWN conductors may be connected directly to recessed fixtures only when the fixtures are equipped with outlet boxes approved by Underwriters Laboratories, Inc. for use with wires having insulation rated for maximum operating temperature of 75o C., (167o F.); otherwise, conductors with Type SF2 insulation shall be run from fixture terminal connections to an outlet box placed at least one foot (1') from the fixture, such a tap shall extend for at least four feet (4'), but not more than six feet (6'), in flexible metal conduit.

H. Branch circuit home run numbers shown on the drawings shall be used for connection of circuit wiring to similarly numbered protective devices in branch circuit panelboards.

I. Where the length of a home run, from panel to the first outlet exceeds 75 feet (75') for 120-volt circuits, the conductor size shall be No. 10 AWG or that shown on the drawings, whichever is larger.

J. For all 3-phase circuits, contractor shall provide and install a full-size neutral conductor and a grounding conductor for a complete 5-wire circuit. If the neutral conductor is not required by the equipment, contractor shall install wire nuts on each end of the neutral conductor for future use.

3.3 CONDUIT

A. When conduits are shown to be installed in the floor slab, under the floor slab, or underground, whenever possible and approved by the Architect/Engineer, conduits one-inch (1") trade size and smaller shall be installed in the concrete floor slab. Conduits embedded in concrete slabs shall have lateral spacing not less than three diameters except where the slab has been specially designed to accommodate closer spacing.

B. Conduits larger than one-inch (1") trade size shall not be installed in the floor slab and shall be installed a minimum of twelve inches (12") below the floor slab.

C. Conduits shown underground but not in or under a floor slab shall be installed not less than thirty inches (30") below grade. Conduit locations shall be identified by means of 4" wide, detectable, Red warning/ marker tape installed in trench in accordance with NEC requirements

D. Prior to backfilling of trenches and /or providing concrete encasement, contractor shall take photographs of conduit installation including spacers/supports and concrete support blocks. In addition, prior to backfilling trenches and after concrete encasement, take additional photographs of installation. Submit photographs to engineer upon request.

E. Rigid conduit joints shall be made with threaded fittings made up tight with at least five threads fully engaged. Compression type threadless fittings and setscrew type fittings shall not be used for RGS unless specifically approved in writing by the Architect/Engineer.

F. Couplings and connectors for EMT shall be compression type or cast iron set screw type.

G. Where conduits enter boxes or cabinets that do not have threaded hubs the conduit shall be secured in place with galvanized locknuts inside and outside and shall have bushings inside for interior locations. All exterior terminations shall be made with Meyers hubs or approved equivalent. Conduits larger than one inch (1") shall have galvanized insulating bushings.

H. All conduits shall be installed as indicated or scheduled on the drawings and shall be of sufficient size to accommodate the required number of insulated conductors including equipment-grounding conductor. A grounding conductor shall be pulled in every raceway and properly terminated. The Contractor shall increase the conduit size from that shown on the drawings where necessary to accommodate the equipment-grounding conductor and/or where to comply with the NEC.

I. Unless otherwise noted, conduit shall be run concealed. Conduit runs from wall mounted receptacles, toggle switches, etc. shall be run concealed in walls whenever possible.

J. Conduit runs shall be straight; elbows and bends shall be uniform, symmetrical, and free from dents or flattening. All conduit shall be installed with runs parallel or perpendicular to walls, ceilings and structural members.

K. Conduit shall not be run nearer than three inches (3") to hot water or steam pipes except where crossings are unavoidable. Conduit shall be kept at least one inch (1") from covering of pipe crossed and the conductor size shall be increased one (1) size

L. Conduit shall be held securely in place by approved hangers and fasteners of appropriate design and dimensions for the particular application. Support shall be such that no strain will be transmitted to the outlet box and/or pull box supports. Conduit shall be secured only to the building structure.

M. All conduit runs shall be installed in accordance with all applicable sections of the National Electrical Code and local codes or ordinances.

N. Where empty conduits are shown, a #14 pull wire shall be installed and conduits shall be capped.

O. Terminations to all mechanical equipment and to all dry-type transformers shall be made using a minimum of 12" to a maximum of 24" liquid-tight flexible metallic conduit.

P. At each concealed junction box in the power and lighting system, identify the panel and circuit number(s) contained in the junction box by writing in permanent marker on the outside of the junction box cover.

Q. Where conduits are run from condition spaces to/thru un-conditioned spaces, the ends of the conduits shall be sealed (after conductor installation) to prevent the transmission of air from non-conditioned spaces in to the conditioned spaces. Expanding spray foam and EYS seals are approved methods of sealing conduits.

R. For all surface mounted devices, including fire alarm, intercom and nurse call systems, device boxes shall be Wiremold No. R5752 and R5753 or approved equivalent style boxes sized such that device does not overhang edge(s) of back box. Color of box shall match device.

3.4 METAL-CLAD CABLE (600 VOLTS AND BELOW)

A. The metallic sheath shall be galvanized steel or aluminum corrugated sheath type and shall be terminated at outlet boxes, cabinets, etc. with fittings specifically approved for such use, which shall properly ground the metallic sheath.

B. Each metal-clad cable assembly shall have one (1) green insulated ground conductor sized as required by NEC for the application as a minimum size.

C. Where run in walls, cable shall be fastened using B-Line Series BX4 or approved equivalent cable fasteners. Cable shall be fastened to wall stud not more than 8" from entry into device box.

D. MC Cable shall be supported horizontally and vertically every 5' minimum or closer where required by NEC and applicable federal, state and local ordinances.

3.5 WIRING DEVICES

A. All wiring devices installed shall be identified as to which panel serves it and which overcorrect protection device protects the wiring device. This shall be accomplished via panel name and circuit number being written using a permanent marker on the back side of the coverplate.

3.6 MANUFACTURER'S DIRECTION

A. Contractor shall be responsible for coordinating all aspects of equipment electrical service installation for all electrical gear, devices, mechanical, plumbing, fire protection, architectural, and owner furnished equipment including any and all medical equipment. Contractor shall obtain and review actual manufacturer's installation instructions and shall install electrical facilities to said equipment in accordance with the instructions, NEC, NFPA and contract documents. Should a discrepancy exist between the manufacturer's installation directions and the contract documents, the engineer shall be notified in writing immediately.

3.7 COORDINATION WITH OTHER TRADES

A. Prior to purchasing and installing any wire and/or conduit for all circuitry to mechanical equipment, medical equipment, owner furnished equipment, and other equipment requiring electrical power furnished by other trades as part of this project, contractor shall review equipment cut sheets and shall verify exact equipment electrical requirements. Any discrepancies between contract documents and equipment submittals shall be immediately brought to the architect/engineer's attention for clarification.

END OF SECTION 16050



SECTION 16313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, I nominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.
3. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor can survive published surge current rating on a per mode basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable. In house testing will not be accepted.
4. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage. MCOV shall be a tested value per section 37.7.3 of UL1449 4th Edition.

2.2 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR (Type A)

A. Basis of Design: Subject to compliance with requirements. Provide comparable product to the following:

1. Current Technology "TG3" Series. Equal by ASCO 570 Series

B. SPDs: Listed as Type 1 SPD per UL1449 4th Edition

1. SPDs with the following features and accessories:

a. Integral disconnect switch (where breaker not provided).
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts: one normally open and one normally closed, for remote monitoring of protection status, and Advanced monitoring with status, surge counter and history log of events.

C. Comply with UL 1283 with a maximum attenuation of 54dB based on 50ohm insertion loss test per MIL-STD-220B

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per mode shall not be less than 200 kA. 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 or up to and not to exceed 200,000 kA.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277V or 208Y/120V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 700 V for 208Y/120 V.
3. Line to Line: 1200 V for 208Y/120 V.

F. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: [700 V] [1000 V].
3. Line to Line: 1200 V.

G. SCCR: Equal or exceed 200 kA.

H. I nominal Rating: 20 kA and compliance to all UL96A requirements for ac surge protection.

I. Temporary Over Voltages: SPD shall be able to prevent common temporary over voltages from damaging the MOVs, increasing longevity and ability of SPD unit to protect the critical load. 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%

J. 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 PANEL SUPPRESSORS (Type B and C)

A. Basis of Design: Subject to compliance with requirements. Provide comparable product by the following:

1. Current Technology "TG3" Series. Equal by ASCO 570 Series

B. SPDs: Listed as Type 1 SPD per UL1449 4th Edition

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per mode shall not be less than 150 kA (Type B) and 50 kA (Type C). The peak surge current rating shall NOT be the arithmetic sum of the ratings of the individual MOVs in a given mode. SPD manufacturer shall provide independent 3rd party testing validating unit is capable of surviving a single surge at the specified rating.

D. Comply with UL 1283 with a maximum attenuation of 34dB based on 50ohm insertion loss test per MIL-STD-220B

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277V or 208Y/120V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 700 V for 208Y/120 V.
3. Neutral to Ground: 700 V for 208Y/120 V.
4. Line to Line: 1200 V for 208Y/120 V.

F. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

G. SCCR: Equal or exceed 200 kA.

H. Inominal Rating: 20 kA

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 3R.

2.5 CONDUCTORS AND CABLES

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" (HPI) 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

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. If installed lead length must exceed 10', SPD manufacturer shall provide a low impedance cable that improves the installed performance.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 SYSTEM TESTING

A. Upon completion of installation, provide the start-up and testing services of a factory-authorized and factory-trained local service representative. 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 and 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.

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 16313



SECTION 16400 - ELECTRICAL DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions); as appropriate, apply to the work specified in this section.

B. Refer to all Electrical specification sections, as well as the plans and specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

1.2 ELECTRIC SERVICE

A. Contractor shall be responsible for obtaining a new 120/208 volt 3 phase 4 wire underground electric service from the local power company, Entergy, as specified herein and as shown on the Drawings. The Contractor shall be responsible for all utility company fees and for the timely coordination of all utility company work.

1.3 GENERAL

A. All electrical gear furnished as part of this project, panelboards, switchboards, motor control centers, dry-type transformers, safety switches, etc. shall be of the same manufacturer unless specified otherwise. Electrical equipment manufactured by a subsidiary or parent company of manufacturer that is prior approved is not itself prior approved unless its own manufacturer's name specifically is listed as being prior approved.

1.4 ARC-FLASH; COORDINATION AND FAULT CURRENT STUDIES

A. As part of the electrical gear shop drawings, the contractor shall perform and submit complete arc–flash, coordination and fault current studies, including phase-to-phase and ground faults for coordinating all elements of the distribution system. These three studies shall be performed and furnished by the successful electrical gear manufacturer. Contractor shall refer to these specification sections for specific study requirements. These studies shall be submitted simultaneously with the gear submittal or the gear submittal will be returned un-reviewed.

1. Overcurrent Protective Device Short-Circuit Study (Cannot be VE'd from project)
2. Overcurrent Protective Device Coordination Study
3. Overcurrent Protective Device Arc-Flash Study (Cannot be VE'd from project)

B. Provide all arc-flash safety and short circuit current stickers on all panels, switchboards, safety switches, motor control center, etc. as required/specified. Refer to details for additional requirements. Proposed stickers for each individual piece of gear shall be submitted for review as part of shop drawings.

C. Provide and install a fully coordinated electrical distribution system as directed by the Overcurrent Protective Device Coordination Study at no additional costs to the Owner.

D. In addition, this study shall indicate all required settings for adjustable circuit breakers and motor circuit protectors. These settings include instantaneous, short time, long time, ground fault trip characteristics and all-time based pick-up, drop-out and re-close parameters.

E. The contractor shall provide all breakers, trip plugs, solid state breakers, etc. to provide a fully coordinated electrical system as identified in the coordination study. This shall be accomplished as part of the Base Bid and all alternates at no additional costs to the owner and/or design team.

F. Refer to individual specification sections of each specified study for additional requirements.

G. Electrical gear submittals will not be reviewed until all device studies specified are performed, submitted and approved.

1.5 SERIES RATING OF EQUIPMENT

A. The electrical gear provided and installed as part of this project shall not be series rated.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Panelboards shall be circuit breaker type using quick-make, quick-break, trip free, thermal magnetic trip indicating, bolt-on circuit breakers. Two and three pole branches and mains shall be common trip. Panelboards shall be dead front safety type with main breaker or main lugs, and number and size of branches as shown on the drawings. Panelboards shall have single, feed through, or double lugs, to accommodate feeder conductors as shown on the drawings, and shall have neutral and ground bus for termination of conductors. Bussing shall be copper.

B. Doors shall be fitted with flush cylinder locks, keys to which shall all on project be alike. Two (2) keys shall be furnished for each lock. Cabinet fronts shall be finished as directed by the Architect/Engineer. Cabinet fronts shall not be removable with door in the locked position. Provide for each panel a directory frame with waterproof transparent plastic window on inside of door and place therein a typewritten identification of all circuits.

C. Directories shall be made only after permanent room numbers have been assigned. Room numbers shown on the construction drawings shall not be used for making directories. Each circuit shall be clearly identified as to use and location (ex: Receptacles Rooms 201, 202 or Lighting Rooms 207, 209, 211, and 213).

D. Cabinets shall be galvanized steel not less than twenty inches (20") in width. Gutters shall not be smaller than minimum dimensions required by the National Electrical Code.

E. Double section panelboards shall be comprised of cabinets of equal dimensions.

F. All panels rated NEMA 1, shall be of the door-in-door type construction providing tool-less access to interior of the panelboard(s).

G. Panelboards shall be as shown in the schedules and shall be completely factory assembled. Do not purchase panelboards or cabinets until shop drawings have been approved. Approved manufacturers include:

1. General Electric
2. Square D
3. Eaton-Cutler Hammer
4. Siemens
5. Approved Equivalent

H. Minimum short circuit current interrupting ratings for circuit breakers shall be 22,000 amps. Where a specific interrupting rating is shown on the drawings, in the panel schedules, or as required by the coordination and fault current study, panelboards and associated circuit breakers shall be rated for that value as a minimum at no additional cost to the owner.

I. In branch circuit panelboards having two (2) vertical columns of devices, circuit numbers shall be such that, starting at the top, odd numbers shall be used in sequence down the left hand side. See Schedule of Panelboards on drawings for circuit device sizes and number of poles.

J. Construction of panelboards shall be such that, where applicable, any three (3) adjacent single-pole devices are individually connected to each of the three different phases in such a manner that 2 or 3 pole devices, when available, can be installed at any location.

K. UL Listing: Panelboards shall be listed by UL and bear the UL label.

L. Interior panelboards shall be NEMA 1 unless noted otherwise. All exterior panelboards shall be rated NEMA 3R.

2.2 LABELS

A. All panelboards, contactors, safety switches and fused safety switches installed by this contractor shall have plastic tags with 1/4" characters embossed thereon identifying the equipment by name, voltage, ampacity, phase and number of current carrying conductors such as:

Panel Name
120/208 V - 400A
3 Phase - 4 Wire
Fed From Panel:_____, Circuit _____
Fused @ _____**

The tags shall be fixed to the center of the equipment cover/door with a suitable heavy duty industrial grade adhesive.

**Note – For fused safety switches, label shall include fuse sizes contained therein.

B. Color Coding of labels shall be as follows:

Normal Power	White Background with Black Letters

2.3 LIGHTING CONTACTORS

A. The Contractor shall furnish and install lighting contactors where shown on the drawings except those contactors shown mounted in branch circuit panelboards shall be factory mounted by panelboard manufacturer. Contactors shall be suitable for use at voltage rating of circuits controlled and shall have the number of poles and ampere rating shown on the drawings as a minimum.

B. The contactor amp rating shall be continuous per pole for all types of ballast and tungsten lighting, resistance and motor loads. The contactor shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. The contactor shall have straight-through wiring with all terminals clearly marked. The contactor shall be approved per UL508 and/or CSA, and be designed in accordance with NEMA ICS2-211B. They shall be industrial-duty rated for applications to 600 volts maximum. The contactor shall have the following:

1. Control-circuit fuse holder, with one (1) fuse.
2. 0.2-60 second TDE (Time Delay Energize) and TDD (Time Delay De-energize) timer attachments.

C. The contactor shall have a NEMA Type I enclosure, and shall be the mechanically held type.

D. Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated.

2.4 SAFETY SWITCHES

A. Furnish and install safety switches at locations and in capacities shown on the drawings, as hereinafter specified and/or as required by the latest edition of the National Electrical Code.

B. Safety switches shall be rated heavy duty and fusible.

C. Safety switches exposed to the weather shall be rated NEMA 3R.

D. Safety switches shall be of the solid neutral type where required by circuit or feeder specified.

E. Safety switch covers shall be internally mechanically held closed when in the ON position and shall be allowed to open in the OFF position. The switch shall come equipped with provisions to allow the switch to be padlocked in the off position.

F. Galvanized angle or other suitable supports shall be provided for switches that cannot be mounted on walls or other rigid surfaces. Switches shall not be supported by conduit alone and shall not be mounted on HVAC or other equipment unless specifically approved by the Architect/Engineer. Verify mounting heights for all exterior locations with Architect/Engineer prior to rough-in.

G. Safety switches shall be General Electric, Square "D", Eaton Electrical, Siemens or approved equivalent.

2.5 FUSES

A. Unless otherwise noted or specified, all fuse holders shall be equipped with dual-element, time-lag, and current limiting fuses. Provide one (1) spare set of fuses for each size initially installed, with a minimum of three (3) fuses of each size. Spare fuses shall be turned over to the Owner's maintenance supervisor prior to requesting substantial completion inspection.

B. Fuses shall be Gould, Bussman, or approved equivalent.

PART 3 - EXECUTION

3.1 MANUFACTURER'S DIRECTION

A. All electrical gear shall be installed in accordance with the manufacturer's directions. Contractor shall review these directions prior to rough-in. Should any discrepancies exist between the contract documents and the manufacturer's direction, contractor shall advise the engineer in writing.

B. All electrical terminations shall be properly tightened to manufacturer's specifications. Where manufacturer's specifications are not available, contractor shall refer to the NEC and adjust tightness valves (torque) to the NEC published values.

C. Install all safety switches, breakers, disconnects, etc., in accordance with manufacturer's directions and maintain all required NEC clearances. Coordinate exact locations in field with applicable contractors.

END OF SECTION 16400



SECTION 16401 - OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

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 a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Short-Circuit Study Specialist and Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and 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.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. SKM Systems Analysis, Inc.
2. ETAP

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:

      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
      3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Engineer.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Control panels.
7. Standby generators and automatic transfer switches.
8. Branch circuit panelboards.
9. Disconnect switches.

3.3 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION 16401



SECTION 16402 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

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 computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.

3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Coordination Study Specialist and Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. The following parts from the Protective Device Coordination Study Report:

        1) One-line diagram.
        2) Protective device coordination study.
        3) Time-current coordination curves.

    b. Power system data.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and 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.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. SKM Systems Analysis, Inc.
    b. ETAP

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

    a. Arcing faults.
    b. Simultaneous faults.
    c. Explicit negative sequence.
    d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:
1) Adjustable pickups and time delays (long time, short time, ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

K. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

3.3 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.4 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of the system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of the motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141 and voltage sags so as not to affect the operation of other utilization equipment on the system supplying the motor.

3.5 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Engineer.

2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.

c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.7 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 16402



SECTION 16403 - OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.

2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Specialist and Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and 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.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. SKM Systems Analysis, Inc.
   b. ETAP

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

G. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude with and without required Arc Energy Reduction methods.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:

1. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to the attention of Engineer.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.

11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.4 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Control panel.

3.5 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.6 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION 16403



SECTION 16455 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions) as appropriate, apply to the Work specified in this Section.

B. Refer to all Electrical portions of the specifications, as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

1.2 GENERAL

A. Contractor shall provide grounding of service equipment, transformers, non-current carrying conductive surfaces of equipment, cable tray, metallic raceways, fencing, metal buildings, structures and other equipment as specified herein and as shown on the drawings.

1.3 SCOPE

A. The equipment shall be grounded as shown on the plans and as specified herein. All metal structures and equipment, including fences, shall be connected to the systems ground grid. Ground conductors must be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.

B. Provide and install 1" C with insulated 3/0 C.U. service grounding conductor from grounding electrode(s) to telephone service backboard and to each and every tele/data/CATV closet.

C. Provide and install Andrew Corporation No. MTC 9674TS 1/4" x 2" x 10" Tamper Resistant Copper Bus Bar Kit or approved equivalent, at each telephone service backboard, data backboard, CATV backboard in the MDF Room and IDF Rooms. Terminate 3/0 C.U. conductor to each bus bar. Refer to details.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Main grounding conductors shall be bare, soft drawn, stranded, single conductor copper wire, and generally sized as follows:

1. Ground grid cable: #3/0 AWG
2. Equipment and structures to grid conductor: #3/0 AWG
3. Fence grid conductor: #3/0 AWG
4. Fence-to-fence post conductor: #2 AWG (Stranded)
5. Fence post to grid conductor: #2 AWG (Stranded)

2.2 CONNECTORS

A. All connectors shall be of the exothermic weld type.

2.3 GROUND RODS

A. Ground electrodes shall be copper-clad steel rods nominal 3/4 inch in diameter and ten feet (10') long.

2.4 EXOTHERMIC WELD PROCESS

A. All wire-to-wire exothermic welds shall be the parallel type. Wire-to-wire rod connections shall be "T" type. The following is a partial list of approved Cadweld type connections. Prior approved equivalent connectors by other manufacturers may be utilized.

Connections	Cadweld Type
Parallel cable-to-cable	PG
Cable to ground rod	GR, FT, NT or NX
Cable to steel	VN
Cable to lug	LA
Cable to rebar	Consult factory (similar to RR)

PART 3 - EXECUTION

3.1 EXPOSED NON-CURRENT-CARRYING METAL PARTS

A. Ground connections to equipment or devices shall be made as close to the current-carrying parts as possible; that is, to the main frame rather than supporting structures, bases or shields. Grounding connections shall be made only to surfaces that are clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease and dirt. Copper and galvanized steel shall be cleaned to remove oxide before making welds or connections. Code size ground conductors shall be run in all conduits containing circuits protected by overcurrent devices; then properly terminated.

B. All raceways, cable racks, cable trays, conduits, armored or shielded cable or cables with ground and all exposed non-current carrying metal parts shall be grounded. Such items shall be bonded together and permanently grounded to the equipment ground bus.

Conduits shall be connected by the grounding bushings or clamps to ground bus. Flexible "jumpers" shall be provided around all raceway expansion joints. Bonding straps for steel conduit shall be copper. Jumper connections shall be provided to effectively ground all sections of rigid conduit connected into plastic pipe. No metallic conduit shall be left ungrounded. In conduit systems interrupted by junction or switch boxes where locknuts and bushings are used to secure the conduit in the box, the sections of conduit and box must be bonded together using grounding bushings.

C. Any conduits entering low voltage (600 volts or below) equipment through sheet metal enclosure and effectively grounded to enclosure by hub need not be otherwise bonded. Both ends of ground buses in switchboards, etc., shall be separately connected to the main ground bus to form two (2) separate paths to ground.

D. All metal buildings shall be grounded by separate grounding conductor and ground rods. Fencing (existing and new) shall be grounded as specified herein and as shown on the drawings. Where exposed to physical damage, the ground wires shall be suitably protected with PVC conduit enclosures. Cables below grade shall be laid with a reasonable amount of slack to reduce the possibility of breakage.

3.2 EXOTHERMIC WELD PROCESS

A. The grounding grid shall be installed and connected as specified herein and as shown on the drawings using an exothermic weld process (Cadweld or other approved manufacturer). Where bolted connections are required, brass/bronze 2 hole pads exothermically welded to the grounding conductor shall be used.

B. All exothermic weld grounding connections shall be made using exothermic welded Cadweld (or other approved manufacturer) connections, tools and materials.

C. Unless noted otherwise, all copper-to-copper or copper-to-steel splices and terminating specified shall be made with exothermic welds.

D. Steel surfaces shall be ground or filed to remove the galvanizing coating and the surface cleaned and dried thoroughly prior to making the welds. All welds shall be repainted with an approved galvanized paint after the welds are made.

E. Copper surfaces shall be sanded to remove oxides and the surface cleaned and dried thoroughly prior to making the welds. All welds shall be painted with an approved anti-oxide manufactured by T&B or Burndy (or other approved manufacturer) to prevent corrosion.

F. Brass/bronze split bolts shall be used to connect the fence grounding conductors where shown on the drawings.

G. Where bolted connections are specified, brass/bronze 2 hole pads shall be utilized except for equipment manufactured neutral and ground busses. The equipment to be grounded shall be cleaned of all paint, dirt, and rust prior to making the bolted connection. All bolts, nuts, washers, and lock washers shall be stainless steel. All such connections shall

be coated with an approved anti-oxide compound. Only one (1) 2-hole pad shall be terminated on one (1) set of bolts, nuts and washers.

H. Where approved in writing by the Engineer, brass/bronze pipe ground clamps or 2 set screw 2 hole pads may be used for special conditions.

I. Where grounding conductors or PVC conduits penetrate walls, floors, etc., these openings and conduits shall be sealed with Dow Corning No. 2001 Silicone RTV (or other prior approved manufacturer) after installation is complete.

J. Provide gradual bends for all grounding grid cables wherever possible. Sharp bends will not be permitted. The minimum being radius should be 8 inches.

K. The Contractor shall notify the Architect/Engineer when the buried grounding grid is completed for inspection by the Engineer prior to backfilling. Notification should be no less than 24 hours prior to scheduling the backfill of trenches.

L. The Contractor shall test the grounding grid resistance and continuity. The testing shall be performed after all underground and above ground connections have been made. Refer to "Acceptance Testing" specification section for additional requirements.

3.3 ELECTRICAL SERVICE ENTRANCE

A. Grounding conductor shall be installed from one (1) ground rod to the next and then looped back to the service equipment. Both ends of the grounding conductor loop shall be properly terminated on the service equipment's neutral bus. Provide all required lugs to accomplish this. Properly bond to ground buss per NEC requirements.

B. Ground rods shall be spaced a minimum of 6'0" from each other.

C. Extend grounding conductor to all metallic water piping, building steel, concrete reinforcing steel, all other building steel for adjacent buildings services from main electrical service and properly terminate.

D. Grounding conductor shall be installed using 1" schedule 80 PVC conduit.

E. Prior to pouring of slab(s) and prior to covering grounding grid, contractor shall take digital photographs of all ground rods, terminations, conductors and overall photo and shall submit to engineer prior to requesting substantial completion.

F. Provide and install hand-hole (inspection well) with bolt-down removable cover at all ground rods to allow visual inspection of the terminations of the grounding conductors to the grounding electrode(s). Refer to details for additional requirements.

END OF SECTION 16455



SECTION 16471 - TELEPHONE/DATA/CATV COMMUNICATION SYSTEM(s)

PART 1 - GENERAL

1.1 The Contractor shall provide install and connect the complete telephone/data system equipment, backboards, conduit, cable tray, j-hooks, wiring and testing as specified herein and shown on the drawings.

1.2 SCOPE OF WORK

A. This installation includes the furnishing of labor, materials, and equipment required for the installation of all service, inside station, and riser cables for telephone and data use between distribution frames, and to each station outlet location required by the plans and specifications.

B. The work shall include but is not necessarily limited to the following:

1. Furnish and install telephone outlets, data outlets, TV outlets, cables, connecting blocks, backboards, conduits, mounting brackets and associated hardware for bundling, racking and cross-connecting as required.
2. Furnish and install one (1) 1" C from each tele/data outlet concealed up wall to above ceiling. Turn conduits 90º and extend conduit to accessible ceiling space. Provide nylon bushings at ends of conduits. Coil 36" of spare cable (for each cable installed) and secure loop at quarter points of the loop. Extend cables to respective termination point(s).
3. Furnish and install two (2) 4-pair EIA - Category 6a UTP telephone/data station cable to each tele/data outlet shown on the drawing and specified herein. Cables shall be plenum rated where installed in plenums.
4. Furnish and install duplex EIA/TIA 568A, 8 pin 4-pair modular RJ45 data jacks at each telephone/data outlet shown on drawings as specified herein. Color of each jack shall comply with owner's color coding requirements. Verify color coding requirements in writing with owner prior to purchasing jacks.
5. Furnish and install 6-position modular type wall outlets for all telephone/data shown on the plans. Color of wall outlets shall match color of wall devices and shall be selected in shop drawings.
6. Furnish and install grounding and ground bars as shown on the drawings and as specified. Refer to Section Grounding for additional requirements.
7. Provide and install all required pigtails to Type 110 blocks and terminate each end of the multi-pair station service cables. Copper phone cables only.
8. Furnish and install on the plywood wall backboards all type 89 brackets and Type 110 terminal blocks as shown on the drawings and specified herein for proper termination of the wiring. Copper phone cables only.
9. Furnish and install type184 binder post as required on backboards. Copper phone cables only.
10. Furnish and install two (2) 2" telephone service entrance conduits from main telephone equipment room to property line. Refer to site plan

11. Furnish and install two (2) 2" CATV service entrance conduits, from main CATV equipment room to property line. Refer to site plan.
12. Install 1-RG6 plenum rated quad shield coax cable from video receivers to each TV outlet and terminate as required on each end.
13. Contractor shall submit an installation color coding, labeling and testing plan for each floor prior to commencing work.

1.3 APPLICABLE DOCUMENTS

A. The following current issues of rules and regulations shall apply to this scope of work:

1. EIA/TIA 568, 569, 570, 606, TSB36, TSB40
2. Building Industry Consulting Service (BICS)
3. Telephone Standards Handbook GHB-155
4. Planning Handbook CHB-156
5. Design Handbook CHB-157
6. REA Construction and Installation Manuals
7. REA Specification PC4 for Acceptance Tests
8. List of Materials Acceptable for use on telephone systems of REA borrowers
9. National Electric Code (NEC)
10. State and Local Codes
11. Telco System Practices
12. UL

1.4 GENERAL REQUIREMENTS

A. Installation costs including all necessary materials, cables, closures, bridging clips, splice materials, and terminations are to be the responsibility of the Contractor.

B. Cables routed above the drop ceiling and where not installed in conduit shall be supported to the structure utilizing "J" hooks. Cables are not allowed to rest on the ceiling tiles nor building steel. Maximum clearance to other electrical systems shall be maintained.

C. All cables, wires, and equipment shall be securely and neatly installed. Inside routings shall be installed parallel and perpendicular to existing structural lines and members.

D. All cables, wires, and equipment shall be firmly held in place. Fastening and support shall be adequate to support their load with ample safety factors.

E. The Contractor shall be responsible for replacing, restoring, or bringing to original condition any damage to floor, ceilings, walls, furniture, grounds, pavement, etc., caused by his personnel and operations. Contractor shall restore any damage or disfigurements at his expense.

F. Cables shall be continuous; no splices will be allowed.

G. The Contractor shall refer to the Construction Phasing Description section of these specifications for additional information and requirements. It is intended that the Telephone and Data Communications System be placed in service and be of beneficial use to the Owner at the completion of each construction phase of the work prior to occupancy by the Owner.

H. The Contractor shall coordinate all of his work with the Owner's Information Network Department to maintain tele/data service to the old and new systems as may be required. The Contractor will provide all new services as specified and shown on the drawings in a timely manner.

I. The Contractor shall not interrupt existing tele/data services and systems in any way until new facilities are in place and approval is received from the Information Network Department and the Architect/Engineer.

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATIONS

A. Inside Unshielded Twisted Pair (UTP)

1. All unshielded twisted pair requirements for use shall meet EIA Category 6a plenum specifications.

    a. NEC
    b. UL
    c. ANSI/ICEA Publication S-80-576
    d. EIA/TLA 568, 569, 570, 606, TSB 36, TSB 40

2. Multi-pair Riser Cables

    a. Cables from the MDF shall be further distributed to each of the other closets and terminated on 110 block in the IDFs there. The intra-building inter-IDF cables shall be of the multi-pair type, conforming to or exceeding the following EMMA 568 physical specifications of CAT 6a physical specification.

3. UTP Patch Cords

    a. EIA Category 6a UTP patch cords shall be supplied at each wall outlet for each jack installed. At the MDF's and IDF's, patch cords shall be terminated at both ends in 4-pair Type 110 or equivalent connectors for plugging onto the type 110 or equivalent cross-connect panels, IDFs and MDFs. The other patch cords shall be terminated in 8 position modular male connectors at both ends conforming to FCC Part 68 Rules, Subpart F. The ends shall be wired in accordance with EIA/TIA 568B.

4. UTP Termination Wall Plates

   a. The four-pair horizontal cables shall be terminated on 6-position modular duplex (two) outlets meeting EIA specifications for EIA Category 6a UTP and configured in compliance with T56B. The outlets shall be in compliance with FCC Part 68 Rules, Subpart F. The outlets with integrated or separate cover plates shall be installed in single standard electrical wall boxes. The data termination shall allow keyed connectors. The termination of wires shall be by the insulation displacement method equivalent to type 110 and shall require the use of the same punch down tool as the UTP termination blocks specified below.
   b. Jacks shall allow the insertion of 4 and 6 pin plugs as well as 8 pin plugs or RG6 - Coax connectors. Metal faceplates specified for all wiring devices. Each faceplate shall have provisions for inserting colored tabs to provide use identification for each jack

5. UTP TERMINATION BLOCKS

   a. At the MDF and IDF closets, all UTP cables shall be terminated on rack mounted two (2) "U" 48 -port patch panels and terminating blocks meeting EIA/TIA 568 specifications for EIA Category 6a UTP. These terminating blocks shall be used for MDFS, IDFs and all UTP cross-connect requirements. They shall allow termination of cables as well as the capability of connecting pre-assembled single pair and composite 4-pair patch cords. Termination blocks to be used for terminating outside plant cables shall be equipped with gas discharge protection units.
   b. The blocks shall be equipped with designation strips and color coded for terminating sets of four pairs of wires in accordance with ICEA specifications.
   c. Cable tie wraps shall be included to neatly route, store and organize the termination cables.

6. INSIDE FIBER

   a. All fiber optic cables shall comply with the FDDI specifications published in ANSI Standard. The cables shall also comply with EIA and the FOTP specifications. The fibers in the cable shall conform to the industry standard color coding as specified by EIA. The outer jacket shall have markings indicating that it is a fiber optic cable. Other markings shall be core size and mode.
   b. Unless specified otherwise, all fiber optic cables shall be a minimum of twelve (12) strands.
   c. Fiber optic cable shall be tight-buffered riser cable, single-mode, OS 2, complete with flame retardant jacket.
   d. Cables shall be NEC OFNR listed and compliant to UL-1666, CSA FT-4, and ICEA S-83-596 standards.

7. FIBER CONNECTORS

a. All fiber optic cables shall be terminated on connectors installed on rack mounted patch panels. The connectors shall be of the Type LC as defined in the EIA 568 or ANSI FDDI standards, constructed of ceramic or metal/ceramic materials. Plastic connectors shall not be used.
b. The connector design shall incorporate strain relief such that it can withstand pulling, bending or twisting of the cable during installation and removal without affecting its operating characteristics.
c. The connectors shall conform to all applicable EIA specifications for attenuation, durability, tensile strength, thermal shock, temperature cycling, humidity, impact, etc.
d. Provide and install all fiber patch cords complete with LC connectors at both ends. Patch cords shall be 3-meters in length.

8. TYPE LC TERMINATING OUTLETS

a. The connectors and adapters shall conform to specifications as outlined for connectors.

9. FIBER OPTIC SPLICES

a. All fiber optic cables shall be installed in continuous lengths without splices. If splicing is required for extra long distances, the splices shall be constructed by fusion and offer an attenuation of no more than 0.2 dB per splice. Mechanical splices are not permitted. All splices shall be stored neatly in splice boxes that allow easy access for maintenance and testing.

10. FIBER TERMINATION PANELS AND ADAPTERS

a. The fiber optic cables shall be terminated in Type LC connectors. The terminated fibers shall be inserted in Type LC or equivalent fiber optic couplings /adapters/barrels mounted on rack mounted termination panels/enclosures. The panels shall be of metal construction with the capability of neatly storing excess fiber lengths and providing protection from dust and dirt. The panels shall allow ease of access to and maintenance of fibers.
b. The panels shall allow cables to be installed and stored such that they do not alter the attenuation of the cables (as may happen when the fibers are tightly coiled or the fiber is excessively bent at the connector strain relief). The adapters shall be metal, of the same manufacture as the connectors and shall introduce a loss of no more than 0.1 dB when two connectors are installed in it.

11. EQUIPMENT RACKS

a. Each closet shall be equipped with an EIA standard heavy-duty steel 4-post 19 inch equipment racks. Each rack shall be free standing with holes for anchoring it to the floor. They shall be 72 inches high and tapped

with mounting holes of 19 inches in width. Provide vertical wire management system on each side of the rack.

12. UTP CABLES AND PATCH CORDS COLOR CODING

a. Wireless access points - white.
b. All other ethernet - blue.

13. TELEPHONE SYSTEM

a. Contractor shall provide and install two (2) CAT 3 UTP cables from the AT &T service pint in the MDF to each elevator machine rooms. Terminate on wall plates in machine rooms as specified.

PART 3 - EXECUTION

3.1 PAIR IDENTIFICATION

A. The following room recording procedure shall be completed after each wire or cable has been pulled:

1. Terminations: Telephone station cables, CATV station cables and data station cables shall be tagged at backboards with cable tags indicating telephone or data and marked with room number to which it is connected. In rooms where more than one jack exists, the jacks are to be numbered sequentially, and indicated on the cable tag. The outlet number shall also be indicated on the faceplate of the jack.

a. Each pair terminated shall be legibly labeled on the terminal blocks according to the room number and jack with which it is associated.
b. Each station wire shall be plainly marked at its backboard end with the room number to which it is connected, and terminated on the Type 110 termination blocks.
c. All cables will be legibly and permanently numbered at each end. String tags are not acceptable.

3.2 CROSS CONNECTIONS

A. At the backboards, Contractor shall cross connect all pairs from each station cable designated for telephone and/or data use to an incoming pair of the riser cable designated for telephone and/or data use. The cross connection of these pairs should provide four (4) continuous pair from each data outlet and one (1) continuous blue/white pair from each telephone located on that floor. Contractor shall label each pair on the Type 110 terminal according to the numbering scheme.

3.3 MDF LAYOUT AND CABLE DISTRIBUTION

A. The MDF and IDF are constructed of a combination of a backboard on which shall be mounted to type 110 cross-connect blocks and 4-post rack. Provide a minimum of ten feet spare cable for each run coiled on wall (see detail).

3.4 UTP NETWORK

A. The UTP network consist of the following elements:

1. Outside Plant
2. Inside Plant - Riser and Horizontal
3. MDFs
4. IDFs
5. Wall Plates
6. Patch Cables

3.5 CABLE INSTALLATION

A. The contractor shall optimize cable utilization by designing splice points. All cable splices and cable routed through manholes shall be supported on cable racks.

3.6 INSIDE

A. The cables in the risers and closets shall be neatly bundled and tie wrapped. Cable trays shall be provided and installed where necessary, especially between the backboards and equipment racks, and the backboard and the horizontal pathways. Cables traversing the vertical paths shall be anchored to the wall. The method and means of running horizontal cable distribution will vary. Each duplex wall outlet shall have a conduit that runs in the wall from that outlet to the wire closet. Thus, the 4-pair horizontal cable runs shall emanate at the wall outlets, run along the wall conduit, and terminate at the voice or data patch panel in the wire closet.

B. All cables shall be labeled and color coded in accordance with the EIA 606 standard.

3.7 HORIZONTAL RUNS

A. The wall outlets are of three types: voice, data, and CATV. The voice outlets shall be connected to the voice cross-connect panels in the wire closets. The data outlets are identified by the keyed slot and they shall be connected to the data cross-connect panels in the wire closets. The voice and data cross- connect panels are so identified on the closet drawings. The wall outlets shall be wired in accordance with EIA T568B configuration. At each wall outlet, 18 inches of wire shall be allowed spare for future changes.

B. Since the cables to be terminated shall be of EIA Category 6a quality, all terminations shall ensure minimum of untwisting at the connections. The length of wire shall be untwisted only to the extent necessary for making the connection. Both the cross-connect panels and the wall outlets are of type 110. These allow the twists to be maintained to the point of termination. Also, the cable slots between the index strips provide space to maintain cable shield to the point of termination.

C. All terminations on the cross-connect panels shall be labeled and color coded in accordance with industry standards as specified by EIA. All terminations, cables and panels shall be identified and labeled in accordance with EIA 606.

3.8 RISER CABLES

A. The individual cable wires shall be installed in accordance with the method and color coding described under Installation and Test Instructions.

B. The terminations on the central IDF shall be identified to indicate the MDF connections and the floor connections, both with their own sequential numbering scheme that corresponds with the other end of the cable and also indicated at the location of the other end of the cable. The terminations on the individual floor IDFs shall identify the position on the MDF.

3.9 TESTING

A. All conductors in every cable shall be tested end-to-end to prove that they meet the cable specifications described in EIA standards and this document. The tests shall be conducted in the presence of a Telecommunications Specialist. All tests shall be completed first before any corrective action is taken. Corrected conductors shall be tested again. The Telecommunications Specialist reserves the right to request that the conductors passing the previous tests be tested again after corrective action has been taken on the faulty conductors. Conductors not passing the tests shall also be documented together with the corrective action taken. Test results shall be documented and supplied before the installation is considered for acceptance.

B. The following tests shall be conducted as a minimum:

1. Compliance with color coding
2. Tip and ring polarity
3. Neatness of cable routing and tie downs
4. Continuity
5. Shorts, grounds and opens
6. Crosses (shorts to other pairs)
7. Rolls (reversed polarity)
8. Splits

3.10 ACCEPTANCE TESTING

A. When the Contractor has completed all cable installation and termination, and he is ready for testing, he shall inform the Architect/Engineer of the intent. The Architect/Engineer shall assign the Telecommunications Specialist who shall monitor the Contractor testing. The Architect/Engineer has the authority to accept or reject any test and request, and, at his discretion, complete retesting of any portion of the plant if there are an unreasonable number of pairs not passing tests indicated above. The Architect/Engineer may request the Contractor to replace any portion of the plant if the tests indicate faulty or improper installation, or numerous repairs are necessary to pass the tests. The plant shall be accepted by the Architect/Engineer after the Contractor has demonstrated that all the pairs have passed all the tests, all the tests have been documented, the plant is labeled and recorded, and all plant records have been provided in accordance with the requirements of the Documentation Sub-Section later in this document. The Contractor shall comply with any and all warranties required by the general contract agreement with the Architect/Engineer.

3.11 RECEIVING FIBER OPTIC CABLES

A. Before commencing installation, the Contractor shall inspect and test the cables on the reel. The reels shall be accompanied by manufacturer's test report for that particular glass strand and cable indicating such parameters as the attenuation and bandwidth. The Contractor shall at a minimum perform attenuation, break/kink and length verification tests on each strand on the reel with the aid of an OTDR. A printout of the test for each fiber shall be generated and submitted for records. A five foot section of the cable shall be stripped back and inspected for consistency of manufacture of the jacket, buffer, plastic coating, etc. An inspection and test report shall be provided. Installation shall only proceed after the test documentation has been submitted and the cables have been accepted for installation by a telecommunication specialist.

3.12 INSTALLATION OF FIBER OPTIC CABLES

A. The installation plan shall describe the approach that the Contractor plans to take in installing the fiber optic cables. Some of the typical factors are:

1. Supervisory and technical staff contingent and qualifications
2. Testing the ducts before installation
3. Use of mechanical devices
4. Pulling Force
5. Manhole organization - laying on cable racks and loops of extra cable, etc.

B. All outside fiber optic cables shall be installed in inner ducts and prominently labeled with "caution, glass fiber cables" or equivalent, at six foot intervals wherever the cables are exposed to view. Inside cables shall be installed in inner ducts only where installation is in conduits. Open trays do not require inner ducts. Unwound cables shall be placed in figure 8 configurations when they are not on the reels. When a cable is installed, the pulling tension shall be minimal, less than the manufacturer's recommended tension. The cable on the reel shall be unwound such that there is no tension on the cable. The cable

shall either be unwound manually, or by any mechanical means that turns the wheel as opposed to pulling the cable. The cable shall be hand-fed over or around any curves, bends or edges without scrapes or bends in the cable. Strain reliefs or supports shall be provided where necessary, such as in manholes or vertical risers.

C. At each end of the cable a minimum of ten feet of service loop cable shall be allowed for termination and future use. All excess cable shall be neatly stored out of harm's way.

3.13 TERMINATIONS OF FIBER OPTIC CABLE

A. Both single mode and multi-mode-cables are to be installed. Both these types of cables shall be terminated in LC type connectors. However, the two cable types shall be connected on separate fiber patch panels. Proper procedures shall be followed and the right tools used for terminating the fibers in the connectors. Below are examples of precautions and procedures which shall be conformed to:

1. The tool used for stripping the fiber shall conform to the size of the fiber being stripped and shall leave no nicks on the fiber; the stripping shall be effortless and, for example, not require looping of the fiber around the finger for gripping.
2. If crimping is required, the appropriate size apertures on the tool shall be selected.
3. The jacket material remaining after stripping shall be removed by dissolving in chemicals and not by scraping.
4. If the connector required adhesives or epoxy for fastening the fiber to the connector, the material shall be injected in the connector such that it oozes out, displacing all the air from the space to be occupied by the fiber.
5. While seating the fiber in the adhesive filled connector, no air bubbles shall be introduced, such as by inserting and re-inserting the fiber. The fiber protruding from the connector ferrule shall have a small bead formed at its base.
6. The scribe tool used for preparing the excess fiber for removal shall be of high quality and sharp so as not to shatter the glass fiber. The scribed fiber shall be pulled rather than snapped.
7. Heat guns or hot-air blowers shall not be used for curing.
8. Heat shrink tubing shall not be used.
9. A minimum of three types of polishing paper shall be used (changing them often).
10. Polishing shall be performed using the figure 8 routine, creating a spherical polished end profile; a recessed profile shall be rejected.
11. The quality of the polish end shall be inspected using a microscope with a minimum magnification of 200x.
12. All finished terminations shall be covered with boots at all times; similarly, all adapters shall also be covered with boots.
13. Strands of fiber from loose tube cables shall be sheathed in protective fan-out tubing or spiral from the point the fiber leaves the cable to the point where it is terminated on a connector. All gel or waterproofing compounds shall have been cleaned off.
14. The terminations shall be sequentially numbered in synchronization with the color code. The terminations and cables shall be labeled to clearly describe the location at the other end.

3.14 TESTING OF FIBER OPTIC CABLE

A. All tests shall be conducted at 1300 mn.

B. The cable shall be tested on the reels with the OTDR before beginning installation.

C. The fibers shall be tested with the OTDR after the cables have been pulled and the ends dressed for termination. A paper trace of the test shall be provided for each fiber. Evidence of kinked or otherwise damaged fibers shall be cause for replacement of the entire cable.

D. Termination of the fiber on connectors shall only commence after OTDR traces have been approved by the Architect/Engineer and the cable accepted for termination. The terminated fibers shall be tested using the power meter. The OTDR - and power meter tests shall be performed from both ends using calibrated adapters and connectors.

E. Reference measurements of the power receivers shall be checked frequently. Any deviation of 0.1 dB or more shall be cause for retesting the fibers that were tested with that reference.

F. All test equipment, especially the OTDR and the power meter shall have been calibrated by the manufacturer or an accredited test facility within six months prior to beginning the tests on site.

G. Acceptance Testing. When the Contractor has completed all cable installation and termination, and he is ready for testing, he shall inform the Contracting Officer of the intent. The Contracting Officer has the authority to accept or reject any test and request, and at his discretion, complete retesting of any portion of the plant if there are an unreasonable number of fibers not passing tests indicated above. The Contracting Officer may request the Contractor to replace any portion of the plant if the tests indicate faulty or improper installation, or excessive re-work is necessary to pass the tests. The plant shall be accepted by the Contracting Officer after the Contractor has demonstrated that all the fibers have passed all the tests, all the tests have been documented, the plant is labeled and recorded, and all plant records have been provided in accordance with the requirements of Documentation, Section 3.4 later in this document. The Contractor shall comply with any and all warranties required by the general contract agreement with the Contracting Officer.

3.15 GROUNDING

A. The buildings shall be equipped with central point grounding schemes. A master ground bar shall be installed at the MDF. Ground window bars shall be installed at the IDF in every other closet. All cables with metallic elements and all metallic hardware shall be grounded in accordance with REA Section 810 and EIAMA PN-2327 grounding specifications for telecommunications.

3.16 DOCUMENTATION

A. The Contractor shall provide two sets of documents. One set shall provide a record of all the tests conducted on cables, terminations, etc. Another set shall depict all the telecommunications wiring and cabling installation, within and to the building.

3.17 TEST DOCUMENTATION

A. Test records shall be provided for the following tests:

1. UTP, Terminations

    a. Manufacturing test results
    b. Outside plant cables
    c. Riser cables
    d. Horizontal cables

2. Fiber

    a. Manufacturing test results
    b. Outside plant fibers - OTDR before and after installation
    c. Fiber terminations - power meter tests

3.18 RECORD DOCUMENTATION

A. After all installations have been completed and tested, the Contractor shall provide records of the installation in accordance with EIA/TIA Standard 606. The records shall be required in hard copy format printed from a software such as Cable Management Systems by Microtest (CMS). CMS is a commercially available off-the-shelf software designed specifically for cable installation records. The Contractor shall supply the software and the records using the software to one FWS technician.

B. As described in the EIA standard, the following types of records shall be supplied:

1. Fiber, voice and data terminations located in work areas, telecommunications closets, equipment rooms and entrance facilities.
2. Telecommunications media between terminals (horizontal distribution).
3. Pathways between terminations that contain the media.
4. Spaces where terminations are located.
5. Bonding/grounding as it applies to telecommunications.

C. All the elements of the telecommunications infrastructure shall be identified and labeled by a code. The coding method to be used shall be as specified in the EIA 66 standard. On the following page is a representative list reproduced from the standard (xxx denotes a numerical designation).

CODE	DESCRIPTION
BCxxx	Bonding Conductor
BCDxxx	Backbone Conduit
Cxxx	Cable
CBxxx	Backbone Cable
CDxxx	Conduit
CTxxx	Cable Tray
ECxxx	Equipment (bonding) conductor
EFxxx	Entrance Facility
ERxxx	Equipment Room
Fxxx	Fiber
HHxxx	Hand Hole
ICxxx	Intermediate Cross-Connect (IDF)
Jxxx	Jack (Outlet)
MCxxx	Main-Cross-connect (MDF)
MHxx	Man hole or maintenance hole
PHxxx	Pull Box
Sxxx	Splice
SExxx	Service Entrance
SLxxx	Sleeve
TCxxx	Telecommunications Closet
TGBxxx	Telecommunications grounding busbar
TMGB	Telecommunications main grounding busbar
WAxxx	Work Area

3.19 MAINTENANCE CONSIDERATIONS

A. The cable installation shall be installed to maximize the safety, maintainability, and performance effectiveness of maintenance personnel, and shall minimize demands upon skills, training and manpower. Splices/terminations shall be placed and supported so as to maximize the efficiency and ease with which it can be maintained and shall ensure accessibility.

3.20 CABLE TESTS

A. Contractor shall perform testing of all pairs for each cable installed as directed by these specifications. Post construction cable acceptance tests consist of conductor continuity tests, and conductor insulation resistance tests. These tests assure that the cable has been terminated properly and has not been damaged during construction. An Owner's representative will be required to witness these tests.

B. Each cable pair shall be tested for shorts (T to R and T&R to ground), continuity, and loop resistance. Maximum loop resistance from the main telephone/data panel to each jack shall be within 5% of the calculated value based on the actual length of cable installed, and the loop ohms/1000 ft. for copper conductors.

3.21 DEFECTIVE CABLE PAIRS

A. The vendor shall test all cable pairs and shall record, on the pair assignment record, the nature of the defect for each pair found to be defective and remedies used to clear the defect. In order for the cable distribution system to be considered acceptable, there shall be no defective pairs in any cable. Any cable having defective pairs shall not be used and shall be replaced at Contractor's expense.

3.22 INSPECTIONS

A. Routine on-site construction inspections by the Architect/Engineer and/or an Owner's representative will involve trips to the complex to inspect construction, so as to assure adherence to standard construction practices. The number of such inspections will be at the Architect/Engineer's discretion.

3.23 ACCEPTANCE

A. The project shall be considered acceptable based upon the following:

1. Contractor has furnished and installed all equipment and materials and performed all work in accordance with these specifications.
2. Contractor has successfully completed all the required testing assuring compliance with the required specifications.
3. Contractor has removed all trash and debris by contractor from the area and restored site to original condition.
4. Contractor has submitted the required documentation to state officials.

END OF SECTION 16471



SECTION 16495 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Automatic transfer switch (ATS).

1.2 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and all Specification Sections.

B. Shop drawings or published product data for each transfer switch, including dimensioned plans, sections, and elevations showing minimum clearances; conductor entry provisions; gutter space; installed features and devices; and materials lists.

C. Wiring diagrams, elementary or schematic, differentiating between manufacturer-installed and field-installed wiring.

D. Single-line diagrams of transfer switch units showing connections between automatic transfer switch, bypass/isolation switch, power source, and load, plus interlocking provisions.

E. Operation and maintenance data for each type of product, for inclusion in Operating and Maintenance Manual specified in Division 1. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay setting and calibration instructions.

F. Manufacturer's certificate of compliance to the referenced standards and tested short-circuit closing and withstand ratings applicable to the protective devices and current ratings used in this Project, as indicated and as specified in paragraph "Tested Fault Current Ratings."

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms are experienced in manufacturing equipment of the types and capacities indicated and have a record of successful in-service performance.

B. Emergency Service: Manufacturer maintains a service center capable of providing emergency maintenance and repairs at the Project site with an 8-hour maximum response time.

C. Comply with NFPA 70, "National Electrical Code," for components and installation.

D. Comply with NFPA 110, "Standard for Emergency and Standby Power Systems."

E. Comply with NEMA ICS 1, "General Standards for Industrial Control," ICS 2, "Industrial Control Devices, Controllers and Assemblies," and ICS 6, "Enclosures for Industrial Controls and Systems."

F. UL Compliance: Comply with UL Standard 1008, "Automatic Transfer Switches," except where requirements of these Specifications are stricter.

G. Single-Source Responsibility: Obtain generator (s) ATSs, paralleling gear, and remote annunciators, fuel system(s) from a single manufacturer that assumes responsibility for all system components furnished.

H. The automatic transfer switch shall be warranted by its manufacturer for five (5) consecutive calendar years from the date of substantial completion. This warranty shall be in full, non-limited, non-pro-rated warranty and shall cover all parts, labor, trip charges and incidental materials. Should a repair/replacement of the installed unit that is covered by this five (5) year warranty occur and last more than two (2) consecutive calendar days, contractor shall provide a rental ATS at no additional costs to the owner for the duration of the repair/replacement. This includes any and all cable rental costs, installation and connection equipment and/or labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cummins
2. Asco
3. Caterpillar
4. Kohler
5. Approved Equivalent

2.2 TRANSFER SWITCH PRODUCTS, GENERAL

A. Current and Voltage Ratings: As indicated on the drawings.

B. Tested Fault-Current Ratings: Closing and withstand ratings exceed the indicated available rms symmetrical fault current at the equipment terminals based on testing according to UL Standard 1008, conducted at full-rated system voltage and 20 percent power factor. Rate each product for withstand duration time as follows when tested for rated short-circuit current correlated with the actual type of circuit protective device indicated for transfer switches for this Project:

1. Molded-Case Circuit Breakers, 150 Amperes or Smaller: 1.5 closing and withstand duration cycles.
2. Molded-Case Circuit Breakers, Larger than 150 Amperes: 3 closing and withstand duration cycles.

C. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 deg C to 70 deg C.

D. Resistance to Damage by Voltage Transients: Components meet or exceed voltage surge withstand capability requirements when tested according to ANSI C37.90.1, IEEE Guide for Surge Withstand Capability (SWC) Tests. Components meet or exceed voltage impulse withstand test of NEMA ICS 1.

E. Four-Pole Switches: 4-pole switches shall be provided and shall provide full-capacity over-lapping neutral switching.

F. Enclosures: General-purpose NEMA 3R gasketed, conforming to UL Standard 508, "Electric Industrial Control Equipment," except as otherwise indicated.

G. Heater: Within enclosure of units exposed to outdoor temperature and humidity conditions, connect thermostat within enclosure to control heater.

H. Factory Wiring: Train and bundle factory wiring and identify consistently with shop drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.

1. Designated terminals accommodate field wiring.
2. Power Terminals Arrangement and Field Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Terminals: Pressure-type, suitable for copper or aluminum conductors of sizes indicated.
4. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

I. Electrical Operation: Where indicated, accomplish by a non-fused, momentarily energized solenoid or electric motor-operated mechanism, mechanically and electrically interlocked in both directions. Switches using components of molded-case circuit breakers or contactors not designed for continuous-duty, repetitive switching between active power sources are not acceptable.

J. Switch Action: Mechanically held in both directions for double-throw switches.

K. Switch Contacts: Use silver composition for switching load current. Units rated 225 amperes and more have separate arcing contacts.

L. Overcurrent devices are not part of switch products.

M. Refer to electrical riser diagram for voltage and amperage of switch(s).

2.3 AUTOMATIC TRANSFER SWITCHES (ATSs)

A. Comply with Level 1, Type 10 equipment according to NFPA 110, "Standard for Emergency and Standby Power Systems." Emergency power system shall start and assume load within ten (10) seconds of a power outage.

B. Switching Arrangement: Double-throw type, with synchronized (in-phase monitoring to prevent switching when phase angle between sources is greater than thirty degrees) closed transition normal functioning.

2.4 AUTOMATIC TRANSFER SWITCH FEATURES

A. Voltage sensing for each phase of normal source. Pick-up voltage is adjustable from 85 percent to 100 percent nominal, and drop-out voltage is adjustable from 75 percent to 98 percent pick-up value. Factory set for pick-up at 90 percent and drop-out at 85 percent.

B. Time-delay override of normal source voltage-sensing delays transfer and engine start signals. Adjustable 0 to 6 seconds, and factory set at 1 second.

C. Voltage/Frequency Lockout Relay: Prevent premature transfer. Voltage pick-up is adjustable from 85 percent to 100 percent nominal. Factory set to pick-up at 90 percent. Pick-up frequency is adjustable from 90 percent to 100 percent nominal. Factory set to pick-up at 95 percent.

D. Retransfer Time Delay: Adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of the delay upon loss of voltage or sustained under-voltage of the emergency source, provided the normal supply has been restored.

E. Test Switch: Simulates normal source failure.

F. Switch-Position Pilot Lights: Indicate source to which the load is connected.

G. Source-Available Indicating Lights: Supervise sources via the transfer switch normal and emergency source-sensing circuits.

1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

H. Unassigned Auxiliary Contacts: Two normally open SPDT contacts for each switch position.

1. Rating: 10 amperes at 240 V a.c.

I. Transfer Override Switch: Overrides automatic retransfer control so the ATS will remain connected to the emergency power source regardless of the condition of the normal source. A pilot light indicates the override status.

J. Engine Starting Contacts: One isolated normally closed and 1 isolated normally open. Contacts are gold flashed or gold plated and rated 10 amperes at 32 V d.c. minimum.

K. Engine Shut-Down Contacts: Time delay adjustable from 0 to 5 minutes; factory set at 5 minutes.

2.5 FINISHES

A. Enclosures: Indoor NEMA I installations. Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

B. Enclosures: Outdoor NEMA 3R (Gasketed) installations. Custom color enamel (as selected by Architect during submittal phase) over corrosion resistant pre-treatment and primer

2.6 SOURCE QUALITY CONTROL

A. Factory test components, assembled switches, and associated equipment to ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for conformance with specified requirements. Perform dielectric strength test conforming to NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor Mounting of Transfer Switches: Level and anchor the unit to the 4" thick concrete housekeeping pad.

B. Wall mounting of Transfer Switches; Level and anchor the unit to the wall.

3.2 WIRING TO REMOTE COMPONENTS

A. Match the type and number of cables and conductors to the control and communications requirements of the transfer switches used. Increase raceway sizes at no additional cost to the Owner if necessary to accommodate required wiring.

3.3 CONNECTIONS

A. Tighten factory-made connections, including connectors, terminals, bus joints, mountings, and grounding. Tighten field-connected connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values. When manufacturer's torquing requirements are not indicated, tighten connectors

and terminals to comply with tightening torques specified in UL Standards 486A and 486B. Provide and install all required raceways and conductors/cables for a complete and fully operational system.

3.4 GROUNDING

A. Make equipment grounding connections for transfer switch units as indicated and as required by the NEC.

3.5 PROGRAMMING

A. A factory authorized and trained technician shall perform initial start-up programming of the ATS and shall adjust ATS parameters to accommodate actual utility, generator, load requirements.

B. At a time not more than one-month after the facility has been in use by the owner, a factory authorized and trained technician shall perform any necessary and/or owner desired adjustments to said programming to accommodate actual utility, generator, load requirements.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise field tests.

B. Preliminary Tests: Perform electrical tests as recommended by the manufacturer and as follows:

1. Measure phase-to-phase and phase-to-ground insulation resistance levels with insulation resistance tester, including external annunciator and control circuits. Use test voltages and procedure recommended by the manufacturer. Meet manufacturer's specified minimum resistance.
2. Check for electrical continuity of circuits and for short circuits.

C. Field Tests: Give 7-day advance notice of the tests and perform tests in presence of Owner's representative.

D. Coordinate tests with tests of generator plant and run them concurrently.

E. Tests: As recommended by the manufacturer and as follows:

1. Contact Resistance Test: Measure resistance of power contacts for ATSs, NATSs, and BP/ISs. Resolve values in excess of 500 micro-ohms and differences between adjacent poles exceeding 50 percent.

2. Ground Fault Tests: Coordinate with testing specified in Division 16 Section "Overcurrent Protective Devices" to ensure sensors are properly selected and located to optimize ground-fault protection where power is being delivered from either source.

    a. Verify grounding points and sensor ratings and locations.
    b. Apply simulated fault current at the sensors and observe reaction of circuit interrupting devices.

3. Operational Tests: Demonstrate interlock, sequence, and operational function for each switch at least 3 times.

    a. Simulate power failures of normal source to ATSs and of emergency source with normal source available.
    b. Simulate low phase-to-ground voltage for each phase of normal source of ATSs.
    c. Verify time-delay settings and pick-up and drop-out voltages.

F. Test Failures: Correct deficiencies identified by tests and prepare for retest. Verify that equipment meets the specified requirements.

G. Reports: Maintain a written record of observations and tests. Report defective materials and workmanship and retest corrected items. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.7 DEMONSTRATION

A. Training: Furnish the services of a factory-authorized service representative to instruct Owner's personnel in the operation, maintenance, and adjustment of transfer switches and related equipment. Provide a minimum of 4 hours of instruction scheduled 7 days in advance. As part of project close-out documents, Contractor shall submit original sign-in sheet of all persons present at instruction session.

END OF SECTION 16495



SECTION 16500 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions) as appropriate, apply to the Work specified in this Section.

B. Refer to other Electrical specifications, as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

1.2 GENERAL

A. The Contractor shall furnish and install lighting fixtures and accessories as shown on the drawings and/or described herein.

B. Unless otherwise specified, lighting fixtures shall be permanently installed and connected to the wiring system.

C. The Contractor shall support each new fixture independently, from the building structure. Ceiling framing members shall not be used to support fixtures except in specific areas where ceiling supports for this purpose have been specified elsewhere in these specifications.

D. Catalog numbers scheduled on the drawings or descriptions of lighting fixtures contained herein may indicate fixture compatibility with certain types of ceiling construction. The Contractor shall determine exact type of ceilings actually to be furnished in each area and shall obtain fixtures to suit, deviating from specified catalog numbers or descriptions only where necessary, and only to the extent necessary to insure fixture-ceiling compatibility. The Contractor shall notify the Architect/Engineer in writing where such changes are to be made. Contractor shall clean all lighting fixtures of dirt and debris upon completion of project prior to requesting substantial completion inspection.

E. Fixtures for recessed locations shall have a thermal cutout and be installed in accordance with manufacturer's requirements and in accordance with NEC.

F. Fixtures shall not be wired with or have any parts constructed using asbestos materials.

G. All requests for prior approval shall contain the following:

1. Photometric data for each fixture being submitted.
2. For all exterior lighting, point by point foot candle levels shall be submitted. (Exception: Wall packs, ground mounted flood lights, landscape lighting).

3. Listing of all deviations of fixtures proposed as compared to fixtures specified.
4. For interior lighting point by point foot-candle levels shall be submitted for typical interior spaces (offices, classrooms, corridors) and for spaces with indirect and/or specialty lighting.

PART 2 - PRODUCTS

2.1 EMERGENCY BATTERY PACKS

A. Emergency battery packs shall be provided and installed in all fixtures denoted by the letter "E" appearing at the end of the fixture type designation and where required in the light fixture schedule. Emergency battery packs shall be installed in the ballast/driver housing (not on top of the fixture) of the fixture(s) unless specifically noted otherwise on the drawings.

B. Operation of the fixture shall be as follows:

Normal A/C Power	Switch Position	Operation of Lamps/LED's
On	On	All lamps/LED's operating
On	Off	All lamps/LED's off
Off	On	Emergency Lamps/LED'S all operating
Off	Off	Emergency Lamps/LED's all operating

C. Emergency operation of the light fixture shall provide a minimum total lamp output of 1200 lumens for a minimum time period of ninety (90) minutes.

D. Emergency battery packs shall be as manufactured by Bodine, Iota Engineering Co., or approved equivalent.

E. The Contractor shall be responsible for any additional wiring, conduit, labor, etc., to provide the emergency lighting system specified at no additional cost to the Owner. This includes running of a continuously energized conductor to each and every battery pack.

2.2 LED FIXTURES

A. Manufacturers of LED luminaires shall demonstrate a suitable testing program incorporating high heat, high humidity and thermal shock test regimens to ensure system reliability and to substantiate lifetime claims.

B. The use of IESNA LM-80 data to predict luminaire lifetime is not acceptable.

C. At time of manufacture, electrical and light technical properties shall be recorded for each luminaire. At a minimum, this should include lumen output, CCT, and CRJ. Each luminaire shall utilize a unique serial numbering scheme. Technical properties must be made available for a minimum of 5 years after the date of manufacture.

D. Luminaires shall be provided with a 5 year warranty covering LEDs, drivers, paint and mechanical components.

1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array and electronic driver (power supply).
2. The rated operating temperature range shall be 30°C to +40°C.
3. Each luminaire is capable of operating above 100°F° (37°C), but not expected to comply with photometric requirements at elevated temperatures.
4. Photometry must be compliant with IESNA LF-79 and shall be conducted at 25°C ambient temperature.
5. The individual LEDs shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
6. Luminaire shall be constructed such that LED modules may be replaced or repaired without replacement of whole luminaire.
7. Each luminaire shall be listed with Underwriters Laboratory, Inc. under UL 1598 for luminaires, or an equivalent standard from a nationally recognized testing laboratory.
8. Power Consumption: Maximum power consumption allowed for the luminaire shall be determined by application. The luminaire shall not consume power in the off state.
9. Operation Voltage: The luminaire shall operate from a 60 HZ ± 3HZ AC line over a voltage ranging from 108 VAC to 305 VAC. The fluctuation of line voltage shall have no visible effect on the luminous output.
10. Power Factor: The luminaire shall have a power factor of 0.90 or greater.
11. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent.
12. Surge Suppression: The luminaire onboard circuitry shall include fused surge protection devices (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD shall protect the luminaire from damage and failure for common mode transient peak voltages up to 10 kV (minimum) and transient peak currents up to 5 kA (minimum) SPD shall conform to UL 1449 depending on the components used in the design. SPD performance shall be tested per the procedures in ANSI/IEEE C62.41-1992 (or current edition for category C (standard). The SPD shall fail in such a way as the luminaire will no longer operate. The SPD shall be field replaceable.
13. Each luminaire shall have integral UL Listed Class II power supplies. Class I power supplies will not be acceptable.
14. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.
15. RF Interference: LED drivers must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.
16. Drivers shall have a Class A sound rating.
17. Illuminance: The illuminance shall not decrease by more than 30% over the expected operating life. The measurements shall be calibrated to standard photopic calibrations.

18. Light Color Quality: The luminaire shall have a correlated color temperature (CCT) range of 3300K to 3700K, The color rendition index (CRI) shall be 80 or greater. Binning of LEDS shall conform to ANSI/G.NEMA SSL 3-2010.
19. Backlight –Uplight-Glare: the luminaire shall not allow more than 10 percent of the rated lumens to project above 80 degrees from vertical. The luminaire shall not allow more than 2.5 percent of the rated lumens to project above 90 degrees from vertical. Backlight and Glare ratings as per fixture schedule and calculated per IESNA TM-15.
20. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
21. The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
22. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
23. The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.
24. The heat sink shall be aluminum.
25. The luminaires shall be dimmable from 100 percent output to 0 percent output.
26. Driver shall be integral to the fixture.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All surface mounted fixtures shall be properly anchored so that all sides of the fixture are butted up against the mounting surface. A minimum of two (2) anchors shall be used; however, where additional anchors are required to properly install fixture (all sides evenly spaced from ceiling), the Contractor shall provide and install them at no additional cost to the Owner.

1. Anchor types shall be as follows:

Mounting Surface Material	Anchor type
* Gypsum board (wall)	Toggle bolts or blocking with screws
Gypsum board (ceiling)	Expansion type anchor
Concrete/concrete block	Expansion type anchor
** Wood	Screws

*Anchor type shall be determined in field by Architect/Engineer as dictated by fixture weight.

** Any fixture installed on combustible material shall be installed on ½ minimum spacers unless prior approved, otherwise in writing by Architect/Engineer.

B. All recessed fixtures in suspended ceiling shall be supported by a minimum of two (2) support wires, at opposite corners of the fixture. Each support wire shall be continuous without splices to the building structure and separately anchored. Fixture support wires shall support only the light fixture and not the ceiling. Surface mounted fixtures installed on lay-in ceiling shall be supported as lay-in fixtures. Refer to details for additional requirements.

END OF SECTION 16500



SECTION 16550 - OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions) as appropriate, apply to the Work specified in this Section.

B. Refer to all other Electrical specification sections, as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

1.2 GENERAL

A. Contractor shall provide and install motion sensors in accordance with the plans and specifications herein. System shall be installed to provide detection system coverage of the entire space the sensors are located in. It is understood that due to some manufacturer's devices providing different coverage patterns, the plans represent a generic system. Contractors shall evaluate each space individually and shall at no additional costs to the owner, provide additional detection sensors where required to provide a complete coverage pattern and shall also adjust installation locations to retain the coverage while reducing false triggers of the sensors.

PART 2 - PRODUCTS

2.1 WALL MOUNTED SENSORS

A. For single-pole/single switch applications wall mounted motion sensors shall be IR-TecLDS700S, Watt Stopper No.: DSW-100, Lutron MS-A102, Greengate ONW-D-1001-MV.

B. For two-pole/dual switch applications, wall mounted motion sensors shall be IR-TecLDT700S or Watt Stopper No.: DSW-200, Greengate ONW-D-1001-DMV.

C. Color of sensor shall be selected by Architect/Engineer during shop drawing submittal.

2.2 CEILING MOUNTED SENSORS

A. Ceiling mounted motion sensors shall be IR-Tec-BDS-600S, Watt Stopper No. DT-305, Lutron LOS-CDT-2000-WH, Greengate OAC-DT-2000.

B. All relays, contactors, and power packs required to provide a fully operational system shall be provided and installed at no additional cost to the owner.

C. Install device using properly sized device box recessed in ceiling. Utilize MC-cable to run all conductors. Install power pack in properly rated junction box.

D. Color of sensor shall be selected by Architect/Engineer during shop drawing submittal.

2.3 POWER/SWITCH PACKS

A. Power packs shall employ zero crossing circuit to limit inrush current. Contacts shall be dry-type (Isolated) twenty-ampere (20A). Leads shall be Class 2 Teflon insulated for use in plenums. Power pack shall be rated for both 120 volt and 277 volt operation.

B. Install device using properly sized device box recessed in ceiling. Utilize flexible conduit to run all control voltage conductors. Install power pack in properly rated junction box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Should a particular manufacturer's product require that additional sensors and associated wiring and accessories be provided to allow full and complete coverage of the space, the additional sensors and associated wiring and accessories shall be provided at no additional cost to the owner.

B. Installation of motion sensor shall be such that motion is detected as soon as a person enters the particular room and with the sensor being a minimum of four feet (4') from any HVAC diffuser/register.

C. All sensors shall be installed on the line side of all toggle switches so that power is maintained to the sensor at all times.

D. Prior to requesting substantial completion, contractor shall coordinate with the owner to determine the length of time the sensors shall keep the lighting illuminated after the room if vacated and shall program sensors accordingly. Time shall be adjustable from a minimum of 5 minutes to a maximum of 30 minutes. Contractor shall provide a minimum of one additional setting adjustment per sensor installed for the duration of the one-year warranty period.

3.2 SUBMITTALS

A. Contractor shall submit a proposed layout in shop drawings indicating all sensor and power pack locations. The sensor Contractor shall be responsible for such layout.

3.3 MISCELLANEOUS ITEMS

A. Contractor shall be responsible for providing all relays, contactors, power packs, etc. to provide a complete motion detecting lighting switching circuit.

END OF SECTION 16550



SECTION 16621 - EMERGENCY GENERATOR - DIESEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. The equipment supplied and installed shall meet the requirements of the National Electric Code and all applicable codes and regulations. All equipment shall be new, of current production by a national firm which manufactures the generator and controls, and assembles the generator set as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained service personnel. Emergency power system shall include all parts and accessories to provide a NFPA 110 Level 2 Class 48 Type 10 installation.

1.2 SUBMITTAL

A. Submittal shall include specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and other remote devices if included elsewhere in these specifications.

B. Where a "Standard Specification" (i.e. ANSI, UL, etc.) is referenced and no manufacturers are listed the Contractor shall submit manufacturers for Prior Approval in adherence with the specified standard.

1.3 TESTING

A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer shall be responsible for design prototype tests as described herein: Components of the emergency system, such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes which will not be sold, shall be used for these tests. Prototype test programs shall include the requirements of NFPA-110 and the following:

1. Maximum power (kW).
2. Maximum starting (kVA) at 35% instantaneous voltage dip.
3. Alternate temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40.
4. Governor speed regulation under steady-state and transient conditions.
5. Voltage regulation and generator transient response.

6. Fuel consumption at 1/4, ½, 3/4, and full load.
7. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
8. Three-phase line-to-line short circuit test.
9. Cooling air flow.
10. Torsional analysis testing to verify that the generator set is free to harmful torsional stresses.

1.4 WARRANTY AND PREVENTIVE MAINTENANCE

A. The emergency generator system (including but not limited to paralleling gear, automatic transfer switches, fuel system, generator, engine, enclosure, annunciator, etc.) shall be warrantied by the manufacturer for five (5) years from the date of substantial completion. This warranty shall be a full, non-limited, non-pro-rated warranty and shall cover all parts, labor, trip charges, and incidental materials.

B. As part of this five (5) year warranty/preventive maintenance program, the contractor shall provide a full preventive maintenance program providing all recommended and required maintenance care on the complete generator, transfer switch (s) and fuel system. This program shall be based upon an annual run-time of one hundred fifty (150) hours. Program shall include but not be limited to all fluid changes, filter changes, inspections, belts, hoses, trip charges, materials, labor, disposal fee, etc....for a complete and all-inclusive maintenance program. For service intervals where the manufacturer indicates to replace oil and oil filters, contractor shall provide a complete oil and filter change. Simple testing of the oil (and replacement determined by the testing) is not acceptable. Similarly, this applies to all manufacturer recommended fluid changes. Should a repair/replacement of the installed unit that is covered by this five (5) year warranty occur and last more than two (2) consecutive calendar days, contractor shall provide a rental generator at no additional costs to the owner for the duration of the repair/replacement. This includes any and all cable rental costs, installation and connection equipment and/or labor. Fuel shall be provided by the owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. The standby generator set shall be rated standby power (defined as continuous operation for the duration of any power outage) 120/208 volts, 3 phase, 4 wire, .8 power factor, (Power ratings as indicated on plans) at 5000 feet altitude, 104 degrees Fahrenheit. Vibration isolators shall be provided between the engine-generator and welded steel base or between the base and the floor. Generator(s) shall be manufactured in accordance with ISO 9001 listing requirements.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cummins
2. Caterpillar
3. Kohler
4. Approved Equivalent

2.3 FINAL PRODUCTION TESTS

A. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

1. Single-step load pickup.
2. Transient and steady-state governing.
3. Safety shutdown device testing.
4. Voltage regulation.
5. Rated Power.
6. Maximum Power.

2.4 ENGINE

A. The engine shall be equipped with the following:

1. Engine: Engine shall be stationary, liquid cooled, with a fuel system that is compatible with #2 ULSD diesel fuel. Design shall be four cycle, turbo charged and after-cooled. Engine equipment shall include, but not be limited to the following:

    a. 50 gallon day tank with auxiliary fuel pumps solenoid fuel shut off valve, fuel filter, battery, batteries charger and flexible fuel connection.

2. Engine protection devices shall have sensing elements located on the engine to initiate the following preliminary alarms and shutdowns:

    a. Low coolant temperature alarm.
    b. Low lube oil pressure alarm.
    c. High coolant temperature alarm.
    d. Low lube oil pressure shutdown.
    e. High coolant temperature shutdown.
    f. Overspeed shutdown.
    g. Overcrank lockout and shutdown.

3. Electronic governing system to control generator system frequency, speed regulation of +/- .25% minimum from no load to full load with automatic overspeed shutdown.
4. Provide low coolant level shutdown which shall activate high coolant temperature lamp.
5. Engine starting batteries - Optima Red Label or equivalent AGM type.

6. Static dual rate 10 ampere automatic battery charger.
7. Engine mounted thermostatically controlled jacket water heater to maintain jacket water temperature of 90 degrees F. minimum.
8. Positive displacement, mechanical full pressure lube oil pump, full flow lube oil filter with replaceable element, pressure relief valve, and oil drain valve with hose extension.
9. An engine mounted radiator sized for operation in a 122 degree F. ambient temperature shall be provided. Also include a 50/50 mix of ethylene glycol. Where radiator is remote type, provide and install NEMA 3R variable frequency drive unit on leg of radiator. VFD shall be complete with integral fusible disconnect switch.
10. A critical grade exhaust silencer shall be provided along with a stainless steel flexible exhaust connection as recommended by generator set manufacturer.
11. Heavy duty, dual element air cleaner
12. Water separator
13. Duplex fuel filter
14. Deep sump oil pan
15. Duplex oil filter
16. Heavy duty starting motor
17. All required fluids and lubricants for proper operation of system.

2.5 GENERATOR

A. The alternator shall be salient-pole, 2/3 pitch, 4 busbar, self-ventilated of drip-proof construction with amortiser rotor windings and skewed for smooth voltage waveform The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H and be vacuum impregnated with epoxy varnish non-hygroscopic varnish with a final dip of epoxy. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable Volts-per-Hertz operation capable of maintaining voltage within + or - 0.5% at any constant load from 0 to 100% of rating. the regulator must be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads. Generator shall be rated for 130C temperature rise on 40°C ambient. Provide and install 120/240V anti-condensation heater.

B. On application of any load up to the rated load, the instantaneous voltage dip shall not exceed 20% and shall recover to = or - 0.5% of rated voltage within one second.

C. The generator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system.

D. The generator shall be capable of accepting the loads that were specified with the stated rated load being the largest running loads and 10% being the largest instantaneous voltage dip when loads are started as specified on the loads report.

E. A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished and shall not automatically reset preventing restoration of voltage if maintenance is being performed. This breaker shall protect the generator from damage

due to its own high current capability and shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition.

F. The generator, having a single maintenance free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

2.6 CONTROLLER

A. Set-mounted controller capable of facing right, left, or rear shall be vibration isolated on the generator enclosure. The microprocessor control board shall be moisture proof and capable of operation from -40c to 85c. Relays will only be acceptable in high current circuits.

B. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:

1. Fused DC circuits.
2. Complete two-wire start/stop control which shall operate on closure of a remote contact.
3. Speed sensing and a second independent starter motor disengagement systems shall protect against the starter engaging with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
5. Cranking cycler with 15-second ON and OFF cranking periods.
6. Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
7. Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
8. Adjustable engine cool down timer factory set at five minutes to permit unloaded running of the standby set after transfer of the load to normal.
9. Three-position (Automatic - OFF - TEST) selector switch. In the test position, the engine shall start and run regardless of the position of the remote starting contacts. In the automatic position, the engine shall start when contacts in the remote control circuit close and stop five minutes after those contacts open. In the off position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault lamp shall also be accomplished by putting the switch to the off position.
10. Indicating lights to signal:

    a. (Not-in-auto (flashing red))
    b. (Overcrank (red))
    c. (Emergency stop (red))
    d. (High engine temperature/low coolant level (red))
    e. (Overspeed (red))
    f. (Air damper (red))
    g. (Battery charger malfunction (red))

h. (Low battery voltage (red))
i. (Low fuel (red))
j. (System ready (green))
k. (Pre-alarm high engine temp. (yellow))
l. (Pre-alarm low oil pressure (yellow))

11. Test button for indicating lights.
12. Alarm horn with silencer switch per NFPA-110.
13. Terminals shall be provided for each signal in 10 above for connection to remote monitoring devices.
14. Remote annunciator indicating conditions listed in Item 10 above shall be installed where shown on the plans.

2.7 INSTRUMENT PANEL

A. A set mounted instrument panel shall include:

1. Dual range voltmeter, 3 ½ inch, = or - 2% accuracy.
2. Dual range ammeter, 3 1/2/inch, = or - 2% accuracy.
3. Voltmeter-ammeter phase selector switch.
4. Lights to indicate high or low meter scale.
5. Direct reading pointer-type frequency meter, 3 ½ inch, + or - 5% accuracy, 45 to 65 Hz scale.
6. Panel illuminating lights.
7. Battery charging meter.
8. Coolant temperature gauge (liquid cooled models).
9. Oil pressure gauge.
10. Running time meter.
11. Voltage adjust rheostat (+ or - 5% range).

2.8 ACCESSORIES

A. The following accessories shall be provided:

1. Overvoltage protection will shut down the unit after one second of 15% or more overvoltage
2. Battery rack, battery cables, 12-volt battery(ies) capable of delivering the minimum cold-cranking amps required at zero degrees Fahrenheit per SAE Standard J-537.
3. Gasproof, seamless, stainless steel, flexible exhaust connector(s) ending in pipe thread.
4. Flexible fuel line(s) rated 300 degrees F and 100 PSI ending in pipe thread.
5. Engine exhaust silencer, coated to be temperature and rust resistant, rated for critical applications. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment.
6. Block heater thermostatically controlled to maintain engine coolant at 90 degrees Fahrenheit (32 degrees Celsius) to meet the start-up requirement of NFPA-99 or NFPA-110 Regulations.

7. 10-Ampere automatic float and equalize battery charger with + - 1% constant voltage regulation from no load to full load over + - 10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40 degrees C to + 60 degrees C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Provide alarm circuit board to meet the requirements of NFPA-110 for low battery voltage, high battery voltage, and battery charger malfunction.
8. 16-light remote annunciator shall monitor all controller functions described in Article 10 of the controller section plus line power and generator power monitoring. An integral lamp test and horn silence switch shall be included that meets NFPA-110.
9. Main-line circuit breaker 208 V., 3 pole with parallel output lugs.
10. Spring-type, heavy duty, vibration isolators shall be provided between engines/generator and frame and between frame and concrete pads.

2.9 OUTDOOR GENERATOR SET ENCLOSURE

A. Description: Weatherproof aluminum housing. Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools.

B. Fixed Louvers: At air inlet and discharge. Louvers prevent entry of rain and snow.

C. Fixed Dampers: At air inlet and discharge

D. Air Flow Through Housing: Adequate to maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at the top of the range specified under "System Service Conditions."

E. Rated for windload of 150 mph sustained winds with 15mph gust factor.

F. When generator unit is installed on a sub-base fuel tank provide and install a 4' wide welded aluminum work platform on all four (4) sides of unit complete with ADA compliant hand-rails and fixed stairs. Provide 18" diameter 4' deep, 3500 psi concrete footings for all support legs of platform.

G. Provide and install two (2) Lithonia No, VAP-6000LM-PCL-WD-MVOLT-35k-80CRI-STSL with emergency battery pack fixtures (one on each long side of generator). Provide and install one (1) 120V weatherproof. GFCI receptacle adjacent to generator control panel.

H. Enclosure shall be of the sound attenuating type. Enclosure shall limit total unit noise at 7 meters to a maximum sound pressure level of 74 db and a maximum 8-position average of 71.2 db.

2.10 FINISHES

A. Outdoor Enclosures: Custom color (color shall be selected by Architect during shop drawing submittals) Field applied final finish over corrosion-resistant pretreatment and manufacturer's standard primer.

2.11 SUB-BASE FUEL TANK

A. Unit shall be complete with factory, double-wall, containment sub-base fuel tank.

B. UL 2085 listed.

C. Emergency tank and rupture basin vents.

D. Tank mounted mechanical fuel gauge.

E. Low and high level fuel switches (interface with generator set annunciator).

F. Basin drain.

G. Integral 5-gallon spill basin.

H. Sized for a continuous run-time of forty-eight (48) consecutive run-hours at 100% of unit's rated maximum load.

PART 3 - EXECUTION

A. The equipment shall be installed as shown on the plans, in accordance with the manufacturer's recommendation and all applicable codes.

3.2 PROGRAMMING

A. A factory authorized and trained technician shall perform initial start-up programming of the generator controller and shall adjust controller parameters to accommodate actual utility, generator, load requirements.

B. At a time not more than one-month after the facility has been in use by the owner, a factory authorized and trained technician shall perform any necessary and/or owner desired adjustments to said programming to accommodate actual utility, generator, load requirements.

3.3 SITE TEST

A. An installation check, start-up and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified a minimum of one (1) calendar week prior to test of the time and date of the site test. The tests shall include:

1. Fuel, lubricating oil, and antifreeze (liquid cooled models) shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected.
2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, generator strip heaters, remote annunciator, etc.
3. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
4. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test.
5. Load Bank test at 25% power for ½ hour, 50% power for ½ hour, 75% power for 1 hour and at full power for two (2) hours. Contractor shall be responsible for all costs to refill fuel tank to maximum capacity three (3) times complete.
6. During load bank test, record the following parameters in fifteen minute intervals. Submit results prior to requesting substantial completion for project.

    a. Voltage L-L
    b. Voltage L-N
    c. Current/Phase
    d. Oil Pressure
    e. Coolant Temperature
    f. Generator mounted volt meter readings (all settings)
    g. Generator mounted amp meter readings (all settings)
    h. Hour meter readings

3.4 TRAINING

A. Provide six (6) hours of factory authorized training. These six (6) hours shall be divided in to two (2) three hour training sessions.

B. Field training shall cover all the items contained in the Operation and Maintenance Manuals.

C. As part of project close-out documents, submit original sign-in sheets of both training sessions.

END OF SECTION 16621



SECTION 16670 - LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes lightning protection for buildings and associated structures and requirements for lightning protection system components.

B. The work covered by this section of the specifications consists of furnishing all labor, materials and items of service required for the design and installation and full UL certification of the complete and entire lightning protection system.

1.3 SYSTEM DESCRIPTION

A. Protect entire building including all roof mounted equipment.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each component specified.

1. Roof adhesive data.
2. Decorative air terminal illustrations.

C. Shop Drawings detailing lightning protection system design shall include air terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and data on how concealment requirements will be met.

D. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by nationally recognized testing laboratory (NRTL) or trade association. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Certification, signed by Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material.

F. Field inspection reports indicating compliance with specified requirements.

G. The complete design drawing(s) must be signed and approved by the installing contractor, who is Lightning Protection Institute Certified Master Designer. This signature will assure the proper lightning protection design and installation.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Provide UL Master Label for the entire Lightning Protection System.

C. System shall be compliant with Lightning Protection Institute Standard LPI 175 and upon completion of project Contractor shall provide LPI certification of system.

D. Provide NFPA 780 compliant system.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by of one of the following:

1. Advanced Lightning Technology
2. East Coast Lightning Equipment
3. Preferred Lightning Protection, LLC
4. Prior approved equivalent manufacturer

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96A, LPI 175 and NFPA 780.

B. System Materials: Copper, with solid blunt-tip air terminals, except as otherwise indicated.

C. Air Terminals for Single-Ply Membrane Roof Mounting: Units with bases especially designed for single-ply membrane roof materials.

D. Ground Rods: Copper-clad steel with a minimum of 27 percent of rod weight in copper cladding.

1. Diameter: 3/4 inch (nominal)
2. Length: 10 feet (nominal)

2.3 LIGHTNING PROTECTION EQUIPMENT

A. All materials shall be copper and bronze and of the size, weight and construction to suit the application and used in accordance with LPI, UL and NFPA code requirements. Class I sized components may be utilized on roof levels 75 feet and below in height. Class II sized components are required for roof levels over 75 feet in height. Bolt type connectors and splicers shall be utilized on Class I and Class II structures. Pressure squeeze clamps are not acceptable. All mounting hardware shall be stainless steel to prevent corrosion.

2.4 ALUMINUM COMPONENTS

A. Aluminum materials may not be used except on roofs that utilize aluminum, galvalume or galvanized metal roofing components. On aluminum, galvalume or galvanized metal roofs or where aluminum, galvalume or galvanized metal parapet caps exist, the entire roof lightning protection equipment shall utilize aluminum components to insure compatibility. However, the down leads and grounding are to utilize copper with the bimetal transition occurring at the through roof assembly with an approved bimetal through roof assembly.

2.5 SURGE PROTECTION DATA

A. A surge protection device at the main electrical service entrance is required by lightning protection standards. The surge protection device must comply with UL Standard 1449 as a Type 1 or Type 2 lightning rated unit. Unit shall be a Current Technology SL3 series, Vertiv 570 Series or approved equivalent with main breaker or prior approved equivalent. It shall be the responsibility of the Electrical Contractor to provide and install a surge protection device on the main electrical service. Refer to Electrical Specifications for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces, areas, and conditions, with Installer present, for compliance with installation tolerances and other conditions affecting performance of lightning protection. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lightning protection as indicated, according to manufacturer's written instructions.

B. Comply with UL 96A, LPI-175, and NFPA 780.

C. Conform to the most stringent requirements when more than one standard is specified.

D. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops. Where indicated, run conductors in nonmetallic raceway, Schedule 40, minimum.

E. Conceal system conductors.

F. Conceal down conductors.

G. Conceal interior conductors.

H. Conceal conductors from normal view from exterior locations at grade within 200 feet of building.

I. Provide notification at least 48 hours before concealing lightning protection components.

J. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

K. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's installation instructions.

L. Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.

M. Bond ground terminals to counterpoise conductor.

N. Bond grounded metal bodies on building within 12 feet of ground to counterpoise conductor.

O. Bond grounded metal bodies on building within 12 feet of roof to counterpoise conductor.

P. Bond grounded metal bodies on building within 12 feet of roof to interconnecting loop at eave level or above.

Q. Bond lightning protection components to grounded metal bodies on building at every 60 feet with intermediate-level interconnection loop conductors.

R. The installation shall be accomplished by an experienced installation company that is a member of the Lightning Protection Institute (LPI) and an employer of LPI Certified Master Installers of lightning protection systems and UL Listed. For example: Bonded Lightning Protection Systems, Ltd. - 1-800-950-7933 with locations in Dallas, Fort Worth, Houston, Austin, San Antonio, Oklahoma, Louisiana, Alabama. A Certified Journeyman or Master Installer shall supervise the work. All equipment shall be installed in a neat, workmanlike manner. The system shall consist of a complete conductor network at the roof and include air terminals, connectors, splicers, bonds, copper down leads, and proper ground terminals. Copper down lead conductors shall be utilized even when the aluminum is required on the roof. Down lead conductors shall be installed in conduit and shall not be brought directly through the roof. Through roof assemblies with solid brass or stainless steel rods shall be utilized for this purpose. Structural steel may be utilized in the installation as outlined by LPI, UL and NFPA standards.

S. The lightning protection installer will work with other trades to insure a correct, neat and unobtrusive installation. The roofing contractor will be responsible for sealing and flashing all lightning protection roof penetrations as per the roof manufacturer's recommendations. However, the lightning protection contractor will be required to coordinate locations of through roofs and submit details of through roof penetrations as required. The lightning protection contractor shall use a compatible adhesive to adhere lightning protection components to the roof when required. The lightning protection contractor shall furnish and install the adhesive and obtain an approval of the compatible adhesive from the roof manufacturer/contractor prior to the installation. Should the roofing contractor/manufacturer require any special walk pads, membrane patches, pavers, etc. under the components of the lightning protection system, it shall be the responsibility of the roofing contractor to furnish and install such items. The lightning protection installer shall be responsible for marking the roof with all conductor and/or pad locations. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other ground systems.

T. Upon completion of the installation, the lightning protection installer shall conform to the requirements standards for lightning protection systems of the LPI, UL and NFPA. Upon completion the following certifications shall be delivered to the owner; a certification letter and warranty by the installation company, i.e.: Bonded Lightning Protection Systems, Ltd. and an LPI Master Certification, LPI Re-conditioned Certification or LPI Limited Scope Report from Lightning Protection Institute - Inspection Program (LPI-IP) depending on the lightning protection scope of work.

U. The lighting protection contractor shall use a compatible adhesive to adhere lightning protection components to the roof when required. The lightning protection contractor shall furnish and install the adhesive and obtain an approval of the compatible adhesive from the roof manufacturer/contractor prior to the installation. Should the roofing contractor/manufacturer require any special walk pads, membrane patches, pavers, etc.

under the components of the lightning protection system, it shall be the responsibility of the roofing contractor to furnish and install such items. The lightning protection installer shall be responsible for marking the roof with all conductor and/or pad locations.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Periodic Inspections: Provide the services of a qualified inspector to perform periodic inspections during construction and at its completion, according to LPI-177.

B. UL Inspection: Apply for inspection by UL as required for UL master labeling of system. Provide a UL certificate for complete system.

C. ETL Inspection: Provide the services of ETL to inspect completed system for conformance with specified requirements.

END OF SECTION 16670



SECTION 16724 - INTELLIGENT REPORTING FIRE DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section of the specification includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

D. The FACP and peripheral devices shall be listed and labeled 100% by a single U.S. manufacturer (or division thereof).

E. The installing company shall employ NICET (minimum Level III Fire Alarm Technology) technicians on site to guide the installation and final check-out and to ensure the systems integrity.

1.2 SCOPE:

A. A new intelligent reporting, microprocessor-controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
4. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) unit the alarm signal is processed and recorded.

6. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.
7. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
8. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
9. Two-way telephone communication circuits shall be supervised for open and short circuit conditions.

1.3 BASIC SYSTEM FUNCTIONAL OPERATION

A. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. A backlit 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed and the associated system outputs (alarm Notification appliances and/or relays) shall be activated.

1.4 SUBMITTALS

A. General:

1. One printed copy of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Prior Approvals:

1. All submissions for prior approvals shall include the following information as a minimum.

a. Standard Manufacturer's cut sheets on every piece of equipment to be provided as part of this project. Cut sheets shall indicate performance, physical sizes, construction materials, expand ability, etc.
b. Listing of all differences (deficiencies and betterment) between the proposed system and the specified system.
c. Any other supporting information required to demonstrate equivalency to system specified.

C. Shop Drawings:

1. Contractor shall be responsible for submitting a minimum of one (1) printed copy of all submittals to the Architect/Engineer for review. The Architect/Engineer will review the submittal and scan the reviewed submittal after the shop drawing review stamp has been applied. A pdf file of the reviewed submittal will be returned to the contractor. If the submittal is Noted as "APPEARS TO COMPLY" the contractor shall forward the pdf file to the State Fire Marshal's office for their review.
2. No payment will be made to the contractor for any fire alarm system work until submittal is forwarded to the AHJ for approval.
3. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.
4. All submittals to the Architect/Engineer shall include all items as called for in the 2019 edition of NFPA 72: 7.2.1, 7.3.1, 7.3.2, 7.3.4.2, 7.4 and the following as a minimum:

a. System Riser Diagram - include all devices and components of the system by zone, group or individual device. Each device shall be labeled indicating location in the facility.
b. Submittal shall include a master list of all components and equipment to be installed as part of the system. List shall include manufacturer, model number, size, voltage and quantity of each component.
c. System Wiring Diagram - Include diagrams for equipment and for system with all terminals and interconnections identified. Make all diagrams specific to this project and distinguish between field and factory wiring.
d. System Component Data Sheets - Indicating current draw-in alarm mode and in standby mode. Also submit component data sheets to indicate UL compatibility with system and compatibility with rest of system. Indicate all applicable data by highlighting on ALL submittal booklets.
e. Zone Designations, group(s) or individual device(s).
f. Battery Load Calculations for sizing battery for sixty (60) hours of continuous system operation in standby mode followed by five (5) minutes of continuous full evacuation alarm condition (fifteen (15) minutes of continuous full evacuation alarm if a voice evacuation alarm system is present in the system.) Calculations shall be on equipment manufacturer's standard form and shall clearly indicate capacity of batteries proposed to be installed.
g. Master list of system components by model number, description and quantity of each.
h. Shop Drawings showing details of graphic annunciator

i. Device Address List
j. Annunciator Lay-out, configurations.
k. Review Application - Contractor's portion completed
l. Review Application Fee - If Required
m. Blueline or Xerox copies of plans complying with the following criteria:

1) Drawn to scale
2) Identify each room or area
3) Show all system components, identifying each
4) Show all exits, door swings, ceiling height, light fixtures, exit lights (with direction arrows), HVAC openings in ceilings, whether ceilings are sloped or flat, and show all projections 0'-4" below ceilings
5) Shall not have Architect's/Engineer's titlebox and/or professional stamp
6) No markings showing additions, deletions or revisions after copies are made
7) Highlight in yellow or blue all system components
8) Proposed conductor routings

n. Statement on type of system - must be one of the following:

1) Local
2) Auxiliary
3) Remote Station
4) Proprietary

o. Description of this project's specific Sequence of Operation.
p. Description of wiring.
q. Designation of type
r. Color of insulation
s. Notifications appliance circuits shall be designed so that the maximum load on the circuit does not exceed eighty (80) percent of that available for alarm notification.

5. Manufacturer's certificate certifying supplier is an authorized factory representative along with mileage distance of office to job site.
6. Certificate showing that supplier/installer is licensed by the State Fire Marshal's Office to install, modify and maintain fire detection and alarm system.
7. Be aware that State Fire Marshal requirements do not allow work to occur on any portion of the fire alarm system prior to receipt of their approval on shop drawings.

D. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

E. Software Modifications:

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

F. Certifications:

1. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.5 GUARANTEE

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.6 MAINTENANCE:

A. Maintenance and testing shall be as specified herein or as required by the local AHJ where more stringent. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:

1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
2. Each circuit in the fire alarm system shall be tested semiannually.
3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 14.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment and

response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.7 POST CONTRACT EXPANSIONS:

A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable beam detectors, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

C. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.

D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.

E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.8 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

1. National Fire Protection Association (NFPA) - USA:

a. No. 13 Sprinkler Systems
b. No. 70 National Electric Code (NEC)
c. No. 72 National Fire Alarm Code
d. No. 101 Life Safety Code

2. Underwriters Laboratories (UL) – USA

a. No. 38 Manually Actuated Signaling Boxes
b. No. 217 Smoke Detectors, Single and Multiple Station
c. No. 228 Door Closers–Holders for Fire Protective Signaling Systems
d. No. 268 Smoke Detectors for Fire Protective Signaling Systems
e. No. 268A Smoke Detectors for Duct Applications
f. No. 346 Waterflow Indicators for Fire Protective Signaling Systems

g. No. 464 Audible Signaling Appliances
h. No. 521 Heat Detectors for Fire Protective Signaling Systems
i. No. 864 Control Units for Fire Protective Signaling Systems
j. No. 1481 Power Supplies for Fire Protective Signaling Systems
k. No. 1610 Central Station Burglar Alarm Units
l. No. 1638 Visual Signaling Appliances
m. No. 1971 Visual Signaling Appliances
n. No. 2017 General-Purpose Signaling Devices and Systems
o. CAN/ULC S524-01 Standard for Installation of Fire Alarm Systems

1) The FACP shall be ANSI 864, 9th Edition Listed. Systems listed to ANSI 864, 8th edition (or previous revisions) shall not be accepted.

B. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

C. Local and State Building Codes including the International Building Code.

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.9 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

1. UL Underwriters Laboratories, Inc.
2. FM Factory Mutual
3. MEA Material Equipment Acceptance (NYC)

B. The fire alarm control panel shall meet UL Standard 864, (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).

C. The system shall be listed by the national agencies as suitable for extinguishing release applications

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. Models which are scheduled for obsolescence with the next twelve (12) months shall not be accepted. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. All wiring shall be installed using conduit in un-accessible spaces, and/or where exposed and j-hooks in accessible spaces.
3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4 inch (19.1 mm) minimum.
7. All fire alarm system junction boxes shall be painted red in color with the word "FIRE" painted in white 1" high letters painted on each junction box cover.
8. All fire alarm system junction boxes shall be painted with the word "FIRE", painted in white 1" high letters painted on each junction box cover.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet (254 m). The system shall support up to 1,000 ft. (25.4 m) of untwisted, unshielded wire. The system shall

permit use of IDC and NAC wiring in the same conduit with the communication loop.

5. All field wiring shall be completely supervised.
6. The Fire Alarm Control panel shall be capable of T-Tapping Class B (NFPA Style 4) Signaling Line Circuits (SLC's). Systems which do not allow or have restrictions in, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.

C. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The Fire Alarm Control Panel and all remote power supply units shall be connected to a separate dedicated branch circuit, maximum 20 amperes. The circuit breaker protecting this circuit shall be of the locking type. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. Main FACP or network node shall be a Silent Knight Model 6700 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. Operator Control

1. Acknowledge Switch:

a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.
b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:

a. The first application of the alarm silence switch shall silence only the audible portion of the notification appliances. The visual portion of the

appliances shall remain active, upon the second activation of the alarm silence switch, all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch:

   a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch:

   a. Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. Lamp Test:

   a. The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal

C. System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.
2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
3. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits
4. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
5. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
6. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
7. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.

8. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
9. The FACP or each network node shall provide the following features:

    a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
    b. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
    c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
    d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel to display and print system reports. Provide system printer.
    e. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
    f. PAS pre-signal, meeting NFPA 72 3-8.3 requirements.
    g. Rapid manual station reporting (under 3 seconds) and shall meet NFPA 72 Chapter 1 requirements for activation of notification circuits within 10 seconds of initiating device activation.
    h. Periodic detector test, conducted automatically by the software.
    i. Self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
    j. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
    k. Walk test, with a check for two detectors set to same address.
    l. Control-by-time for non-fire operations, with holiday schedules.
    m. Day/night automatic adjustment of detector sensitivity.
    n. Device blink control for sleeping areas.

10. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."

11. Network Communication

    a. The FACP shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

D. Central Microprocessor

1. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

E. System Display

1. The system shall support the following display mode options:

    a. 80-character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.

2. The display shall provide all the controls and indicators used by the system operator:

    a. The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.

3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
4. The display shall also provide Light-Emitting Diodes. The 80-character display shall provide 12 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, ALARM SILENCED, Controls Active, Pre-Discharge, Discharge and Abort.
5. The system shall support the display of battery charging current and voltage on the 80-character LCD display.

F. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

G. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.

    a. One EIA-232 interface shall be used to connect an UL-Listed 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.
    b. One EIA-232 interface shall be used to connect a UL-listed CRT terminal (CRT terminal not included as part of this project). This interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.
    c. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.

d. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

H. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

I. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

J. Power Supply:

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

    a. Ground Fault LED
    b. AC Power Fail LED
    c. NAC on LED (4)

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
7. All circuits shall be power-limited, per UL864 requirements.

K. Auxiliary Field Power Supply - Addressable:

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.

2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
10. The addressable power supply mounts in either the FACP backbox or its own dedicated surface mounted backbox with cover.
11. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
13. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.

15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

L. Field Charging Power Supply (FCPS)

1. The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
2. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
3. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
4. The FCPS shall include an attractive surface mount backbox.
5. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
6. The FCPS include power limited circuitry, per 1995 UL standards.

M. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. .Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:

    a. Device status
    b. Device type
    c. Custom device label
    d. View analog detector values
    e. Device zone assignments
    f. All program parameters

5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.

6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
10. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:

    a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
    b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
    c. All devices tested in walk test shall be recorded in the history buffer.

11. Waterflow Operation

    a. An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.

12. Supervisory Operation

    a. An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

13. Signal Silence Operation

    a. The FACP shall have the ability to program each output circuit (notification, relay, speaker etc.) to deactivate upon depression of the signal silence switch.

14. Non-Alarm Input Operation

    a. Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

15. Combo Zone

    a. A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4 SYSTEM COMPONENTS

A. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as shown on plans.
4. Where shown to be installed outside, device shall be of the weatherproof design.
5. Where installed surface mounted, provide factory backbox and/or backbox skirt so that edge of device does not overhang installation box.

B. Speakers:

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.
5. Where shown to be installed outside, device shall be of the weatherproof design.
6. Where installed surface mounted, provide factory backbox and/or backbox skirt so that edge of device does not overhang installation box.

C. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

4. Where shown to be installed outside, device shall be of the weatherproof design.
5. Where installed surface mounted, provide factory backbox and/or backbox skirt so that edge of device does not overhang installation box.

D. Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

E. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

    a. This unit shall provide for each zone: alarm indications, using a red alarm a yellow trouble long-life LEDs and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
    b. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.

F. Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
7. The system shall allow a minimum of 32 terminal mode LCD annunciators. Up to 10 LCD annunciators shall be capable of the following system functions: Acknowledge, Signal Silence and Reset, which shall be protected from unauthorized use by a keyswitch or password.
8. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

G. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

H. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.

5. Communication shall include vital system status such as:

    a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
    b. Independent Addressable Device Status
    c. AC (Mains) Power Loss
    d. Low Battery and Earth Fault
    e. System Off Normal

f. 12 and 24 Hour Test Signal
g. Abnormal Test Signal (per UL requirements)
h. EIA-485 Communications Failure
i. Phone Line Failure

6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

I. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 17.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Bases shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications.

8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. Manual stations shall be of the double action type.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of aluminum with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
4. All manual stations installed outdoors, in non-conditioned spaces and/or wet environments shall be installed with STI No. STI-3150-R weather stopper cover.
5. Surface mounted manual stations shall be complete with factory backbox such as the Notifier BG-2. Typical wiring device backboxes will not be accepted.

C. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.

2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

E. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

F. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

G. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

H. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

I. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

J. Surge Suppression

1. Provide and install Ditek No. 2MHLPB-WS on all initiating circuits entering/leaving the building. Provide and install devices in junction box concealed above accessible ceiling immediately at building exterior wall. Properly ground device per manufacturer's instructions.
2. Provide and install Ditek No. DTK-120SRD-A on all 120V circuits providing power to any and all fire alarm system components. Provide and install empty cabinet adjacent to respective fire alarm system (match fire alarm system device cabinet). Cabinet to house surge protection device.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3.2 TEST

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 14. Testing shall be personally supervised by NICET Level III Certified Personnel.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

D. Verify activation of all flow switches.

E. Open initiating device circuits and verify that the trouble signal actuates.

F. Open and short signaling line circuits and verify that the trouble signal actuates.

G. Open and short Notification Appliance Circuits and verify that trouble signal actuates.

H. Ground all circuits and verify response of trouble signals.

I. Check presence and audibility of tone at all alarm notification devices.

J. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.

K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

L. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 SPARE PARTS

A. Contractor shall furnish the extra materials listed below, prior to installation that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents:

1. Intelligent photoelectric smoke detectors.
2. Addressable manual fire alarm pull station.
3. Addressable control relay (multi voltage)
4. Addressable monitor module.
5. Isolator Module
6. Strobe Ceiling and Wall mounted (multi candela type with range of 30 - 110cd).

7. Speaker/Strobe Ceiling and Wall Mounted, (multi candela type with range of 30 - 110cd).
8. Duct Detector and Housing
9. Detector base(s).
10. Ceiling Mounted Speaker

B. Provide a quantity equal to no less than five percent (5%) of the number of units of each type installed but not less than one (1) of each type.

C. Each spare part shall be complete with 50" of 3/4" EMT conduit, system wiring and required system programming.

3.4 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until new equipment is accepted. Remove tags from new equipment when put into service and tag existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of the new fire detection and alarm system, remove existing disconnected fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed; deliver to Owner. Remove from site and legally dispose of remainder of existing material.

3.5 PROGRAM CODE

A. At the end of the project and prior to requesting substantial completion, the Contractor shall provide on CD-ROM a copy of the current program code for the system.

1. During program upload or download the system shall retain the capability for alarm reporting.

2. The system shall download to a PC for program editing. System program shall be stored on a CD-ROM and all programming shall be multi-level password protected. A duplicate copy of the CD-ROM shall be turned over to the Owner's personnel prior to requesting substantial completion. All system passwords shall also be turned over to the Owner at this time.

3.6 SYSTEM TESTING

A. After installation of the Fire Detection and Alarm System is complete, the contractor shall align, adjust and balance the system and perform complete 100% operational testing as herein before described to determine conformance of the system to the requirements of the contract documents. Correct deficiencies observed in testing and replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Record results using the fire alarm system printer of the

testing and submit to the Engineer as part of the close-out documentation. Should the installation of a permanent printer not be part of the project, contractor shall provide and install a temporary printer and all required interface hardware, paper, toner (ink), software and programming to provide the required test reports. This temporary printer shall be available for printing test reports as required until final acceptance of the fire detection system has been issued by the engineer.

B. In addition to the testing requirements herein before specified, testing shall also include the following as a minimum:

1. Verify the absence of unwanted voltages between circuit conductors and the ground conductor(s).
2. Test all conductors for short circuits.
3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
4. Test each and every initiation and signaling device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
5. Test both primary and secondary power sources for proper operation.
6. Test the system to ensure that all specified functions operate as specified. This includes all function switches and indications at all Fire Detection and Alarm System control and monitoring points.

C. In addition to the documentation required above the contractor shall provide completed copies of Forms 7.8.2(a) through 7.8.2(l) as included in the 2019 Edition of NFPA 72.

D. All documents shall be stored in a locked "Documentation Cabinet ". Cabinet size as required to hold all documentation for the system. Cabinet shall comply with the requirements of NFPA 72:7.7.2

3.7 FIRE MARSHAL'S CHECKOUT

A. Upon completing the entire installation of the Fire Detection and Alarm System, the Contractor shall perform a demonstration of the operation of the complete system in the presence of the Architect/Engineer. The above demonstrations shall encompass the work performed under this Contract. Any deficiencies found with the Fire Detection and Alarm System installed as part of this project shall be corrected with no additional expense to the Owner prior to demonstration to "Authority Having Jurisdiction (AHJ)". After successful and accepted demonstration of the entire system to the Architect/Engineer, the Contractor shall schedule demonstration of the system with the Authority having Jurisdiction (AHJ).

B. The Contractor shall be responsible for coordinating this demonstration with the Architect/Engineer and "Authority Having Jurisdiction (AHJ)" a minimum of forty-eight (48) hours prior to the meeting.

3.8 CLOSE-OUT DOCUMENTATION

A. Upon successful completion of installation of the Fire Detection and Alarm System, the Contractor shall submit to the AHJ's office through the Architect/Engineer, a copy of the Fire Alarm System Certifications and Description form as described and required in NFPA 72.

B. Contractor shall also label the Fire Detection and Alarm System as being certified by a Louisiana State Fire Marshal licensed contractor.

C. Equipment Manuals: As part of the equipment manual submittals, the Contractor shall include the following information as a minimum:

1. All information required to be submitted as part of the shop drawing submittal
2. Operation and Maintenance Manual
3. Device Address List
4. Record of field tests of the system including the 100% operational test.
5. Names, addresses, and telephone numbers of service department including nighttime and holiday access.

3.9 WARRANTY PERIOD REQUIRED WORK

A. Three (3) months after date of substantial completion of the entire system, the Contractor shall provide a complete checkout and calibration of entire Fire Detection and Alarm System. A detailed report of this checkout shall be immediately submitted to the Architect/Engineer for review and acceptance.

B. When requested by the owner within one (1) year of date of Substantial Completion, the contractor shall provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three (3) requested adjustment visits to the site for this purpose.

C. At a period between eleven (11) and twelve (12) months from the date of substantial completion, contractor shall provide complete checkout and calibration of entire Fire Detection and Alarm System and shall certify the system as being fully operational.

3.10 TRAINING

A. Contractor shall provide one (1) on-site training session with a minimum of four (4) hours of instructions on system operation to Owner's representative(s) upon completion of construction phase of the work. Contractor shall conduct instruction session prior to use by the Owner or requesting substantial completion.

B. Contractor shall submit to the Engineer through the Architect, a sign-in sheet with the instructor's signature and signatures of all persons present during the instructional session. The sign-in sheet shall indicate time of instruction session. This sheet shall be submitted prior to use by the Owner or requesting substantial completion. Training

session shall be requested in writing to the Engineer a minimum of seven (7) consecutive calendar days prior to time requested.

C. Items to instruct the Owner's personnel on include startup, shutdown, troubleshooting, servicing, adjusting, and preventive maintenance.

D. At the same time as the three (3) month check-out and calibration listed above, the contractor shall also provide one (1) additional training session consisting of a maximum of four (4) hours for owner's personnel. Sign-in sheets shall be submitted as hereinbefore specified. This session shall also be scheduled a minimum of seven (7) consecutive calendar days prior to requested time.

END OF SECTION 16724