

ADDENDUM NO. 1

TO: PLANS AND SPECIFICATIONS FOR THE STATE OF MISSOURI

Replace Fire Alarm Panels - Infrastructure
Crossroads Correctional Center
Cameron, Missouri
PROJECT No.: C2404-01

Bid Opening Date: 1:30 PM, December 3, 2024 (UNCHANGED)

Added Unit Prices Form is attached. Bidders must use the Unit Prices Form marked ADDED PER ADDENDUM #1 to bid this project.

Bidders are hereby informed that the construction Plans and/or Specifications are modified as follows:

SPECIFICATION CHANGES:

1. Section 004322 – Unit Prices Form
 - a. ADD Unit Prices Form. Unit Price No. 1, Unit Price No. 2 and Unit Price No. 3 are added. **Bidders must use the attached Unit Prices Form marked ADDED PER ADDENDUM #1 to bid this project.**
2. Section 012200 – Unit Prices
 - a. ADD Section 012200. Unit Price No. 1, Unit Price No. 2 and Unit Price No. 3 are added. See attached specification section.
3. Section 284621 – Addressable Fire-Alarm Systems
 - a. REMOVE and REPLACE specification section in its entirety. Sections were revised and sections were added. See attached revised specification section.

DRAWING CHANGES:

1. Sheet FA-002
 - a. General Notes 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66 were added.
 - b. See attached revised drawing.

GENERAL COMMENTS:

1. The Pre-Bid Meeting was held November 14, 2024, followed by a walk-through of the project site. The Pre-Bid Meeting sign-in sheet is attached.
2. If an additional site visit is necessary, contact Chris DeVore (Chris.Devore@oa.mo.gov) who will coordinate with the on-site and Central Office DOC personnel.
3. PLEASE CONTACT MANDY ROBERSON, CONTRACT SPECIALIST, AT 573-522-0074 OR Mandy.Roberson@oa.mo.gov FOR QUESTIONS ABOUT BIDDING PROCEDURES, MBE\WBE\SDVE GOALS, GOOD FAITH EFFORT FORMS AND SUBMITTAL REQUIREMENTS.
4. All bids shall be submitted on the bid forms without additional terms and conditions, modifications, or stipulations. Each space on the bid forms shall be properly filled. Failure to do so will result in rejection of the bid.
5. MBE/WBE/SDVE participation requirements can be found in DIVISION 00. The MBE/WBE/SDVE participation goals are 10%/10%/3%, respectively. All MBE, WBE, and MBE/WBE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity.

ADDENDUM NO. 1

No other certifications from other Missouri certifying agencies will be accepted. If a bidder is unable to meet a participation goal, a Good Faith Effort Determination Form must be completed. Failure to complete this process will result in rejection of the bid.

6. The deadline for technical questions was November 25, 2024 at 12:00 PM.
7. Changes to, or clarification of, the bid documents are only made as issued in the addenda.
8. All correspondence with respect to this project must include the State of Missouri project number as indicated above.
9. Current Planholders list available online at: [C2404-01 Replace Fire Alarm Panels-Infrastructure-Crossroads Correctional Center :: Plan Holders :: State of Missouri Office of Administration \(oafmdcplanroom.com\)](https://oafmdcplanroom.com).
10. Prospective Bidders contact American Document Solutions, 1400 Forum Blvd Suite 7A, Columbia MO 65203, 573-446-7768 to order official plans and specifications.
11. Special considerations for correctional facilities:
 - a. In general, cell phone possession within the secured area is limited to the project superintendent or on-site foreman only.
 - b. Within the secured area, tobacco products are prohibited.
 - c. It is preferred the Contractor provide a "job-box" for tool storage within the prison rather than bringing tools in and out on a daily basis. The on-site facilities staff will provide space for the job-box within a secure location and accessible to the Contractor while on the job.
 - d. An inventory of tools and materials will be kept at all times and the inventory will be checked daily.
 - e. Contractor should allow extra time to go through the security protocols when entering the secured area.
 - f. Contractor should allow not less than 2-4 days for the personnel security clearance process.
 - g. Bidders shall thoroughly familiarize themselves with the requirements of Section 013513.16 Site Security and Health Requirements (DOC).

ATTACHMENTS:

1. Pre-Bid Meeting Sign-In Sheet
2. Section 004322 – Unit Prices Form
3. Section 012200 – Unit Prices
4. Section 284621 – Addressable Fire-Alarm Systems
5. Sheet FA-002





November 27, 2024

END ADDENDUM NO. 1

Pre-Bid Attendance Sheet

Replace Fire Alarm Panels, Infrastructure
 Crossroads Correctional Center
 Department of Corrections, Cameron, MO
 Project No. C2304-01

11/14/2024 10:00 am

Name & Title	Company Name Type of Contracting	MBE/WBE/ SDVE Status	Phone	E-Mail Address
Chris DeVore Project Manager 	Office of Administration FMDC	N/A	C: 573-619-2042	Chris.devore@oa.mo.gov
Michael Varhola Construction Project Specialist	Office of Administration FMDC	N/A	C: 816-797-3442	Michael.Varhola@oa.mo.gov
Aaron Keck Project Manager (DOC) 	Department of Corrections Central Office Construction Unit	N/A	O: 573-751-7169	Aaron.Keck@doc.mo.gov
Brett Adkison Phys. Plant Manager 	Department of Corrections Crossroads Correctional Center	N/A	O: 816-632-2727	Brett.Adkison@doc.mo.gov
Jaime Abshier Designer 	FSC Inc. Engineers	N/A	913-693-5987	jabshier@fsc-inc.com
Sherif Said Designer	FSC Inc. Engineers	N/A	913-278-7658	ssaid@fsc-inc.com

Pre-Bid Attendance Sheet

Replace Fire Alarm Panels, Infrastructure
 Crossroads Correctional Center
 Department of Corrections, Cameron, MO
 Project No. C2304-01

11/14/2024 10:00 am

Name & Title	Company Name Type of Contracting	MBE/WBE/ SDVE Status	Phone	E-Mail Address
Charles Ibe PM	GRE Electric	MBE	816-299-2949	charles.ibe@globalbrockco.com
Chuck Tracker	FSC		816-590-3636	ctracker@fsc-inc.com
Tim Symmonds	VAZQUEZ CC	MBE	816-604-7563	timse@VAZQUEZCC.COM
Randy Brockbro	VAZQUEZ CC	MBE	816-223-9708	randyb@VAZQUEZCC.COM
Jake Jacobson	24/7 Fire Protection	WBE	816-898-3473	jake@247fire.net

ADDED PER ADDENDUM #1

SECTION 004322 - UNIT PRICES FORM

PROJECT NUMBER: C2404-01

1.0 Description

- A. For changing specified quantities of work from those indicated by the contract drawings and specifications, upon written instructions of Owner, the following unit prices shall prevail. The unit prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover the finished work of the several kinds of work called for. Only a single unit price shall be given and it shall apply for either MORE or LESS work than that shown on the drawings and called for in the specifications or included in the Base Bid. In the event of more or less units than so indicated or included during construction the total contract price shall be decreased as appropriate or increased by contract change in accordance with General Conditions Article 4.1.

2.0 Unit Prices

- A. Unit Price No. 1 – Replacing damaged circuitry of 1 to 4 conductors per 100 lineal feet.

- 1. Description: Remove and replace 1 to 4 conductors with new according to Section 260501 – Common Work Results and Electrical Requirements for Fire Alarm Systems and Section 284621 – Addressable Fire-Alarm System.
- 2. Unit of Measurement: 100 Lineal Feet
- 3. Base Bid Quantity: 3,750 Lineal Feet

\$ _____ per 100 lineal feet

- B. Unit Price No. 2 – Install smoke detector devices.

- 1. Description: Remove and replace and/or install new smoke detectors according to Section 260501 – Common Work Results and Electrical Requirements for Fire Alarm Systems and Section 284621 – Addressable Fire-Alarm System.
- 2. Unit of Measurement: Each
- 3. Base Bid Quantity: 375

\$ _____ each

- C. Unit Price No. 3 – Install duct detector devices.

- 1. Description: Remove and replace and/or install new duct detectors according to Section 260501 – Common Work Results and Electrical Requirements for Fire Alarm Systems and Section 284621 – Addressable Fire-Alarm System.
- 2. Unit of Measurement: Each
- 3. Base Bid Quantity: 77

\$ _____ each

SECTION 012200 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.
- B. Quantities of Units to be included in the Base Bid are indicated in Section 004322 – Unit Prices Form.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Unit Prices.
- B. Related Sections include the following:
 - 1. Division 1 Section "Allowances" for procedures for using Unit Prices to adjust quantity allowances.
 - 2. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.3 DEFINITIONS

- A. Unit Price is a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit Prices include all necessary material plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of Unit Prices. Methods of measurement and payment for Unit Prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of Work in-place that involves use of established Unit Prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A list of Unit Prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each Unit Price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

- A. Unit Price No. 1 – Replacing damaged circuitry of 1 to 4 conductors per 100 lineal feet.

1. Description: Remove and replace 1 to 4 conductors with new according to Section 260501 – Common Work Results and Electrical Requirements for Fire Alarm Systems and Section 284621 – Addressable Fire-Alarm System.
2. Unit of Measurement: 100 Lineal Feet
3. Base Bid Quantity: 3,750 Lineal Feet

B. Unit Price No. 2 – Install smoke detector devices.

1. Description: Remove and replace and/or install new smoke detectors according to Section 260501 – Common Work Results and Electrical Requirements for Fire Alarm Systems and Section 284621 – Addressable Fire-Alarm System.
2. Unit of Measurement: Each
3. Base Bid Quantity: 375

C. Unit Price No. 3 – Install duct detector devices.

1. Description: Remove and replace and/or install new duct detectors according to Section 260501 – Common Work Results and Electrical Requirements for Fire Alarm Systems and Section 284621 – Addressable Fire-Alarm System.
2. Unit of Measurement: Each
3. Base Bid Quantity: 77

END OF SECTION 012200

SECTION 284621 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00, and Division 01 Specification Sections, apply to this Section.
- B. The requirements of this section apply to Fire and Life Safety System specified elsewhere in the specification; contractor to coordinate with Division 26 for interface with other systems.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire Alarm and Detection Systems:
 - a. As required by the state of Missouri, the project documents will allow for multiple equipment manufacturers, provided that they meet the specification requirements. To produce the provided contract documents Potter Electric Signal, has been used as the basis of design. Manufacturers shall be non-proprietary, addressable systems preferably with their corporate headquarters and manufacturing facilities located the state of MO.
 - b. Work includes a complete Addressable fire alarm system in the Crossroads Correctional Center buildings and providing all materials, equipment, hardware, software, accessories, services and tests necessary to furnish and install intelligent Addressable Fire Alarm System as indicated on the drawings required for replacement of the existing system.
 - c. The system consists of but not be limited to the following:
 - 1. Fire Alarm Control Unit (FACU) per each building.
 - 2. Fire Alarm Annunciator panels.
 - 3. Color graphic station with touch screen.
 - 4. Addressable intelligent manual fire-alarm pull station.
 - 5. Addressable intelligent Photoelectric detectors.
 - 6. Addressable intelligent heat detectors.
 - 7. Carbon monoxide detectors
 - 8. Fault isolator module (one module shall be added in the fire alarm loop, as specified on NFPA 72).
 - 9. Strobe light ceiling / Wall mounted.
 - 10. Horn-Strobe ceiling / Wall Mounted.
 - 11. Sprinkler water flow switch alarm (Switches wired by this Contractor).
 - 12. Sprinkler valve tamper switch monitoring (Switches wired by this Contractor).
 - 13. Zone addressable monitor modules (for water flow and tamper switches and other non-addressable initiating devices).
 - 14. Elevator recall and alternate recall control and relays.

15. Visual Display Unit (VDU).
16. Interface with HVAC system (Supply fans, Exhaust fans, pressurization fans, smoke fans and smoke dampers).
17. Addressable monitor modules (for water flow and tamper switches and other non-addressable initiating devices).
18. Control zone addressable modules.
19. Interface with all Fire Fighting Control Panels (FM200, CO2,...etc).
20. Interface with Automation systems.
21. Battery and battery Charger.
22. Conduits and Wires.

- B. All system components of the Fire Alarm Life Safety system shall be U.L. listed by one U.S manufacturer.
- C. After the completion of the installation of the Fire Alarm System, this Contractor shall perform a complete demonstration test of all systems and devices to the satisfaction of the Owner and their consulting engineer.

1.3 DEFINITIONS

- A. DACT: Digital alarm communicator transmitter.
- B. EMT: Electrical metallic tubing.
- C. FACU: Fire-alarm control unit.
- D. FAAP: Fire-alarm annunciator panel
- E. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the 2007 Energy Independence and Security Act (EISA).
- F. NICET: National Institute for Certification in Engineering Technologies.
- G. PC: Personal computer.
- H. Proprietary: equipment and software owned by a specific person or company. Proprietary fire alarm systems are owned by the manufacturer and local authorized service provider. They exclusively service the manufacturer's equipment and software.
- I. Non-proprietary: "Open source" equipment and software are typically distributed by authorized dealers who have received factory training and represent the manufacturer of the equipment. These systems can generally be serviced by multiple companies authorized by the fire alarm equipment manufacturer.
- J. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not

greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.

2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.4 PERFORMANCE REQUIREMENTS

- A. The fire alarm design documents and this specification section describes the minimum required features, material quality and operational requirements of the fire alarm system. These documents do not depict every connection to be made and wire to be installed. The Vendor and Contractor are solely responsible for determining all wiring, programming, interconnections, and additional equipment required to create a complete and fully functional fire alarm system, based on the equipment and performance characteristics described within these documents.
- B. Device layouts and limited equipment have been shown on the construction documents It is the contactor's responsibility to verify existing conditions, and complete shop drawing submittals that indicate all requirements to create said fire alarm system.
- C. Devices, equipment, and software to be non-proprietary.

1.5 ACTION SUBMITTALS

- A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Owner. Submittals Shall include product data, drawings, and calculations combined in a single submittal.
- B. Product Data: For each type of product, including furnished options and accessories.
 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 2. Include rated capacities, operating characteristics, and electrical characteristics.
 3. Submit Complete, Detailed, and Original Catalogue for the manufacturer and marked up for all of the proposed equipment.
 4. Detailed Bill of material indicating the model number, quantity, mounting accessories and country of origin list for all of the proposed equipment.
 5. Description of operation of the system as described herein, to include all exceptions, variances or substitutions listed.
- C. Shop Drawings: For fire-alarm system.
 1. Comply with recommendations and requirements in "Documentation" chapter of NFPA 72 including but not limited to the information outlined in the "Minimum Required Documentation", "Design (layout) Documentation", and "Shop Drawings" sections.
 2. Include plans, elevations, sections, and details, including details of attachments to other Work.
 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor

- sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Annunciator panel details as required by authorities having jurisdiction.
 5. Detail assembly and support requirements.
 6. Include voltage drop calculations for notification-appliance circuits.
 7. Include battery-size calculations.
 8. Include input/output matrix.
 9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
 10. Include performance parameters and installation details for each detector.
 11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 12. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to the placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring and equipment required for HVAC unit shutdown on alarm.
 - c. Locate detectors in accordance with the manufacturer's written instructions.
 13. Include alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 14. Include floor plans to indicate final outlet locations, showing the address of each addressable device. Show the size and route of cable and conduits and point-to-point wiring diagrams.
 15. Coordinate address nomenclature with the Owner's representative to ensure address labeling is intuitive to facility personnel. Each device should be predominately labeled with the address corresponding to the provided shop drawings and as-builts.

1.6 INFORMATIONAL SUBMITTALS

- A. Architect/Engineer (AE) to approve shop drawing submittals prior to installation. Owner will be notified once submittals have been approved
- B. Certificates: Submit UL certificates for all Fire alarm equipment.
- C. Compliance list: submit a detailed point by point compliance statement with this specification. Where the proposed system does not comply or accomplish the stated function or specification in a manner different from that described and specified, a full description of the deviation shall be provided. Where a full description is not provided it shall be assumed that the proposed system does not comply with the requirements in the specification
- D. Field quality-control reports.
- E. Qualification Statements: For Installer.
- F. Sample Warranty: Submittal must include line item pricing for replacement parts and labor.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Division 00, include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
 - d. Riser Diagram: Submit detailed riser diagram to indicate the connection between all of the system components, size, type and number of all conductors and conduits and the interface with all other system and approved by manufacturer.
 - e. Peripheral device connection details showing all module and device wiring details..
 - f. Device addresses, Submit labeling Schema for all Fire alarm equipment, devices, sounders,....etc for approval and labeling schema shall be matched with device configuration on the FACU. Addresses will be noted on the fire alarm shop drawings.
 - g. Record copy of site-specific software.
 - h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
 - i. Manufacturer's required maintenance related to system warranty requirements.
 - j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.
 - k. Submit detailed report of the test results including any deficiencies found prior to the engineer inspection and testing.
 - l. Submit Proof of factory training and certification of the supervising technician assigned to the project.
- B. Software and Firmware Operational Documentation:
1. Software operating step-by-step instructions and upgrade manuals.
 2. Program Software Backup: On USB media or as approved alternative solution.
 3. Device address list. Address nomenclature to be coordinated with Owner's representative.
 4. Printout of software application and graphic screens.
 5. Contractor to submit any licensing details required for system operation.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. FACU motherboard: Quantity equal to 10 percent of the amount installed for the same motherboard with the highest number of slots but no fewer than one unit.
 2. Loop Cards: Quantity equal to 10 percent of amount installed, but no fewer than two unit.
 3. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 4. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 5. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
 6. Detector Bases: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
 7. Keys and Tools: One extra set for access to locked or tamper-proofed components.
 8. Audible and Visual Notification Appliances: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type
 9. Fuses: Quantity equal to 10 percent of amount of each type installed, but no fewer than two of each type installed in system. Provide in box or cabinet with compartments marked with fuse types and sizes.

1.9 QUALITY ASSURANCE

- A. Standards Compliance:
1. The system shall fully comply with the latest issue of these standards, if applicable.
 - a. National Fire Protections Association (NFPA).
 - b. No. 13 Sprinkler Systems.
 - c. No. 70 National Electric Code (NEC).
 - d. No. 72 National Fire Alarm Code.
 - e. International Building Code-IBC.
 2. Local and State Building Codes.
 3. All requirements of the local Authority Having Jurisdiction (AHJ).
- B. In case of conflict among the referenced standards and codes, the more stringent provision will govern.
- C. Installer Qualifications:
1. Personnel must be trained and certified by manufacturer for the installation of units required for this Project.
 2. Installation must be by personnel certified by NICET as fire-alarm Level IV technician.
 3. Obtain certification by NRTL in accordance with NFPA 72.

1.10 FIELD CONDITIONS

1. The term "withstand" means "unit must remain in place without separation of parts from unit when subjected to specified seismic design loads."
2. Upon completion of installation of Fire and Life Safety System and after system has been energized, test equipment to demonstrate compliance with requirements. Field correct or replace defective equipment, and retest.
3. Inspect existing conduits and wires to ensure they are in good working order for reuse. Replace any wire not meeting the standards noted herein.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace fire-alarm system equipment for FACU and components that fail because of defects in materials or workmanship within specified warranty period.
 1. Warranty Period: Three years from date of Substantial Completion.

1.12 ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES:

- A. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70 "National Electrical Code" for components and installation.
- C. Comply with NECA "Standard of Installation."
- D. Listing and Labeling: Provide products specified in this Section that are listed and labeled by Underwriters Laboratories for the specific purpose and comply with the following standards:
 1. ANSI C80.1, ANSI C80.3, ANSI/NEMA FB 1, ANSI C80.5, ANSI/NFPA 70.
 2. NECA "Standard of Installation."
 3. NEMA RN 1, NEMA TC 2, NEMA TC 3

PART 2 - PRODUCTS

2.1 General:

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, and are limited to the following:
 1. Potter Electric Signal.
 2. Edwards.
 3. Farenhyt by Honeywell.

2.2 EXISTING FIRE-ALARM

- A. Existing Fire-Alarm System to be replaced.

- B. Existing conduit and wiring are to be reused where possible. Existing wiring should be tested for compliance prior to reuse and be replaced where required.
- C. A facility-wide fiber backbone exists throughout the facility with a patch panel located at each building.

2.3 ADDRESSABLE FIRE-ALARM SYSTEM

- A. Description:
 - 1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice-and-strobe notification for evacuation.
 - B. The fire alarm control unit installed in the **Administration building** should be capable of monitoring fire alarm panels in the entire facility. A fire alarm monitor video display unit (VDU) must be provided in the main guard station of the **Administration Building** dedicated to allowing security to monitor each building effortlessly. The screen will notify the security personnel with an audible notification (sonalert or similar) and highlight the location of the trouble, supervisory, or alarm in any building or FACU. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.
 - b. Exception: Per the State of Missouri Department of Corrections the PC utilized for monitoring the fire protection network is not required to be fire rated/UL listed.
 - 2. General Characteristics:
 - a. Automatic sensitivity control of certain smoke detectors.
 - b. Fire-alarm signal initiation must be by one or more of the following devices and systems:
 - 1) Manual Pull stations.
 - 2) Heat detectors.
 - 3) Smoke detectors.
 - 4) Duct smoke detectors.
 - 5) Carbon monoxide detectors.
 - 6) Automatic sprinkler system water flow.
 - c. Fire-alarm signal must initiate the following actions:
 - 1) Continuously operate alarm notification.
 - 2) Identify alarm and specific initiating device at FACU, connected network control units, and remote annunciators.
 - 3) Transmit alarm signal to remote alarm receiving station located in the administrative building.
 - 4) Unlock electric door locks in designated egress paths in public areas and if approved by the owner in writing.

- 5) Release fire and smoke doors held open by magnetic door holders.
 - 6) Activate voice/alarm communication system.
 - 7) Switch HVAC equipment controls to fire-alarm mode.
 - 8) Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
 - 9) Activate stairwell and elevator-shaft pressurization systems.
 - 10) Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 11) Activate preaction system.
 - 12) Recall elevators to primary or alternate recall floors.
 - 13) Activate elevator power shunt trip.
 - 14) Activate emergency lighting control.
 - 15) Activate emergency shutoffs for gas and fuel supplies, except for shutoffs serving legally required life-safety systems such as emergency generators and fire pumps.
 - 16) Record events in system memory.
 - 17) Record events by system printer.
 - 18) Indicate device in alarm on graphic annunciator or Video Display Unit at the Administrative building main guard monitoring station.
- d. Supervisory signal initiation must be by one or more of the following devices and actions:
- 1) Valve supervisory switch.
 - 2) Elevator shunt-trip supervision.
 - 3) Zones or individual devices have been disabled.
 - 4) FACU has lost communication with network.
- e. System trouble signal initiation must be by one or more of the following devices and actions:
- 1) Open circuits, shorts, and grounds in designated circuits.
 - 2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - 3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 - 4) Loss of primary power at FACU.
 - 5) Ground or single break in internal circuits of FACU.
 - 6) Abnormal ac voltage at FACU.
 - 7) Break in standby battery circuitry.
 - 8) Failure of battery charging.
 - 9) Abnormal position of switch at FACU or annunciator.
 - 10) Hose cabinet door open.
- f. System Supervisory Signal Actions:
- 1) Initiate notification appliances.
 - 2) Identify specific device initiating event at FACU, connected network Fire alarm control units, and remote annunciators.

- 3) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
 - 4) Transmit system status to building management system.
 - 5) Display system status on graphic annunciator.
- g. Network Communications:
- 1) Fire alarm control unit located in Admin building shall be connected to the facility fiber backbone.
 - a) Contractor shall be responsible for providing all conduits, boxes, etc. and fiber from the FACU to each building's fiber patch panel.
 - b) Contractor shall be responsible for all terminations including fiber modules (single mode or multimode) and programming.
 - c) Contractor shall interface with onsite IT system to establish any addresses, etc. to complete the system.
 - d) Contractor shall coordinate with onsite IT system to ensure that separate Virtual LAN Network (VLAN) is dedicated for fire alarm systems / graphic software stations.
 - 2) Provide network communications for fire-alarm system in accordance with fire-alarm manufacturer's written instructions.
 - 3) Provide network communications pathway per manufacturer's written instructions and requirements in NFPA 72 and NFPA 70.
 - 4) Provide integration / interfaced gateway for connection to building automation system.
- h. Device Guards:
- 1) Description: UL listed welded wire mesh of size and shape for manual station, smoke detector, gong, or other device requiring protection.
 - a) Factory fabricated and furnished by device manufacturer.
 - b) Finish: Paint of color to match protected device.
- i. Document Storage Box:
- 1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch (216-by-279 mm) manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
 - 2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
 - 3) Color: Red powder-coat epoxy finish.
 - 4) Labeling: Permanently screened with 1 inch (25 mm) high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
 - 5) Security: Locked with 3/4 inch (19 mm) barrel lock. Provide solid 12 inch (304 mm) stainless steel piano hinge.
 - 6) Documents for all buildings are to be provided in a single document storage box located in the administrative building. Document storage boxes are not required in other facility buildings.

2.4 FIRE-ALARM NETWORKING SOFTWARE:

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:
1. Potter Electric Signal.
 2. Edwards.
 3. Farenhyt by Honeywell.
- B. General Characteristics:
1. Graphic software shall be UL listed.
 2. Graphical interface to up to 15 graphic networking stations. Network to maintain connectivity to the fire system and annunciate all events. Ensure a standard ethernet port is all that shall be required to configure the network.
 3. Connect to 1,000 fire alarm control units in a single facility or multiple sites.
 4. Native ethernet working connectivity with fire panels and other network stations.
 5. End-to-end supervision of all panels and Network stations.
 6. Single or multiple monitor support with floatable and dockable windows.
 7. Flexible licensing and software service agreement. Does not require yearly updates to the system for continued functionality. Can be updated as the Owner chooses.
 8. The network shall be fully functional when isolated from other systems and without an internet connection.

2.5 PRIMARY FIRE-ALARM CONTROL UNIT (FACU)

- A. The FACU shall not be proprietary.
- B. This section outlines the FACU required to be utilized in the central security command center of the administration building. This panel may be used elsewhere as necessary to accommodate other buildings. If a large capacity is not necessary to support other buildings, the second FACU outlined in Section 2.6 may be utilized.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, **and are limited to**, the following:
1. Potter Electric Signal.
 2. Edwards.
 3. Farenhyt by Honeywell.
- D. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.
- E. Performance Criteria:
1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
 2. General Characteristics:
 - a. The FACU shall support a minimum Six (6) SLC loops.

- b. The FACU shall include Signaling Line Circuits (SLC) that will power, supervise, monitor, and control a maximum of 127 analog addressable devices which may be made up of any combination of sensors and modules.
- c. The FACU shall be capable of expanding up to 1270 addressable devices using expansion board.
- d. The SLC loop shall not require twisted or shielded cabling. Systems that require twisted and/or shielded cabling for the SLC loop are not acceptable
- e. The FACU shall have 3 form C relays dedicated to Alarm, Trouble, and Supervisory conditions. These relays shall have a contact rating of 3 Amps at 24VDC.
- f. All circuits shall be power limited per UL 864 requirements.
- g. The FACU shall have minimum four (4) programmable Notification Appliance Circuits rated at no less than 3 amps per circuit and capable of being wired in a Class A or Class B configuration.
- h. The FACU shall include an operator interface keypad and annunciation panel that includes a 160-character backlit (4-line 40-character) LCD display and color-coded system status LED's.
- i. The FACU shall include a feature that can quickly and automatically detect, enroll all system devices, and make them operational. The function shall allow an authorized user to subsequently run a function after initial installation in order to make changes to the system, without deleting any existing programming. Systems that include auto-program functions that delete existing programming when ran are not acceptable.
- j. The FACU shall be housed in a UL listed key locked cabinet with sufficient space to house 8AH or 18AH batteries.
- k. FACU shall have the capability to be networked via Fiber cabling.
- l. The FACU shall be capable of being programmed with an IP address so that it can reside on a standard TCP/IP network. The IP address shall be able to be assigned dynamically through DHCP or programmed statically.
- m. The FACU shall include a built-in TCP/IP Ethernet port for programming and communications purposes.
- n. All fiber interface cards and modules shall be included and installed as per fiber optic cabling distances required for FACUs connectivity, interface modules shall be either multimode or single mode.

- o. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
- p. Include real-time clock for time annotation of events on event recorder.
- q. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
- r. FACU must be listed for connection to central-station signaling system service.
- s. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
- t. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.
- u. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
 - 1) Annunciator and Display: LCD include a 4-line 160-character backlit LCD display.
- v. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 - 1) Pathway Class Designations: NFPA 72, Class B.
 - 2) Pathway Survivability: Level 0.
 - 3) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.
- w. Serial Interfaces:
 - 1) One dedicated RS 485 port for central-station operation using point ID DACT.
 - 2) One RS 485 port for remote annunciators, Ethernet modules, or multi-interface modules (printer port).
 - 3) One USB port for PC configuration.
 - 4) One RS 232 port for air-aspirating smoke detector connection.
 - 5) One RS 232 port for voice evacuation interface.
 - 6) The Interfaces shall not be proprietary.
- x. Smoke-Alarm Verification:
 - 1) Initiate audible and visible indication of "alarm-verification" signal at FACU.

- 2) Activate approved "alarm-verification" sequence at FACU and detector.
 - 3) Record events by system printer.
 - 4) Sound general alarm if alarm is verified.
 - 5) Cancel FACU indication and system reset if alarm is not verified.
- y. Notification-Appliance Circuit:
- 1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
 - 2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
 - 3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.
- z. Elevator Recall: Initiate by one of the following alarm-initiating devices:
- 1) Elevator lobby detectors except lobby detector on designated floor.
 - 2) Smoke detectors in elevator machine room.
 - 3) Smoke detectors in elevator hoistway.
- aa. Elevator controller must be programmed to move cars to alternate recall floor if lobby detectors located on designated recall floors are activated.
- bb. Water-flow alarm connected to sprinkler in elevator shaft and elevator machine room must shut down elevators associated with location without time delay.
- 1) Water-flow switch associated with sprinkler in elevator pit may have delay to allow elevators to move to designated floor.
- cc. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls must be connected to fire-alarm system.
- dd. Remote Smoke-Detector Sensitivity Adjustment: Controls must select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.
- ee. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.
- ff. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals must be powered by 24 V(dc) source.
- gg. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.

- hh. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.
- ii. Batteries: Sealed, valve-regulated, recombinant lead acid

F. Accessories:

- 1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.

2.6 SECONDARY FIRE ALARM CONTROL UNIT (FACU)

A. General:

- 1. The FACU shall not be proprietary and networkable with the primary panel outlined in section 2.5.
- 2. The manufacturer shall match the chosen primary FACU to be provided in the Central Security Command Center of the administration building. The criteria outlined for the alternative FACU shall not be permitted to be installed in the Central Security Command Center.

B. The secondary FACU shall be with reduced features as allowed. The same features shall include at a minimum one (1) Signaling Line Circuit (SLC) that will power, supervise, monitor, and control a maximum of 100 analog addressable devices which may be made up of any combination of sensors and modules. Sub-points allow for more than 100 analog addressable software points. The SLC shall have the capability to be wired in an NFPA Style 4, 6, or 7 (Class A, B or X) configuration

C. The FACU shall be expandable via loop expansion module.

D. The FACU shall have 3 form C relays dedicated to Alarm, Trouble, and Supervisory conditions. These relays shall have a contact rating of 3 Amps at 24VDC.

E. The FACU shall have a power supply capable of providing a minimum of 5 amps of 24 VDC power to devices requiring auxiliary power and/or notification appliances.

F. The FACU shall have two (2) programmable Notification Appliance Circuits rated at no less than 3 amps per circuit and capable of being wired in a Class A or Class B configuration. These circuits shall be programmable for, but not limited to, the following output types:

- 1. Notification Appliance Circuit – Continuous Output
- 2. Notification Appliance Circuit – ANSI Temporal Output
- 3. Notification Appliance Circuit – Sounder Base Power
- 4. Notification Appliance Circuit – Synchronized Output
- 5. Auxiliary Power – Constant
- 6. Auxiliary Power – Resettable
- 7. Door Holder Power – Constant
- 8. Door Holder Power – Low AC Dropout
- 9. City Tie - Reverse Polarity Output for applications in compliance with applicable NFPA standards.

10. Releasing Circuit – For use with pre-action sprinkler systems.
 11. Elevator - Recall
 12. Elevator - Shunt trip
 13. HVAC – Unit shutdown
- G. The FACU NAC circuits shall include the capability to automatically synchronize notification appliances from multiple manufacturers simultaneously on the same FACU without the need for a synchronization module. Systems that do not allow for multiple brands of strobes to be synchronized together on the same panel are not acceptable. The following manufacturers synchronization protocol shall be supported as a minimum:
1. Potter
 2. Amseco
 3. Gentex
 4. Gentex Sync with T4
 5. Wheelock
 6. System Sensor
- H. The FACU shall include a 4-wire serial bus for communication with system annunciators, power supplies, expansion modules, and other accessories. The bus shall support a wiring distance of no less than 6500 feet from the panel to the furthest device.
- I. The FACU shall have two (2) programmable I/O Circuits rated at 1 amp per circuit and capable of being wired in a Class B configuration.
- J. The FACU shall include an operator interface keypad and annunciation panel that includes a 32-character backlit LCD display and color-coded system status LED's.
- K. The FACU shall include a LEARN feature that can quickly and automatically detect, enroll all system devices, and make them operational. The LEARN function shall allow an authorized user to subsequently run a LEARN function after initial installation in order to make changes to the system, without deleting any existing programming. Systems that include auto-program functions that delete existing programming when ran are not acceptable.
- L. The FACU shall be housed in a UL listed key locked cabinet with sufficient space to house 8AH or 18AH batteries.
- M. The FACU shall be capable of being programmed with an IP address so that it can reside on a standard TCP/IP network. The IP address shall be able to be assigned dynamically through DHCP or programmed statically.
- N. The FACU shall include a built-in TCP/IP Ethernet port for programming and communications purposes.
- O. The FACU shall include the ability to add a Digital Alarm Communicating Transmitter (DACT). The DACT shall be capable of being used in lieu of or in addition to the IP central station communication capability.

2.7 VIDEO DISPLAY UNIT (VDU)

- A. The VDU must be the secondary operator-to-system interface for data retrieval, alarm annunciation, commands, and programming functions. The desk-mounted VDU must consist of a PC, LCD monitor and keyboard. The VDU must have a 19-inch minimum Touch screen, capable

of displaying a graphical representation of the facility, and each building, 25 lines of 80 characters each. Communications with the FACU and remote FAAP's located in other buildings on facility must be supervised. Faults must be recorded in the history log. The power required must be 120 VAC, 60 Hz from the same source as the FACU. The VDU shall not be proprietary.

- B. To eliminate confusion during an alarm situation, the screen must have dedicated areas for the following functions:
 - 1. Alarm and return to normal.
 - 2. Commands, reports, and programming.
 - 3. Time, day, and date.

- C. Use full English language throughout to describe system activity and instructions. Full English language descriptors defining system points must be 100 percent field programmable by factory trained personnel, alterable and user-definable to accurately describe building areas.

- D. Alarms and other status changes must be displayed in the screen area reserved for this information. Upon receipt of alarm, an audible alarm must sound, and the condition and point type must flash until acknowledged by the operator. Return to normal must also be annunciated and must require operator acknowledgment. The following information must be provided in full English. Coordinate with Owner's representative acceptable address coding for all devices.
 - 1. Condition of the device (alarm, trouble, or supervisory)
 - 2. Type of device (for example, manual pull, waterflow).
 - 3. Location of the device plus numerical system address.
 - 4. The system must have multiple levels of priority for displaying alarms to conform with. Priority levels must be as follows:
 - 5. Level 1 - Fire Alarms Signals.
 - 6. Level 2 - Supervisory Signals.
 - 7. Level 3 - Carbon Monoxide Alarm Signals.
 - 8. Level 4 - Trouble Signals.

- E. Provide the system with memory so that no alarm is lost. A highlighted message must advise the operator when unacknowledged alarms are in the system.

- F. Multiple levels of access must be provided for operators and supervisors via user-defined passwords. Provide the following functions for each level:
 - 1. Operator-level access functions
 - a. Display system directory, definable by device.
 - b. Display status of an individual device.
 - c. Manual command (alarm device with an associated command must use the same system address for both functions).
 - d. Report generation, definable by device, output on the VDU or printer, as desired by the operator.
 - e. Activate building notification appliances.
 - 2. Supervisor level access functions:
 - a. Reset time and date.
 - b. Enable or disable event initiated programs, printouts, and initiators.
 - c. Enable or disable individual devices and system components.

3. The above supervisor-level functions must not require computer programming skills. Changes to system programs must be recorded on the printer and maintained in the control unit as a trouble condition.

G. PROGRAMMING:

1. Where programming for the operation of the VDU is accomplished by a separate software program other than the software for the FACU, the software program must not require reprogramming after loss of power. The software must be reprogrammable in the field.
2. Changes to the software applied at a single PC must automatically provide a system-wide change to all PC's connected within the network.
3. the contractor's responsible for programing and testing the facility fiber network to ensure all buildings successfully report the Administration's central FACU for monitoring the entire facility. The contractor shall coordinate with the state to obtain IP addresses and other required information to accomplish this task.
4. Software installed on the PC shall be standalone and not require internet access. Software shall not require yearly upgrades to maintain functionality.
5. Back-up of the software will be provided to the state in a manner that will allow the state to replace a VDU if it stops functioning to minimize lapse in system monitoring.
6. The PC will have the most recent Microsoft software pre-uploaded to the PC and the monitoring software for the FACU network, including building drawings, and FACU building system and information.
7. The PC will have Bluetooth capability for remote connection and access via 2 factor authentication to accommodate a cellular modem.

2.8 MANUAL FIRE-ALARM PULL STATION

- A. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal.
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes **shall be metal and** must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Double-action mechanism requiring two actions to initiate alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
 2. **Keyed activation for areas accessible to detainees.**
 3. Station Reset: Key- or wrench-operated switch.
 4. Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
 5. Able to perform at up to 90 percent relative humidity at 90 deg F (32 deg C).

2.9 SYSTEM SMOKE DETECTORS

- A. Photoelectric Smoke Detectors:

1. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal
2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 268 7th Edition.
 - b. General Characteristics:
 - 1) Detectors must be two-wire type.
 - 2) 4" Standard base.
 - 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - 4) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
 - 5) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 - 7) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
 - 8) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - a) Primary status.
 - b) Device type.
 - c) Present average value.
 - d) Present sensitivity selected.
 - e) Sensor range (normal, dirty, etc.).
 - 9) Detector must have functional humidity range within 10 to 90 percent relative humidity.
 - 10) Multiple levels of detection sensitivity for each sensor.
 - 11) Sensitivity levels based on time of day.
 - 12) Temperature Range: 32 to 120° F
 - 13) Shall not be proprietary.

2.10 DUCT SMOKE DETECTORS

1. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal
- B. Description: Photoelectric-type, duct-mounted smoke detector.
- C. Performance Criteria:
 1. Regulatory Requirements:

- a. NFPA 72.
 - b. UL 268A.
2. General Characteristics:
- a. Detectors must be two-wire type.
 - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - d. The detector shall be listed for releasing service if used for direct interface with a smoke damper.
 - e. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 - f. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
 - g. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 - h. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
 - i. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - j. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.
 - k. Shall not be proprietary.
 - l. Where duct smoke detector is not easily accessible from the floor provide UL listed keyed remote test station as outlined by NFPA 72.

2.11 CARBON MONOXIDE DETECTORS

- A. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal
- B. Description: Carbon monoxide detector listed for connection to fire-alarm system.
- C. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. NFPA 72
 - b. NFPA 720.
 - c. UL 2075.
 - 2. General Characteristics:

- a. Mounting: Adapter plate for outlet box mounting.
- b. Testable by introducing test carbon monoxide into sensing cell.
- c. Detector must provide alarm contacts and trouble contacts.
- d. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
- e. Locate, mount, and wire in accordance with manufacturer's written instructions.
- f. Provide means for addressable connection to fire-alarm system.
- g. Test button simulates alarm condition.
- h. Shall not be proprietary.

2.12 HEAT DETECTOR

A. Combination-Type Heat Detectors:

1. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal.
2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 521.
 - b. General Characteristics:
 - 1) Temperature sensors must test for and communicate sensitivity range of device.
 - c. Actuated by fixed temperature of 135 deg F (57 deg C) or rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - d. Mounting: Adapter plate for outlet box mounting, or Twist-lock base interchangeable with smoke-detector bases.
 - e. 4" Standard base.
 - f. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - g. Detector must have functional humidity range of 10 to 90 percent relative humidity.
 - h. Shall not be proprietary.

B. Fixed-Temperature-Type Heat Detectors:

1. Potter Electric Signal, System Sensor, Edwards or approved equal.
2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 521.
 - b. General Characteristics:

- 1) Actuated by temperature that exceeds fixed temperature of 190 deg F (88 deg C).
- 2) Mounting: Adapter plate for outlet box mounting or Twist-lock base interchangeable with smoke-detector bases.
- 3) 4" standard base.
- 4) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 5) Detector must have functional humidity range of 10 to 90 percent.
- 6) Shall not be proprietary.

2.13 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Audible Notification Appliances:

1. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal
2. Description: Horns, bells, or other notification devices that cannot output voice messages.
3. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - b. General Characteristics:
 - 1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
 - 2) Chimes, Low-Level Output: Vibrating type, 75 dB(A-weighted) minimum rated output.
 - 3) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. (3 m) from horn, using coded signal prescribed in UL 464 test protocol.
 - 4) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
 - 5) Shall not be proprietary.

B. Fire-Alarm Visible Notification Appliances:

1. Potter Electric Signal, Edwards, System Sensor or approved equal
2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 1971.
 - b. General Characteristics:

- 1) Rated Light Output:
 - a) 15/30/75/110/115/185 cd, selectable in field.
- 2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
- 3) Mounting: Wall mounted unless otherwise indicated.
- 4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
- 5) Flashing must be in temporal pattern, synchronized with other units.
- 6) Strobe Leads: Factory connected to screw terminals.

2.14 EXIT-MARKING AUDIBLE NOTIFICATION APPLIANCES

A. Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
2. General Characteristics:
 - a. Provide exit-marking audible notification appliances at entrance to building exits.
 - b. Provide exit-marking audible notification appliances at entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.15 FIRE-ALARM REMOTE ANNUNCIATORS PANEL

A. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal.

B. Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
2. General Characteristics:
 - a. Annunciator functions must match those of FACU for alarm, supervisory, and trouble indications. Manual switching functions must match those of FACU, including acknowledging, silencing, resetting, and testing.
 - 1) Mounting: Match Existing for each panel and location.
 - b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights must match those of FACU. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
 - c. Shall not be proprietary.

2.16 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

A. Potter Electric Signal, System Sensor, Edwards, Farenhyt by Honeywell or approved equal.

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.

2. General Characteristics:

a. Include address-setting means on module.

b. Store internal identifying code for Fire alarm control unit use to identify module type.

c. Listed for controlling HVAC fan motor controllers.

d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.

e. Integral Relay: Capable of providing direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown.

1) Allow Fire alarm control unit to switch relay contacts on command.

2) Have minimum of two normally open and two normally closed contacts available for field wiring.

f. Control Module:

1) Operate notification devices.

2) Operate solenoids for use in sprinkler service.

2.17 CONDUIT AND TUBING

A. General Requirements:

1. Provide conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NFPA 70 for raceways.

2. In all areas accessible to offenders, all new conduit located at a height of 10 feet or less above finished floor must be rigid conduit. Any new conduit located at a height of 10 feet or more above finished floor shall be EMT. Two-hole straps must also be used to fasten the conduit to the structure with drive anchors. Regardless of conduit type, three straps per ten feet of run is required as a minimum. If not obvious, the Owner will make a determination if an area is accessible to offenders.

3. Bushings for terminating conduits smaller than 1-1/4 inches are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation. Install insulated type bushings for terminating conduits 1-1/4 inches and larger. Upper edge to have phenolic insulating ring molded into bushing. Bushings to have screw type grounding terminal.

4. Raintight Sealking Hubs: Two-piece type with outer internally-threaded hub to receive conduit, inner locking ring with bonding screw, insulated throat, and V-shaped ring or O-ring.

B. Electrical Metallic Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Republic Conduit.
 - c. Wheatland Tube Company.
2. Description: Conduit to be seamless, hot dipped or electro-galvanized steel tubing. Galvanizing to provide zinc coating fused to outside walls of conduit. Provide an enamel lubricating coating on the inside of the conduit. Conduit to conform to ANSI C80.3 - 1983 and listed and labeled under UL 797.
3. Fittings and Conduit Bodies: Compression.
4. Expansion fittings for use with EMT shall allow for a minimum of four inches of movement and shall be similar to O-Z Gedney TX series, complete with bonding jumpers and hardware.

C. Flexible Metal Conduit: Zinc-Coated Steel

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFC Cable Systems.
 - b. Alflex Inc.
 - c. Electri-Flex Co.
2. Description: Interlocked steel or aluminum construction, consisting of spirally wrapped, convoluted hot dip galvanized steel strip. Zinc coating to cover both sides and all edges of steel strip. Convolutions to be interlocked to prevent separation when conduit is bent at radius equal to 4-1/2 times conduit O.D. Conduit to be listed and labeled under UL 1.
3. Fittings: ANSI/NEMA FB 1 -1988. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron.

D. Metal Wireways:

1. Manufactured by one of the following:
 - a. Copper B-Line, Inc.
 - b. Hoffman.
 - c. Square D; Schneider Electric.
2. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, or 3R as environmental conditions dictate, unless otherwise indicated.
3. Material: Primed and painted sheet steel for indoor locations, galvanized sheet steel for outdoor locations sized as indicated or required, whichever is greater.
 - a. Wireway up to 6 inch by 6 inch cross section shall be minimum 16 gage.
 - b. Wireway larger than 6 inch by 6 inch cross section shall be minimum 14 gage.
4. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
5. Wireway Covers: Hinged Utilize flanged-and-gasketed type for outdoor locations.
6. Finish: Manufacturer's standard gray enamel finish.

E. Surface Raceways

1. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color noted on drawings.
2. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Bretts Corp.
 - b. Walker Systems, Inc.; The Wiremold Company
 - c. The Wiremold Company; Electrical Sales Division.
3. Provide types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceway

2.18 IDENTIFICATION FOR FIRE ALARM SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Electromark – Wolcott, New York.
 2. Ideal Industries, Inc.
 3. 3M
- B. Electrical Identification Products
1. Self-Adhesive Vinyl Labels (Notification Devices, SLC devices, Raceways and Boxes): Preprinted, flexible labeled laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
 2. Self-Adhesive Vinyl Tape for Banding (Raceway, Wire and Cable): Colored, heavy duty, waterproof, fade resistant; 2 inches wide.
 3. Self-Adhesive Tape Markers (Wire and Cable): Vinyl or vinyl-cloth, self-adhesive, wraparound cable and conductor markers with preprinted numbers and letters.
 4. Snap-Around, Color-Coding Brands (Raceways and Cables): Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service in accordance with requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without Owner's written permission.
- C. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

3.3 INSTALLATION OF EQUIPMENT

- A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 - 1. Devices placed in service before other trades have completed cleanup must be replaced.
 - 2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - 1. Connect new equipment to existing Fire alarm control unit in existing part of building.
 - 2. Connect new equipment to existing monitoring equipment at supervising station.
 - 3. Expand, modify, and supplement existing [control] [monitoring] equipment as necessary to extend existing [control] [monitoring] functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.
- C. Equipment Floor and Wall Mounting: Install FACU on finished floor.
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inch (1980 mm) above finished floor.
- E. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in normal path of egress within 60 inch (1520 mm) of exit doorway.
 - 2. Mount manual fire-alarm box on background of contrasting color.
 - 3. Operable part of manual fire-alarm box must be between 42 and 48 inch (1060 and 1220 mm) above floor level. Devices must be mounted at same height unless otherwise indicated.
- F. Smoke- and Heat-Detector Spacing:
 - 1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.

2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing must comply with NFPA 72 and manufacturer's instructions.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex A [or Annex B]in NFPA 72.
 5. HVAC: Locate detectors not closer than 36 inches or manufacturers recommended instructions from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inch (300 mm) from lighting fixture and not directly above pendant mounted or indirect lighting.
- G. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.
- H. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch (9100 mm) long must be supported at both ends.
1. The detector or tubes within the duct shall be within 5 feet of the damper.
 2. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- I. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- J. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within dwelling or suite, they must be connected so that operation of smoke alarm causes alarm in smoke alarms to sound.
- K. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- L. Audible Alarm-Indicating Devices: Install not less than 6 inch (150 mm) below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.
- M. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch (150 mm) below ceiling. Install devices at same height unless otherwise indicated.
- N. Device Location-Indicating Lights: Locate in public space near device they monitor.

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate must be laminated acrylic or melamine plastic signs.
 - 2. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch (13 mm) high.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
- C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.6 PATHWAYS

- A. Pathways must be installed in EMT.
- B. Mark EMT conduits as indicated by Specification 26 05 01.
- C. Conduit Size:
 - 1. Conduits be sized as shown on drawings. Where conduit sizes are not indicated, conduits shall be sized in accordance with the latest version of the National Electrical Code (NFPA 70) and shall be limited to a 40 percent conductor fill percentage. Conductor ampacities must be maintained; therefore adjustment factors for temperature and quantity derating values must be observed.
 - 2. Minimum Conduit Size: Unless otherwise noted, 3/4-inch (21-mm) trade size with the following exceptions:
 - a. Below Grade: 1-inch.
 - 3. Conduit sizes may change only at the entrance or exit of a junction box.
- D. General Installation Requirements:
 - 1. Conduits shall be mechanically and electrically continuous from source of current to all outlets unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per NFPA 70.
 - 2. Do not reduce the indicated sizes of raceways. Conduit sizes may only change junction and pull boxes.
 - 3. Complete raceway installation before starting conductor installation.
 - 4. Use temporary closures to prevent foreign matter from entering raceway.
 - 5. Avoid moisture traps; provide junction box with drain fitting at low points in raceway system.
 - 6. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at

each end of pull wire. Empty raceways shall be labeled at each end indicating origin of the raceway. Labels shall be self-adhesive vinyl labels.

E. Conduit Routing:

1. Conduit shall be concealed in walls and above ceilings within finished spaces and may be exposed within unfinished spaces (such as mechanical and utility areas) where conditions dictate and as practical. Where routed exposed, headroom shall be maintained for pedestrian and vehicular traffic.
2. Raceway routing proposed on Drawings is diagrammatic in nature and shown in approximate locations unless dimensioned. Coordinate conduit routing with beams, joists, columns, windows, etc., as required to complete wiring system. Verify field measurements, routing and termination locations of raceway with obstructions and other trades prior to rough-in.
3. Conduit installation shall be coordinated with all other systems on the project. The Construction Team shall exchange details of their work in order to ensure adequate and coordinated fit of all systems within ceiling spaces and exposed unfinished areas.
4. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.
5. Route exposed conduit and conduits above ceilings parallel and perpendicular to building structural lines, and as close to building structure as possible.
6. Raceways are not to cross pipe shafts or ventilating duct openings, nor are they to pass through HVAC ducts. Support riser raceway at each floor level with clamp hangers. Maintain adequate clearance between raceway and piping.
7. Coordinate layout and installation of conduit with other construction elements to ensure adequate headroom, working clearance and access.
8. Route conduit through roof openings provided for piping and ductwork or rooftop unit curbs where possible. Where unavoidable, route conduit through suitable roof jack with pitch pocket. Coordinate roof penetrations with other trades.
9. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
10. Do not install aluminum conduits in contact with concrete.
11. Raceways routed under-slab on grade must be a minimum of 12 inches below the concrete slab.

F. Conduit Supports:

1. Install raceways level and square and at proper elevations. Provide adequate headroom. Group related conduits; support using conduit rack. Construct rack using steel channel. All conduit supports shall be secured to walls, structural members, and bar joists. Do not support conduits from non-structural members, such as ductwork, water or fire suppression piping, or ceiling grid support system.
2. Run parallel or banked raceways together, on common support racks where practical and make bends from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways. Provide space within each rack for 20 percent additional conduits.
3. Support raceways as specified in Division 26 Section "Hangers and Supports."

G. Conduit Fittings and Terminations:

4. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow

- compound manufacturer's written instructions.
5. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
 6. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank coverplate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings where conduits enter or leave hazardous locations, where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces, such as kitchen cold boxes, air-conditioned spaces and other places indicated on the drawings or required by NFPA 70.
 7. Expansion/Deflection Joints: Provide suitable fittings to accommodate expansion and contraction where raceway crosses seismic and expansion joints. Install expansion fittings in the full open position if installed during a period of lowest expected temperature, and in the fully closed position if installed during a period of highest expected temperature. Install at proportionate intermediate position for intermediate temperatures.
 8. In addition to the foregoing, provide expansion fittings according to the following table, for exposed linear runs or runs in hung ceilings where such runs do not contain junction boxes, pull boxes, nor bends totaling more than 30 degrees.
 9. EMT and RMC expansion couplers shall be UL listed with an internal copper braided bonding jumper that meets the requirements of NEC 250.98. Fitting shall be listed as suitable for wet locations and rain water tight when installed in wet or outdoor locations.
 10. Flexible Connections: Use maximum of 6 feet of flexible metal conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement and for all motors. Use Liquidtight flexible metal conduit in wet or damp locations. Install ground conductor across flexible connections.
 11. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

3.7 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch (910 mm) from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.
 1. Smoke dampers in air ducts of designated HVAC duct systems.
 2. Magnetically held-open doors.
 3. Electronically locked doors and access gates.
 4. Alarm-initiating connection to elevator recall system and components.
 5. Alarm-initiating connection to activate emergency lighting control.
 6. Supervisory connections at valve supervisory switches.

7. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
8. Supervisory connections at elevator shunt-trip breaker.
9. Data communication circuits for connection to building management system.
10. Data communication circuits for connection to mass notification system.

3.8 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals as required by NFPA 72 and NFPA 70.
- B. Identify fire alarm system components with permanent address label matching that provided on the fire alarm as-built drawings. Refer to section 2.17 for acceptable labeling manufacturers. Address naming convention to be coordinated and accepted by the Owner's representative.
- C. Install framed instructions in a location visible from FACU.

3.9 BOXES, CABINETS AND ENCLOSURES

- A. General Installation Requirements:
Locate boxes to maintain headroom and present a neat appearance. Locate to allow proper access. Provide access doors for boxes located above inaccessible ceilings
 1. Provide knockout closures to cap unused knockout holes where blanks have been removed.
 - a. Support all boxes, cabinets and enclosures rigidly and independently of conduit except where specifically allowed by the National Electrical Code. Use supports suitable for the purpose.
 2. Boxes located outdoors above ground shall be raintight and gasketed cast aluminum.
 3. Provide covers for all boxes.
2. Outlet Box Installation:
 1. All fire alarm devices furnished under this project shall be mounted on or in an outlet box regardless of whether or not the associated system wiring is in conduit, unless otherwise noted.
 2. Flush-mount outlet boxes in finished areas. Outlets in mechanical rooms, electrical rooms, and the above removable ceilings may be surface-mounted.
 3. Use multiple gang boxes where more than one device is mounted together. Provide barriers to separate different voltage systems.
 4. Align wall-mounted outlet boxes for switches, thermostats and similar devices.
 5. Center ceiling mounted devices within corridors.
 6. Position outlets to locate devices as shown on reflected ceiling drawings. For recessed boxes in finished areas, secure to interior wall and partition studs; allow for surface finish thickness.
 7. Special care shall be taken to set all flush boxes square and true with the building finish. All wall outlets shall be rigidly secured to the stud system, using adjustable supports where necessary, to prevent all box movement.
 8. Outlet Box Application: Unless otherwise noted, outlet boxes shall be installed as follows:

- a. Galvanized Steel Box Installation Locations:
 - 1) Concealed interior locations.
 - 2) Exposed interior locations above 7 feet-0 inches of finished floor.
 - 3) Kitchen and laundry rooms, when recessed.
- b. Cast Box Installation Locations:
 - 1) Exterior locations.
 - 2) Hazardous locations.
 - 3) Exposed interior locations within 7 feet-0 inches of finished floor.
 - 4) Wet or damp locations.
 - 5) Direct contact with earth or concrete slabs on grade.
 - 6) Kitchen and laundry rooms, when exposed.

3. Pull and Junction Boxes:

1. Locate above accessible ceilings or in unfinished areas.
2. Locate pull or junction boxes to limit conduit runs to no more than 150 linear feet of four (4) 90 degree bends between pulling points. For telephone/ data limit bends to no more than three (3) 90 degree bends to pulling points.

4. Cabinets and Enclosures:

1. Install hinged cover enclosures and cabinets plumb. At a minimum, support at each corner.
2. Provide knockout closures to cap unused knockout holes where blanks have been removed.

3.2 IDENTIFICATION

1. Raceway Identification:

1. Identify Raceways of Certain Systems with Color Banding: Band exposed and accessible raceways of the following systems for identification. Bands shall be pre-tensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors and at 20-foot maximum intervals in straight runs. Apply the following colors:
 - a. Fire Alarm System: Red
 - b. At contractor option, manufacturer painted EMT conduit (when EMT conduit is allowed or required to be used for the above systems), may be utilized in lieu of the banding noted above. Fittings would not have to be painted. All painting shall comply with Division 09 requirements.
2. Where conduits leave a switchboard, panelboard, motor control center, etc., identification shall be provided on each conduit indicating the load being served.
3. Contractor shall be responsible for providing the Owner with laminated, colored, typewritten legends indicating the identification color scheme. At a minimum, these legends should be installed in the main electrical room and

branch electrical closets. Provide two additional legends to the Owner to use at their discretion.

4. Identification of Raceways with Labeling:
 - a. Raceway Labeling: Provide labeling on conduits indicating electrical distribution system contained within (e.g. Normal, Life Safety, etc.) and operating voltage level. Label size shall be as follows:

Nominal EMT conduit size	Nominal RGS conduit size	Length of color background on label	Height of letters
up to 1 inch	up to 3/4 inch	8 inches	1/2 inch
1.25 to 1.5 inches	1 to 1.5 inches	8 inches	3/4 inch
2 to 5 inches	2 to 5 inches	12 inches	1.25 inches
6 inches	6 inches	24 inches	2.5 inches

2. Box Identification

1. Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage.
2. At each junction, pull and connection box, identify the following: with self-adhesive vinyl labels. Identification of these boxes shall be located on the inside of cover if located in finished spaces.
 - a. Indicate system type and wiring description (e.g. “FIRE ALARM NAC #2”).
3. Paint box covers for fire alarm system Red.

3. Circuit Identification:

1. Label
 - a. Multiple
 - b. Multiple

4. Conductor Color Coding

1. Power-Circuit
 - a. Color shall be factory-applied, or field-applied for sizes larger than No. 6 AWG, if Authorities Having Jurisdiction permit
 - 1) Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
 - b. Colors for 208/120V Circuits:
 - 1) Phase A: Black
 - 2) Phase B: Red
 - 3) Phase C: Blue
 - 4) Neutral: White
 - 5) Ground Bond: Green

3.3 **FIRESTOPPING**

1. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Provide firestopping materials and

installation requirements using UL listed materials and methods.

3.4 PROTECTION

1. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

3.5 CLEANING

1. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.10 GROUNDING

- A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Ground shielded cables at control unit location only. Insulate shield at device location.

3.11 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by authorities having jurisdiction.
- B. Tests shall be conducted in accordance with NFPA 72
- C. The fire alarm test shall be thorough and test 100% of all circuit, devices, and signals.
- D. Administrant for Tests and Inspections:
 1. Engage qualified testing agency to administer and perform tests and inspections.
- E. Tests and Inspections:
 2. Visual Inspection: Conduct visual inspection prior to testing.
 3. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
 4. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.
 5. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
- F. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

- G. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- H. Prepare test and inspection reports.
- I. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- J. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain fire alarm system. A minimum of 8 hours of technical training shall be provided. Provide video recording of training to Owner. Refer to Specification section 017900 Demonstration and training for additional information and requirements.
- B. To accompany video-recorded training and provide step-by-step instructions for standard operating procedures for maintaining and modifying the Fire Alarm Systems and Network.

3.13 MAINTENANCE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
 - 1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA
 - 2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.14 VDU, FIRE ALARM NETWORK PC, AND SOFTWARE SERVICE AGREEMENT

- A. Open protocol software. Upgrades shall be available to owner directly from any vendor.
- B. Technical Support: Beginning at Substantial Completion, service agreement must include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Including latest version of the networking software and standard Microsoft Office. Install and program software

upgrades that become available within two years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.
 2. Software must be capable of standing alone separate from other systems.
- D. PC shall be delivered to the site with all software downloaded and programming of the fire alarm system complete, ready for system testing once installed to the network.

END OF SECTION 284621

