SECTION 284610

ADDRESSABLE FIRE ALARM SYSTEMs

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Refer to drawings for detailed scope of work description.

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

1.2 APPLICABLE CODES AND STANDARDS

A. Comply with requirements on drawings.

1.3 ORDER OF PRECEDENCE

A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply.

B. Should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:

1. Local / State Codes and associated amendments shall take precedence over this specification.
2. NFPA standards shall take precedence over this specification.
3. This specification shall take precedence over the drawings.

1.4 SUMMARY

A. Section Includes:

1. Fire alarm control units.
2. Emergency voice messaging components.
3. Remote annunciators.
4. Remote graphic annunciators.
5. Power supplies.
6. Network communications.
7. Digital alarm communicator transmitters.
8. Internet protocol (IP) communicators.
9. Manual fire alarm boxes.
10. System detectors.
11. Non-system detectors.
12. Single station smoke alarms.
13. Notification appliances.
14. Addressable interface modules.

15. Fault isolation modules.
16. Magnetic door holders.
17. Surge protection devices.
18. System printers.
19. Fire alarm cables, raceway and boxes.

1.5 DEFINITIONS

A. ADS: Acoustically Distinguishable Space.
B. AHJ. Authority Having Jurisdiction.
C. AV: Audio / Visual
D. BMS: Building Management System.
E. Dedicated Continuous Metal Raceway: Enclosed metal pathway dedicated to power-limited fire alarm cable; comprised of and limited to: EMT, IMC, RGS, FMC, and / or LFMC as specified.
F. EVACS: Emergency Voice Alarm Communication System.
G. FACU: Fire Alarm Control Unit.
H. FATC: Fire Alarm Terminal Cabinet.
I. HLI: High Level Interface
J. IDC: Initiating Device Circuit.
K. PC: Personal Computer.
L. NAC: Notification Appliance Circuit.
M. NICET: National Institute for Certification in Engineering Technologies.
N. PSTN: Publically Switched Telephone Network.
O. SLC: Signaling Line Circuit.

1.6 SUBMITTALS

A. Comply with Division 28 specifications and drawings; state/local regulations; and NFPA 72 - Chapter “Documentation”. For purposes of applying NFPA 72, all identified documentation requirements are a mandatory part of the Work, including those that “apply only where required by other governing laws, codes, or standards, by other parts of the Code; or by project specifications or drawings”.
B. Submit Action Submittals prior to applying for authority having jurisdiction installation permits (where required) and system installation.
C. Submit Informational Submittals after successful initial system testing and prior to scheduling authority having jurisdiction final approval demonstration testing.
D. Submit Closeout Submittals as part of project closeout procedure.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.
    1. Include approvals and listings, construction details, material descriptions, dimensions, profiles, and finishes.
    2. Include rated capacities, operating characteristics, and electrical characteristics.

3. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements of this Specification and of NFPA 72.

4. Include statement endorsed by the manufacturer's authorized representative that the electrical characteristics of the submitted fire alarm cables are within all operating parameters of the fire alarm system as designed and represented by the detailed fire alarm system Shop Drawings.

B. Shop Drawings: For fire alarm system and fire safety control interfaces.

1. Floor Plans. Include floor plans to indicate final equipment, cabinet, device and appliance locations. Indicate address of each addressable device. Show all interface modules. Show candela setting for each strobe appliance. Show complete point-to-point routing of all circuits and pathways; indicate Class and Survivability Level. Show size and type of all conduits, cable, wire, and conductors. Indicate panel circuit designation for each normal power supply branch circuit.

2. Riser Diagram. Include complete device/appliance accurate riser diagram. Indicate address of each addressable device. Show all interface modules. Show candela setting of each strobe appliance. Show each circuit and pathway; indicate Class and Survivability Level. Show size and type of all conduits, cable, wire, and conductors. Indicate panel circuit designation for each normal power supply branch circuit.

3. Equipment Wiring Diagrams and Details. Include wiring diagrams for each system component/node including control unit cabinets, remote power supply cabinets, terminal cabinets, remote annunciators, supervising station transmitters, and PC workstations. 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. Component Wiring Diagrams. Include typical wiring diagrams for fire detector bases, pull stations, conventional devices, interface modules including wiring connections to supervised/controlled equipment, notification appliances, and component modules and cards.

5. Ductwork Smoke Detector Details. Include installation details for each ductwork detector condition. Show plan and section view for each condition. Show requirements for ductwork attachments, penetrations, and access panels. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

6. Calculations - Voltage Drop. Include voltage drop calculations inclusive of safety/spare capacity factor(s) for notification-appliance circuits. Calculations shall assume alarm operation using the minimum standby power available at the conclusion of quiescent and alarm phases of operation.

7. Calculations - Power Supply and Battery Capacity. Include power capacity calculations inclusive of safety/spare capacity factor(s) for each system power supply and connected battery set.

8. Calculations - Conduit Fill. Include conduit fill calculations prepared in accordance with the National Electric Code.

9. Sequence of Operation. Include complete and detailed input/output sequence of operation matrix. Supplement matrix with narrative descriptions for complex specialty sequences.

10. Emergency Voice/Alarm Communication Systems; additionally:

    a. Floor Plans. Indicate amplifier equipment cabinets, primary and remote paging locations, and associated circuits and pathways. Show wattage tap and corresponding ADS for each speaker. Indicate circuit pathway Class and Survivability Level.

b. Equipment Wiring Diagrams and Component Wiring Diagrams. For amplifier racks, remote microphone stations, and speaker appliances.

c. Amplifier Loading. For each speaker circuit, identify quantity of speakers at each wattage tap setting and total connected wattage per circuit and per amplifier. Demonstrate calculated loading inclusive of safety/spare capacity factor(s) is accommodated by amplifier nominal power (watts) capacity.

d. Audio dB Loss Calculations. For each speaker circuit.

e. Power Supply Battery Capacity Calculations. For each amplifier array power supply and connected battery set, inclusive of safety/spare capacity factor(s).

11. Smoke Control Systems; additionally:

a. Floor Plans. Indicate interfaces to smoke control system fans, controllers, dampers, makeup air doors/windows/louvers, operation verification monitoring devices, and associated circuits and pathways.

b. Fire Fighter's Smoke Control Panel. Manufacturer's fabrication drawings including wiring connections, graphics, indicators, and manual controls.

c. Post-fire Smoke Removal Panel. Manufacturer's fabrication drawings including graphics, indicators, and manual controls.

d. Equipment Wiring and Component Wiring Diagrams. Include for control panels; and interfaces to fans, controllers, dampers, makeup air doors/windows/louvers, operation verification monitoring devices.

e. Sequence of Operation. Include complete and detailed smoke control input/output sequence of operation matrix. Supplement matrix with narrative descriptions for complex specialty sequences.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and Certified Engineering Technician.

B. Seismic Qualification Certificates: For fire alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Record of Wiring Inspection and Testing: For field wiring inspection and testing; for each circuit indicate measured values and corresponding acceptance criteria for circuit continuity, resistance, stray voltage, ground-faults, short-circuit-faults, and any other manufacturer recommended conductor field testing parameters.

D. Record of Fire Alarm System Inspection and Testing. Detailed documentation of completed 100 percent fire alarm and signaling system initial acceptance testing. Use NFPA 72 "System Record of Inspection and Testing" forms.

E. Statement of Completion: Written statement that system has been installed in accordance with approved plans and tested in accordance with the manufacturer's published instructions and appropriate NFPA 72 requirements.

F. Sample Warranty: For special warranty.

1.9 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire alarm systems and components to include in emergency, operation, and maintenance manuals.

B. Following submittal of the current Working As-Built drawings for the Demonstration Test and following Building Owner/Client review and approval, the Contractor shall update the Working As-Built drawings as noted in the Building Owner/Client review and to reflect the final as-built configuration. Copy and bind into sets.

C. On the bottom right corner of each drawing sheet, the Contractor shall stamp in red letters 1-inch high, the wording “RECORD DRAWINGS.”

D. The as-built drawings shall be in a final form for submission for final approvals. Once the as-built drawings are approved, the Contractor shall submit three copies and the updated AutoCAD/REVIT files to the Building Owner/Client for distribution.

E. Items for "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

1. Comply with the "Records" section of the "Inspection, Testing and Maintenance" and "Documentation" chapters in NFPA 72.

2. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" chapter in NFPA 72.

3. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.

4. Riser diagram.

5. Device addresses.

6. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.

7. Record copy of site-specific software.

8. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" and "Documentation" chapters in NFPA 72, and include the following:

   a. Equipment tested.

   b. Frequency of testing of installed components.

   c. Frequency of inspection of installed components.

   d. Requirements and recommendations related to results of maintenance.

   e. Manufacturer's user training manuals.

9. Manufacturer's required maintenance related to system warranty requirements.

10. Abbreviated operating instructions for mounting at fire alarm control unit and each annunciator unit.

F. Software and Firmware Operational Documentation:

1. The Contractor shall provide complete indexed bound sets of the Operation and Maintenance (O&M) manual, as outlined in NFPA 72. These O&M manuals shall include the following in addition to that required in NFPA 72:

   a. The final Equipment List identifying the quantities and types of equipment listed by manufacturer’s part number.

b. An equipment datasheet (or specification sheet) on every piece of fire alarm and emergency voice evacuation system equipment installed.

c. Standby power calculations and voltage drop calculations that coincide with the equipment that has been installed in the building.

d. A point ID list referencing the signaling line circuit loops and the devices on those loops.

e. Complete System Programming

1) Program Software Backup: On magnetic media, compact disk or portable USB flash drive, complete with data files.

f. Device labels

g. Evacuation and alert messages.

h. The control unit configuration, serial number, access passwords, and a description of remote functions.

i. Software operating and upgrade manuals.

j. Printout of software application and graphic screens.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: Personnel licensed by the governing licensing authority for the installation of fire alarm systems. Successfully installed, tested, obtained approvals for, and put into service no less than three (3) fire alarm systems similar in type, size, and complexity to that of the Work of this Section.

B. Certified Engineering Technician Qualifications: Personnel trained and certified by the fire alarm system manufacturer as an approved technician.

1. Shop Drawings and Calculations prepared by personnel certified by NICET as fire alarm Level III or IV technician, or licensed as a Professional Fire Protection Engineer by the governing licensing authority.

C. Source Limitations for Fire Alarm System and Components: Single vendor source to provide fire alarm system components and connected non-system components as a single listed addressable fire alarm and signaling system.

1. Modifications to Existing Systems: Components compatible with, and operate as an extension of, existing system.

D. Product Standards: Listed in the "Fire Protection Equipment Directory" published by UL or the "Approval Guide" published by FM Global.

1. Subject to compliance with requirements, indication of a UL product requirement within Part 2 shall be construed to be inclusive of a corresponding FM Global approved product, with or without UL listing.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.11 COORDINATION

A. Definition, “Coordinate”: Where Sections of the Work interact, the Contractor responsible for this Section of the Work initiates verbal and/ or written communication with one or more different Contractors responsible for other interacting Sections of the Work for the purposes of

establishing a coordinated approach of product selections and installation sequencing that satisfies the individual requirements of the interacting Sections of the Work as well as the requirements of the Work as a whole.

B. Coordinate construction operations with those of other Sections of the Work and other entities to ensure efficient and orderly installation of each part of the Work.

C. Coordinate operations and product selections of this Section with operations and product selections included in different Sections that depend on each other for proper installation, connection, and operation.

D. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

E. Coordinate installation of different components with other Sections of the Work to ensure maximum performance and accessibility for required maintenance, service, and repair.

F. Make adequate provisions to accommodate items scheduled for later installation.

G. Coordination Drawings: Contribute to preparation of Coordination Drawings; indicate Division 28 system Work coordinated with other Sections of the Work.

1.12 MAINTENANCE MATERIALS

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

1. Manual Fire alarm Boxes: One spare.

2. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.

3. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.

4. Keys and Tools: One extra set for access to locked or tamper proofed components.

5. Audible and Visual Notification Appliances: One of each type installed.

6. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.13 WARRANTY

A. The Contractor shall guarantee all new equipment installed and new raceways, new wiring and connections to existing wiring and equipment from defects in workmanship and inherent mechanical and electrical defects for a period of one (1) year from the date of written acceptance by the Building Owner/Client**.** Warranty shall include Parts and Labor.

B. The Manufacturer or the authorized representative shall guarantee all new system equipment for a period of one (1) years from the date of written acceptance by the Building Owner/Client**.**

C. Upon completion of the installation of the fire alarm and emergency voice evacuation system equipment including Acceptance Testing, Demonstration of existing fire alarm, and delivery of all record submittals and spare parts, the Contractor shall provide the Building Owner/Client with a signed Completion and Warranty Statement, substantially in the form as follows:

1. “The undersigned, having been engaged as the Contractor on the Sommet Blanc Fire Alarm Project, confirms that the fire alarm and emergency voice evacuation system equipment was installed in accordance with the system manufacturer’s wiring diagrams, installation instructions and technical specifications provided to us by the manufacturer and the Building Owner/Client and that the installed system is warranted for a period of

one (1) year effective <insert date of Building Owner/Client acceptance>**.** The warranty includes parts and labor to repair or replace (at the Building Owner/Client discretion) any and all defects in workmanship or inherent electrical and/or mechanical defects. The installed system includes all new equipment installed and new raceways, new wiring and connections to existing wiring."

D. Emergency Warranty Calls: Provide 24-hr emergency phone number to the Building Owner/Client Designated Representative.

E. Warranty Calls: The Contractor's Fire Alarm maintenance personnel shall respond around the clock, seven days per week to trouble services calls within four (4) from the time of notification of a trouble call. The maintenance personnel shall complete warranty call within five working days of notification.

F. The Contractor's Fire Alarm Maintenance Personnel Qualification: Maintenance Personnel must have three years' experience in the installation of fire alarm emergency voice communications systems, certified by the system manufacturer, and possess a minimum LEVEL II certificate from the National Institute for Certification in Engineering Technologies (NICET) in the subfield Fire Protection Engineering Technology (Fire Alarm Systems).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products listed as a component of a single addressable fire alarm and signaling system technology platform by one of the following:

1. EST; a United Technologies Corp. company.
2. Notifier; a Honeywell company.
3. Siemens Building Technologies, Inc.; Fire Safety Division.
4. SimplexGrinnell LP; a JCI company.
5. Autocall; a JCI company.

B. Where additional manufacturer listings or basis of design products are indicated, provide products listed and duty-rated as compatible with the selected fire alarm and signaling technology platform.

2.2 SYSTEM DESCRIPTION

A. UL 864; non-coded, microprocessor-based addressable protected premises fire alarm and signaling system, with multiplexed signal transmission and audible/visual evacuation signaling. All components provided listed for use and compatible with fire alarm system head-end FACU.

B. Protected premises backbone architecture comprised of multiple fire alarm control units and system components networked via peer-to-peer communications node network.

C. Control units, system components, and power supplies inclusive of boards, drivers, and expansion modules necessary to support the specified system performance criteria, minimum quantity of circuits, and NFPA 72 circuit pathway class designations.

D. System circuiting and component power loading to provide minimum specified spare capacities, safety factors, and redundancies.

E. NFPA 72 Pathway Class (Performance During Fault) and Survivability Level (Fire Resistance):

1. Refer to drawings.

F. No fewer than two (2) visible and two (2) audible NAC's serving each protected premises fire area or evacuation zone. Unless noted otherwise, notification appliances circuited such that no two adjacent appliances are connected to the same NAC.

G. Component Primary Power: 24-V dc obtained from premises AC power supply.

1. Capacity: Alarm current draw of components connected to each power-supply module no greater than 80 percent of the power-supply module rating.

H. Component Standby Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Base Capacity: System operation for twenty-four (24) hours under quiescent load plus fifteen (15) minutes operating all alarm notification appliances.

2. Spare Capacity: 20 percent.

I. Remote power supplies used as distributed power sources only and not as in-line circuit power "boosters".

J. Fire alarm system listed for protected premises in-building Emergency Voice Alarm Communications System (EVACS) service utilizing digital multi-channel technology:

1. Fire Emergency Voice Alarm Communications Systems (EVACS); comply with UL 864, 1480, and 1711.

2. Amplifier loading no greater than 80 percent of rated power capacity (Watts).

K. Fire alarm system interfaces with other premises building systems including Fire Suppression, HVAC, Vertical Transportation, Audio/Visual, Public Address, Access Control, Fire Protection Opening Protectives, Emergency Power, and similar for all code-required and project-specified fire safety supervision and functional control.

L. Fire alarm system control and supervision of building smoke control system(s) including automatic operation, manual operation, and indication of smoke control system component status. Comply with UL 864 UUKL.

M. Retransmission of protected premises alarm, supervisory, and trouble status signals (Contact ID format) to an AHJ approved alarm supervising station.

2.3 PERFORMANCE REQUIREMENTS

A. Operational Performance: Fire alarm system shall process alarm, supervisory, and trouble status signals and perform associated output functions in compliance with NFPA 72, Division 28 and Drawings "Input/Output Matrix".

B. Circuit Integrity and Fault Performance: Fire alarm system circuit integrity and functional performance capability under fault conditions shall comply with the NFPA 72 circuit Class designations as indicated within the "System Description" Article and as indicated on the Drawings.

C. Survivability Performance: Fire alarm system fire resistive performance capability shall comply with the NFPA 72 circuit Level designations as indicated within the "System Description" Article and as indicated on the Drawings.

D. Seismic Performance: Fire alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 FIRE ALARM CONTROL UNITS

A. General: UL 864; power-limited, field-programmable, microprocessor-based, modular design. Interconnected power supplies, circuit board modules, displays, and associated electronics mounted to standard mounting chassis within common control unit cabinet enclosure. Control unit cabinet assemblies configured as control units with integral display and controls or as transponder units with solid door and no local display/controls.

B. Central Processors and System Software:

1. Central Processing Unit (CPU): Solid-state processor for processing and storage of system status and event signal data and execution of control-by-event and logic software functions; with real-time clock for time annotation of events accurate to second time-increments.

2. Memory: System software, event history logs, and programs held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.

3. Software Programming: Programmable via local FACU display and controls and also via externally connected laptop/PC programming application. Passwords required to access software program, one (1) “Master” password for highest level of permissions for use by authorized technicians and multiple “User” passwords for lower level permissions for use by general facilities personnel.

4. Alarm Signal Processing:

a. General: General alarm actuation of notification appliances, emergency control function interface devices, and annunciation at the protected premises within 10 seconds of initiating device alarm activation.

b. Smoke Detector Verification: Capability to password-enable individual addressable smoke detectors to include a maximum 60 second verification phase.

c. Pre-signal Alarm Sequence: Capability to password-enable system such that protected premises general alarm functions are delayed for more than 60 seconds after receipt of initial alarm signal; general alarm functions may be initiated automatically or by human action after delay.

d. Positive Alarm Sequence: Capability to password-enable system such that protected premises general alarm functions are delayed for no more than 15 seconds to permit manual acknowledgement of signal. If signal is not acknowledged within 15 seconds general alarm operation automatically initiates. If signal is acknowledged within 15 seconds, general alarm is delayed for up to 180 seconds to permit investigation. If fire alarm control unit is not reset within the investigation time-delay general alarm operation automatically initiates. If a second initiating device is activated during the investigation time-delay, general alarm operation automatically initiates.

5. Remote Smoke Detector Sensitivity Adjustment: Controls capable of selecting 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.

6. Software Zones: General alarm zone, releasing zone, and special logic zones used to map system inputs from assigned addressable device(s) to corresponding system output(s).

7. Time-Function Control: Capability to assign 24-hr clock time-dependent logic to event functions for time delay feature and/or automatic function scheduling to specific day of the week or year.

8. Non-Fire Events: Capability to assign “Non-Fire” ID category to module addresses such that assigned event functions are executed without indication at the FACU display.

9. Walk test: Test modes to permit system testing under bypass mode.

C. Display and Controls:

1. General: Display and controls arranged for interface between human operator and fire alarm system including system status indication, event status indication, manual query inputs, manual programming inputs, and manual output functions.

2. Event Display: LCD.

3. Status Indicators: LED indicators for indication of system status; with corresponding membrane switch buttons to acknowledge incoming alarm, supervisory and trouble event signals.

4. Audible Indicator: Piezo sounder for audible indication of system status and incoming event signals; silenced upon signal acknowledge.

5. Keypad: Alpha-numeric entry and LCD navigation keys for display scrolling, item selection, system programming, and similar manual user operations.

6. Function-key Modules: Membrane switch buttons used to initiate assigned software function, each with corresponding LED indicators for indication of function status.

a. Provide switches for bypass of the following fire alarm output functions:

1) Occupant notification

2) Smoke control

3) Door hold-opens

4) Security access control panel release

5) Elevator recall

6) HVAC Shutdown

7) HVAC damper closure

8) Lighting / AV override

D. Signaling Line Circuit Controllers:

1. SLC Loop Capacity: Minimum 125 addressable initiating devices and 125 addressable modules (250 addressable devices total) per loop.

2. Degrade Mode: Upon CPU communication failure, controllers capable of stand-alone function mode permitting alarm operation during communication fault condition.

3. Configuration: Capable of supporting Class A or Class B SLC configuration.

E. Serial Interfaces: RS 232, RS 485 or equivalent for communication with system annunciators, printers, graphics displays, digital controllers, and similar distributed system components; USB ports for laptop configuration of system and file download to USB data storage devices.

F. Cabinet Enclosures: Steel back-box with top, bottom, and side knockouts for 1/2-inch through 2-inch metal raceway; manufacturer’s chassis rails for electronics mounting; key-lock latching, left or right swing hinged, removable steel front door panel with and without view panel(s); with trim accessories for flush mount where indicated in Part 3 “Equipment Installation” and Drawings; steel box and door surfaces in factory-finish red enamel.

G. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate

response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.5 EMERGENCY VOICE ALARM COMMUNICATION SYSTEMS

A. General: NFPA 72 compliant, digital, multi-channel, one-way emergency voice alarm communication system for automatic and manual voice broadcast of fire or other emergency instructions and signals; distributed system architecture with central master audio controller and distributed amplifier arrays connected via digital voice audio riser.

B. Master Audio Controller: Solid-state digital multi-channel audio controller with digitized alarm tones and digitally recorded voice messages stored in on-board memory.

C. Tones and Messages: Selectable evacuation tones (Temporal-3, Slow/Fast Whoop, GSA), standard digitally pre-recorded voice messages and digitally recorded custom voice messages. Module on-board memory capacity sufficient for minimum of 32 minutes total message duration at standard resolution.

D. Amplifiers: UL 1711, digital, multi-channel, power-limited 25 or 70 VRMS, with on-board test switches and indicators.

1. Self-Backup Mode: Automatically re-route NAC's connected to a disabled amplifier channel to remaining active amplifier channel(s).

2. Degrade Mode: On-board temporal pattern horn tone for default backup signaling over connected NAC's.

E. Amplifier Supervision: Digital communication between amplifiers and controller for supervision and indication of amplifier status and operating power and voltage values.

F. Microphone Module: Push-to-talk integral corded microphone for manual voice messaging; with local speaker, volume controls, and LED status indicators.

G. Controls and Status Indicators:

1. Indicators: LED indicators for indication of system status and operation of user selected functions.

2. Function-keys: Membrane switch buttons with corresponding LED indicators for selective user initiation of voice messaging and evacuation functions on a premises-wide or per- zone basis.

H. Auxiliary Audio Inputs: Audio controller capable of accepting line-level auxiliary audio source input for re-broadcast over emergency voice speaker circuits.

I. Auxiliary Audio Outputs: Audio controller capable of transmitting line-level auxiliary audio source output for re-broadcast over another system's emergency or non-emergency voice speaker circuits.

J. Cabinet Enclosures: Comply with Article "Fire Alarm Control Units" for cabinet enclosures. Modules and amplifiers mounted within cabinet enclosures common to FACU and within dedicated solid-door remote amplifier array cabinet enclosures.

2.6 REMOTE ANNUNCIATORS

A. General: Display and controls remote from Fire Alarm Control Unit arranged for interface between human operator and fire alarm system including system status indication, event status indication, manual query inputs, manual programming inputs, and manual output functions.

B. Event Display: LCD; [minimum 2 lines, 40 characters] [minimum 16 lines, 640 characters] <Insert other display criteria>.

C. Status Indicators: LED indicators for indication of system status; with corresponding membrane switch buttons to acknowledge incoming alarm, supervisory and trouble event signals.

D. Audible Indicator: Piezo sounder for audible indication of system status and incoming event signals; silenced upon signal acknowledge.

E. Keypad: Alpha-numeric entry and LCD navigation keys for display scrolling, item selection, system programming, and similar manual user operations.

F. Function-key Modules: Membrane switch buttons used to initiate assigned software function, each with corresponding LED indicators for indication of function status.

G. Enclosure: Comply with Article “Fire Alarm Control Units” for enclosures.

2.7 REMOTE GRAPHIC ANNUNCIATORS

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

1. Same manufacturer as the selected manufacturer of the fire alarm and signaling system technology platform.
2. H.R. Kirkland Co.
3. Space Age Electronics, Inc.

B. Description: Factory assembled and -wired graphic annunciator for audible and visible status indication and manual control of connected system components.

1. Smoke Control Applications: UL 864 UUKL; intended to function as a Fire Fighter’s Smoke Control Panel for manual override control and audible and visible status indication of connected smoke control system components.

C. Interfaces: Serial or hard-wire connection to fire alarm system control unit lamp / switch driver module(s).

D. Cabinet Enclosures: Comply with Article “Fire Alarm Control Units” for cabinet enclosures.

E. Display: Color graphics reverse screened onto non-exposed side of scratch-resistant, anti-glare matte finish Lexan sheet mounted to cabinet door panel. Comply with Drawings for layout of graphics, LED indicators, and switches for smoke control and fire pump status / override panels.

2.8 POWER SUPPLIES

A. General: Switched-mode supervised power supply base and expansion modules supplying regulated and filtered 24-V dc power to system components, notification appliances, and auxiliary power loads.

B. FACU Applications: Power supply modules and batteries mounted within Fire Alarm Control Unit (FACU) equipment cabinets to provide integral system power to chassis-mounted components, connected notification appliance circuits, and connected auxiliary power circuits; batteries located within stand-alone battery cabinet for high-capacity applications.

C. RPS Applications: Power supply modules and batteries mounted within distributed Remote Power Supply (RPS) equipment cabinets to provide supplemental power to connected notification appliance circuits and connected auxiliary power circuits.

D. Primary Power Supply: 120-V ac.

E. Secondary Power Supply: 24-V dc supply system including sealed lead acid batteries, automatic float-charge battery charger, and automatic transfer switch.

F. Outputs: Programmable for operation as Notification Appliance or Auxiliary Power circuits; NAC outputs capable of operation as sync-generator or sync-follower; capable of supporting Class A or Class B circuit configuration.

G. Supervision: Loss of primary power, low battery power, battery charger failure, and output circuit fault conditions supervised by fire alarm system via serial communication or system SLC supervision of trouble contacts.

H. Cabinet Enclosures: Comply with Article “Fire Alarm Control Units” for cabinet enclosures.

2.9 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system nodes and peripherals according to fire-alarm manufacturer's written requirements.

2.10 DIGITAL ALARM CELLULAR TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.

B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.

2. Signal Transmission Mode: Cellular.

3. Normal Power Input: 120-V ac.

4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.

5. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.

2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.

3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.

4. Local Fire alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.

5. Local Fire alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.

6. Local Fire alarm-System, Supervisory-Alarm Message: [Actuated when the building alarm system indicates a supervisory signal] <Insert condition>.

2.11 MANUAL FIRE ALARM BOXES

A. General: UL 38; die-cast metal housing, red finish, with molded, raised-letter operating instructions and "FIRE" identification in contrasting color; device shall show visible indication of operation.

B. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral or attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire alarm control unit.

C. Station Reset: Key- or wrench-operated switch.

D. Indoor Protective Cover: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

E. Weatherproof Protective Cover: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.12 SYSTEM FIRE DETECTORS

A. General: Analog addressable system smoke, system heat, or other system detectors for sensing products of combustion; listed as compatible with fire alarm system control unit and with integral addressable module capable of two-way analog communication with fire alarm control unit permitting remote sensitivity control, identification of device address, alarm status, trouble status, and trending of maintenance data.

B. Detector Housing: Low profile, white-polycarbonate thermoplastic, impact resistant, and flame retardant detector housing for mounting into twist-lock base; with LED indicator for indication of detector status-poling (flashing) or in operation (constant).

C. Detector Bases: Ceiling- and wall-mount, low profile, white-polycarbonate thermoplastic, impact resistant, and flame retardant plastic twist-lock fixed base; with terminals for SLC conductor terminations.

1. Auxiliary Detector Bases: Optional bases furnished to perform supplemental detector-local functions.

a. Isolation bases to isolate short circuit faults on SLC.

D. Remote Alarm Indicators (RAI): LED visual indicator in flush-mount plate, connected to corresponding detector base terminals for remote indication of detector alarm.

E. Remote Test Station (RTS): RAI with key operated test switch for remote detector testing.

F. Operating Voltage: 24-V dc nominal for detectors and auxiliary bases; 120-V ac rated contacts for relay bases as per application.

G. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

2.13 SYSTEM SMOKE DETECTORS

A. Comply with "System Fire Detectors" Article.

B. UL 268, photoelectric spot-type with insect-screen protected sensing chamber; for installation in twist-lock system bases.

C. Operating Temperature Range: 32 – 100 deg F (0 – 38deg C).

D. Operating Humidity Range: 10 - 95 percent RH.

E. Sensitivity Range: 0.2 - 3.7 percent obs/ft.

F. Air Velocity Rating: 0 - 4,000 fpm (0 - 1220 mpm).

2.14 SYSTEM SAMPLING TUBE DUCT SMOKE DETECTORS

A. Comply with “System Fire Detectors” Article.

B. UL 268A, photoelectric spot-type system smoke detector listed for installation within detector housing mounted to exterior surface of air distribution ductwork, with connected sampling tubes transporting ductwork air to the external detector sensing chamber; with and without integral output relays.

C. Mounting: For square and round ducts via factory furnished mounting kit.

D. Air Velocity Range: 300 - 4,000 fpm (91 - 1,220 mpm).

2.15 SYSTEM HEAT DETECTORS

A. Comply with “System Fire Detectors” Article.

B. UL 521, spot type heat detector actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless other temperature rating(s) are indicated on Drawings.

2.16 SYSTEM MULTI-CRITERIA DETECTORS

A. Comply with “System Fire Detectors” Article.

B. Multi-criteria fire detector utilizing multiple sensing elements and correlating detection algorithms permitting initiation of alarm upon detection of individual sensing elements or in combination.

1. Photoelectric smoke sensor - comply with “System Smoke Detectors” Article.

2. Heat sensor - comply with “System Heat Detectors” Article.

3. Carbon monoxide sensor - comply with “System Carbon Monoxide Sensors” Article.

2.17 SINGLE STATION SMOKE ALARMS

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

1. BRK Inc.

2. Kidde, United Technologies Corp.

3. System Sensor.

B. General: UL 217; 120-V ac smoke alarm with 9-V dc battery as the secondary power source. With "low" or "missing" battery chirping-sound device and integral push button test switch.

C. Auxiliary Relays: One Form A and one Form C, both rated at 0.5 A.

D. Audible Notification Sounder: Piezoelectric sounder rated at 90 dBA at 10 feet according to UL 464.

E. Multiple-Station Arrangement: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.

F. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. With terminals in the fixed base for connection to building wiring.

G. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

H. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

I. Carbon Monoxide Sensor: With integral UL 2034 carbon monoxide sensor where combination detectors are indicated on Drawings. Furnished with separate visual LED and distinct audible signals for CO alarm annunciation; and with additional output contacts.

2.18 NOTIFICATION APPLIANCES

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

1. Same manufacturer as the selected manufacturer of the fire alarm and signaling system technology platform.
2. Edwards Signaling.
3. System Sensor.
4. Wheelock, Cooper Industries.

B. General Performance Requirements for Notification Appliances: Signaling appliances connected to notification appliance circuits for NFPA 72 public operating mode signaling to building occupants protected by the fire alarm system; and private operating signaling to those persons directly concerned with implementation and direction of emergency action and procedures. Appliance assemblies include audible, audible/intelligible, visible, and combination type as indicated on Drawings.

C. Mounting: Wall or ceiling mount as indicated on Drawings.

D. Housing: Thermoplastic, impact resistant, and flame retardant.

E. Finish: White housing with Red contrasting engraved lettering.

F. Identification: Engraved lettering on housing indicating ”ALERT”.

G. Weatherproof applications: Listed for indoor and outdoor installation.

2.19 AUDIBLE NOTIFICATION APPLIANCES

A. Comply with “Notification Appliances” Article.

B. Bells: UL 464; 6-inch diameter, vibrating motor type bell, 24-V dc; red finish, listed for indoor and outdoor applications.

2.20 AUDIBLE/INTELLIGIBLE NOTIFICATION APPLIANCES

A. Comply with “Notification Appliances” Article.

B. Speakers: UL 1480, 25 or 70 nominal VRMS speaker within dedicated housing, listed sound pressure level of 90 dBA measured at 10 feet.

1. Frequency Range: 400 to 4000 Hz.
2. Wattage Taps: Field selectable 0.25 W, 0.50 W, 1.0 W, 2.0W.

2.21 VISIBLE NOTIFICATION APPLIANCES

A. Comply with “Notification Appliances” Article.

B. Strobes: UL 1971, xenon strobe with clear polycarbonate lens mounted on an aluminum faceplate and field selectable candela output setting within dedicated housing, 24-V dc; with candela setting indicator visible through viewing window.

1. Strobe flashing in temporal pattern, synchronized throughout each evacuation zone and synchronized between evacuation zones where strobes from multiple evacuation zones can be observed by a single viewer.
2. Comply with Drawings for appliance candela output.

C. Flashing Beacons: UL 1638; 6-inch diameter, red lens beacon, 24-V dc; listed for indoor and outdoor applications.

2.22 COMBINATION AUDIBLE/INTELLIGIBLE AND VISIBLE NOTIFICATION APPLIANCES

A. Combination audible/intelligible and visible notification appliance with audible and visible signaling elements assembled within a common housing.

1. Audible/intelligible speakers - comply with “Audible/Intelligible Notification Appliances” Article.
2. Visible strobe - comply with “Visible Notification Appliances” Article.

2.23 ADDRESSABLE INTERFACE MODULES

A. General: Microelectronic interface module for supervision and control of premises fire safety functions with integral address-setting means, internal code for FACU identification by module type, and output contact ratings to match controlled/supervised equipment.

B. Monitor Module: Provides a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Relay Module: Capable of providing a direct output signal to controlled equipment or device.

1. Allows the FACU to switch the relay contacts on command.
2. Minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module: Capable of providing a supervised direct output signal to controlled notification appliance, equipment or device.

1. Allows the FACU to switch the relay contacts on command.
2. Minimum of two normally open and two normally closed contacts available for field wiring.

2.24 FAULT ISOLATION MODULES

A. Module capable of sensing and automatically isolating SLC short circuit fault.

2.25 MAGNETIC DOOR HOLDERS

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

1. Bosch Security Systems Inc.
2. Rixson, Yale Security Inc.
3. RSG Inc.

B. Description: Normally powered hold opens, fail-closed; equipped for wall or floor mounting and complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Operating Voltage: 24-V dc.

C. Material and Finish: Match door hardware.

2.26 SURGE PROTECTIVE DEVICES

A. General: UL 497B, hybrid gas discharge tube/diode technology surge protective devices; listed for power-limited fire alarm circuit applications intended to prevent component damage or nuisance alarms induced by lightning strikes, stray currents, or voltage transients.

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

1. Citel America Inc.
2. Ditek Corp.
3. Space Age Electronics, Inc.
4. Transtector Systems, Inc.

2.27 SYSTEM PRINTERS

A. Printer shall be listed and labeled as an integral component of the fire alarm system.

2.28 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

2.29 RECORD DOCUMENT BOX

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (or by approved alternative manufacturer):

1. Space Age Electronics, Inc.

B. Description: System record document storage box with digital software storage via integral flash drive.

2.30 FIRE ALARM CABLES

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

1. Anixter Inc.
2. Belden Inc.
3. Southwire Co.
4. West Penn Wire

B. Fire Alarm Cable: UL 1424, Type FPL, power-limited fire alarm cable; red-jacketed, twisted-pair and parallel-pair insulated solid copper conductors; unshielded and shielded.

C. Fire Alarm Metal-clad Cable: UL 1424, Type MC-FPLP, power-limited fire alarm cable; jacketed, twisted-pair solid copper conductors with red aluminum interlocking outer armor jacket; unshielded and shielded.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Red Alert MC-FPLP cable, manufactured by Southwire Co.

D. Minimum Fire Alarm Cable Conductor Size:

1. Auxiliary (24 Vdc) Power: 14 AWG / 2C.
2. Data Communications Network: 16 AWG / 2C.
3. Digital Voice Riser: 16 AWG / 2C.
4. Notification Appliance Circuits: 14 AWG / 2C.
5. Relay Circuits: 14 AWG / 2C.
6. RS Serial Data Communications: 18 AWG / 2C.
7. Signaling Line Circuits: 16 AWG / 2C.
8. Speaker Circuits: 16 AWG / 2C.
9. Supervision Circuits: 16 AWG / 2C.

E. Data and Voice Circuits:

1. Fire alarm cable for Data Communications Network, Digital Voice Riser, Signaling Line Circuits, Speaker Circuits, RS Serial Data Communications, and other manufacturer-specific data and voice circuits shall be shielded, twisted-pair unless fire alarm manufacturer's installation guidelines recommend or require unshielded twisted-pair cable.
2. Fire alarm cable electrical characteristics for Data Communications Network, Signaling Line Circuits, RS Serial Data Communications, and other manufacturer-specific data circuits shall comply with the fire alarm manufacturer limitations for linear-unit and total-circuit capacitance and resistance.

2.31 FIRE-RESISTIVE FIRE ALARM CABLES

A. Multi-conductor Fire-resistive Cable: UL 2196 fire resistive, Type FPL, power-limited fire alarm cable; ceramifiable silicon insulation; jacketed, solid copper conductors; unshielded and shielded.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Duralife FPL fire resistive alarm cable, manufactured by Radix Wire Co.

2.32 FIRE ALARM TERMINAL CABINETS

A. Enclosure: 16-gauge steel; factory applied red enamel finish; removable hinged door with keyed locking latch; with embedded 1/2 inch, 3/4 inch, 1 inch, 1-1/2 inch and 2 inch knockout clusters.

B. Terminals: Each terminal pole with quick-connect wire termination points and integral test port; sized to accept 20 - 12 AWG and rated for 20 amp at 250V (Class B/UL) 300V (CSA).

C. Identification: Marked "FIRE ALARM TERMINAL CABINET" in 2-inch white factory applied indelible screened lettering; field identification labels on the inside cover corresponding to the terminal strip's labeling inside the back box.

D. Basis-of-Design Product: Subject to compliance with requirements, provide IF-Series fire alarm terminal cabinets, manufactured by Space Age Electronics Inc.

2.33 FIRE ALARM RACEWAY AND BOXES

A. Metal conduit and tubing:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Allied Tube & Conduit; a Tyco International Ltd. Co.
    b. Wheatland Tube Company.
    c. O-Z Gedney; a unit of General Signal.
    d. AFC Cable Systems, Inc.
    e. Greenfield.
    f. Anamet Electrical, Inc.; Anaconda Metal Hose.
    g. Electri-Flex Co.
    h. Robroy.
2. Rigid Steel Conduit: ANSI C80.1; zinc-coated steel.
3. EMT: ANSI C80.3; zinc-coated steel.
4. FMC: Spiral wrapped zinc-coated steel with insulated throats.
5. LFMC: Highly flexible, hot-dipped galvanized steel conduit with PVC jacket with insulated throats.
6. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
    a. RSC: Threaded steel insulated bushings and throats. Locknuts shall be steel/zinc plated.
    b. EMT: Steel, set-screw or compression type with insulated bushings and throats. Die cast fittings shall not be permitted.
7. Combination Expansion/Deflection Fittings
    a. Fittings shall be threaded, hot dipped galvanized malleable iron or steel with internal bonding jumper.
    b. Fittings shall include bonding jumper, insulated bushing and short nipple.
8. Size: 3/4” minimum.

B. Metal wireways:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper B-Line, Inc.
    b. Hoffman
    c. Square D; Schneider Electric
2. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
3. 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.
4. Wireway Covers: Screw-cover type.

5. Finish: Manufacturer's standard enamel finish.

C. Boxes, Enclosures and Cabinets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
    b. EGS/Appleton Electric.
    c. Erickson Electrical Equipment Company.
    d. Hoffman.
    e. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
    f. O-Z/Gedney; a unit of General Signal.
    g. RACO; a Hubbell Company.
    h. Robroy Industries, Inc.; Enclosure Division.
    i. Scott Fetzer Co.; Adalet Division.
    j. Spring City Electrical Manufacturing Company.
    k. Thomas & Betts Corporation.
    l. Walker Systems, Inc.; Wiremold Company (The).
    m. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
2. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
3. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
4. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and submit “Action Submittals” prior to equipment procurement.

3.2 TECHNICIAN DESIGN AND LAYOUT

A. Roles and responsibilities shall be as set forth in NSPE Position Statement No. 1749 “SFPE/NSPE/NICET Joint Position of the Engineer and the Engineering Technician Designing the Fire Protection System”, available at nspe.org. As applied to the Work, the Contract Documents have been prepared by the “Engineer” and Shop Drawings required by this Section of the Work are prepared by the “Certified Engineering Technician”.

B. As the Certified Engineering Technician, prepare Shop Drawings including drawings, calculations, certifications, and statements indicating system layout, circuiting, and capacities in accordance with the requirements of the Contract Documents.

C. Design and Installation Standard(s): NFPA 70 and NFPA 72.

D. Comply with the performance requirements indicated by the Contract Documents where such requirements are more stringent than those of the Design and Installation Standard(s); otherwise, comply with the performance requirements of the Design and Installation Standard(s).

3.3 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. Confirm fire resistance rating of building construction required to perform as fire alarm system Survivability protection before installation.

C. Examine depth of stud walls to verify clearance for flush-mount equipment before installation.

D. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

E. Examine proposed mounting locations of equipment cabinets with user displays and/or controls with the local fire official to verify satisfactory access and ease of identification before installation.

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

3.4 EQUIPMENT INSTALLATION

A. Comply with the most restrictive requirements of this Section for the installation of low voltage electrical systems.

B. Comply with NFPA 72, and requirements of authorities having jurisdiction for installation and testing of fire alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

C. Install fire alarm system in accordance with the reviewed fire alarm system Shop Drawings. Where field modifications of layout are necessary, obtain prior approval from the fire alarm system vendor’s qualified fire alarm system designer.

D. Arrange equipment cabinets, wire-ways, and conduits with adequate clearances to facilitate access for inspection, maintenance, and component replacement.

E. Install equipment cabinets with top and bottom of cabinets not more than 72 inches above finished floor and not less than 12 inches above finished floor, respectively.

F. Install battery cabinets with top and bottom of cabinets not more than 48 inches above finished floor and not less than 12 inches above finished floor, respectively.

G. Install fire alarm system modules and auxiliary components in accessible locations with bottom of modules and components not less than 12 inches

H. Install equipment cabinets with user displays and/or controls including fire alarm control unit nodes and remote annunciators with displays and/or controls at natural user height.

I. Flush-mount equipment cabinets/back-boxes not located in designated equipment rooms.

J. Flush-mount wall- and ceiling-mounted initiating devices, modules, indicators, and notification appliances unless otherwise indicated.

K. Surface-mount equipment cabinets/back-boxes located in designated equipment rooms.

L. Surface-mount initiating devices, modules, indicators, and notification appliances installed on concrete or masonry unit walls.

M. Surface-mount initiating devices installed to the underside of building structure.

N. Surface-mount or pendant-mount notification appliances installed to the underside of structure.

O. Install ceiling mounted devices, modules, indicators and notification appliances in alignment with adjacent ceiling fixtures and centered within ceiling tiles.

P. Install wall mounted devices, modules, indicators and notification appliances in alignment with adjacent switches and wall fixtures.

Q. Do not install addressable devices in areas subject to temperature extremes. Use conventional initiating devices supervised by addressable monitor modules remotely located within an adjacent conditioned space.

3.5 CABLE AND PATHWAY INSTALLATION

A. General Requirements:

1. Comply with NFPA 70 and NFPA 72.

a. Comply with Division for NFPA 72 pathway Class and Survivability Level requirements.

b. Install fire alarm system pathways and cables in accordance with the reviewed fire alarm system Shop Drawings. Where field modifications of layout are necessary, obtain prior approval from the fire alarm system vendor's qualified fire alarm system designer.

B. Fire Alarm Raceway Installation:

1. Applications:

a. Exposed, Not Subject to Physical Damage within Mechanical, Electrical and unfinished areas defined by architect where located 10'-0" or greater AFF: EMT.

b. Exposed and Subject to Severe Physical Damage: Rigid steel conduit with cast metal device boxes throughout the project where located below 10'-0" AFF.

c. Concealed in Ceilings and Interior Walls and Partitions: MC fire alarm cable or EMT.

d. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

e. Damp or Wet Locations (including exterior to the building): Rigid steel conduit with cast metal device boxes.

f. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

g. Raceway Fittings: Compatible with raceways and suitable for use and location.

1) Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

h. Smoke control SLC: Continuous metal raceway (EMT or rigid steel based upon location).

2. 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.

3. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for motors.

4. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

5. Terminations

    a. Raceway shall enter and be secured to cabinet, junction box, pull box or outlet box with locknut outside and bushing inside, or with liquid-tight, threaded, self-locking, cold-weld wedge adapter.

    b. Vertical conduit runs that terminate in bottoms of wall boxes or cabinets shall be protected from entrance of foreign material before installation of conductors.

    c. Raceway Terminations at Locations Subject to Moisture: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

    d. Provide insulated bushings on raceways entering all panels mand all boxes 12” x 12” and larger to protect conductors.

6. Expansion / Deflection Fittings

    a. Raceway secured rigidly on opposite sides of building expansion joints and long runs of exposed raceway subject to stress due to thermal expansion shall have expansion/deflection fittings. Fittings shall safely deflect and expand to twice distance of structural movement.

    b. Raceways shall cross building expansion joints at right angles; provide expansion fittings as required by manufacturer's instructions. Provide insulated bushings at ends of raceways.

    c. Provide separate external copper bonding jumper secured with grounding straps on each end of fitting when integral ground is not provided.

    d. Coordinate location of expansion/deflection fittings with the structural and architectural drawings.

7. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for motors.

    a. Use LFMC in damp or wet locations.

8. Class A and X Pathways: Unless greater distances are indicated on the Drawings or Specifications, install Class A and X pathways in compliance with NFPA 72 recommendations for minimum horizontal and vertical separation between supply and return pathways.

9. Support raceways as required by the NFPA 70.

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

    a. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

    b. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

C. Fire Resistive Pathway Installation

1. Where NFPA 72 Survivability Level 2 or 3 pathways (2-hr fire resistance rated) are indicated or required, provide one of the following:

    a. UL 1424 fire alarm cable installed within 2-hr fire resistance rated shaft construction or similar 2-hr rated building construction.

    b. UL 2196 fire resistive fire alarm cable (Category FHJR) installed within metal raceway in accordance with the corresponding UL “Circuit Integrity System” (Category FHIT).

D. Fire Alarm Cable Installation:

1. Wiring shall be continuous between equipment, device, and appliance terminals without splices.
2. T-tapping: Not permitted for any fire alarm circuit.
3. Do not install fire alarm system wiring within conduits, junction boxes, or outlet boxes containing conductors of lighting or power systems.
4. Separate power-limited and non-power-limited conductors within enclosures as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess.
5. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams.
6. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal.

E. Grounding: Comply with NFPA 70 and local state requirements.

3.6 INSTALLATION FOR EQUIPMENT SURVIVABILITY

A. Install control units, amplifiers, power supplies, junction boxes, terminal cabinets, or similar components within dedicated 2-hr fire resistance rated fire alarm system equipment rooms where the components originate or comprise a portion of a NFPA 72 Survivability Level 2 or 3 pathway.

3.7 MANUAL FIRE ALARM BOX INSTALLATION

A. Install manual fire alarm boxes in the normal path of egress within 60 inches of the exit doorway.

B. Install manual fire alarm boxes with operable handles between 42 inches and 48 inches above finish floor level.

C. Install all manual fire alarm boxes at a common elevation with respect to finished floor.

D. Install manual fire alarm boxes on a background of a contrasting color.

3.8 SYSTEM SPOT-TYPE FIRE DETECTOR INSTALLATION

A. Locate spot-type fire detectors in a manner that readily permits access – without the need of a lift - from the floor below for detector inspection, testing, and maintenance.

B. Install fire detectors only after all dust and debris producing work is completed.

C. Maintain factory provided detector covers on fire detectors until fire alarm system is approved for closeout and turnover.

D. Install Remote Alarm Indicators in a visible location for each group of fire detector located within a normally locked room or area.

E. Spot-type Smoke- and Heat-Detector Locations and Spacing:

1. Comply with Drawings, and;
2. Comply with NFPA 72 "Smoke-Sensing Fire Detectors".
3. Comply with NFPA 72 "Heat-Sensing Fire Detectors".

3.9 INSTALLATION OF AIR DISTRIBUTION DUCTWORK DETECTORS

A. Comply with NFPA 72, International Mechanical Code, and NFPA 90A.

B. Install duct smoke detectors in accordance with manufacturer's installation guidelines.

C. Locate duct detectors in a manner that readily permits access for detector inspection, testing, and maintenance.

D. Plan and coordinate duct detector locations and mounting requirements with Division 23 prior to ductwork fabrication and installation; show coordinated duct detector layout on Coordination Drawings and Shop Drawings.

E. Furnish duct detector housings and ductwork attachments for installation under Division 23. Coordinate requirements for ductwork penetrations, attachments, sealant, and access panels with Division 23.

F. Do not install duct detectors, housings, or sampling tubes in ductwork until all dust and debris producing work is complete and air distribution system cleaning and startup is complete. Duct detector housings may be attached to ductwork and connected to SLC/IDC prior to air distribution system startup provided they are protected from dust and debris using factory covers.

G. Air Distribution Equipment Shutdown Applications: Use sampling-tube type system duct smoke detectors.

1. Supply Air Systems: Locate duct smoke detectors downstream of fans and filters.

2. Return Air Systems: Locate duct smoke detectors upstream of filters, exhaust air connections, outdoor air connections or decontamination equipment.

H. Fire/Smoke Damper Control Applications: Use sampling-tube type system duct smoke detectors.

1. Locate duct smoke detectors within 5 ft of the associated damper.

2. Locate and support duct smoke detectors in accordance with manufacturer's installation guidelines.

I. Install remote alarm test stations at each duct detector in readily accessible location that does not interfere with other sections of the Work.

3.10 SINGLE STATION SMOKE ALARM INSTALLATION

A. Comply with NFPA 72.

3.11 NOTIFICATION APPLIANCE INSTALLATION

A. Comply with Drawings and NFPA 72 "Notification Appliances".

B. Wall-mounted Audible Notification Appliances: Install with top of appliance not less than 6 inches below the finished ceiling and not less than 90 inches below the finished floor.

C. Wall-mounted Visible and -Combination Audible/Visible Notification Appliances: Install with top of appliance not less than 6 inches below the finished ceiling and the entire appliance strobe lens not less than 80 inches and not more than 96 inches above the finished floor.

D. Install all wall-mounted notification appliances with top of appliance at a common elevation with respect to finished floor.

E. Install exterior flashing beacons such that they are clearly visible from the primary fire department vehicle access route; and as indicated on Drawings. Use a dedicated NAC for each beacon.

F. Install exterior alarm bells adjacent to each sprinkler fire department inlet connection; and as indicated on Drawings. Use a dedicated NAC for each bell.

3.12 CONNECTIONS AND INTERFACES

A. Make connections to premises building systems and components via addressable interface modules. Include necessary interface modules, relays, wiring, resistors, and components as required to achieve the input/output sequence of operations performance criteria indicated by the Drawings.

B. Coordinate voltage and current ratings of connected components such that connections and interfaces operate within listed limitations. Use interposing relays where connected loads exceed rating of addressable interface modules.

C. Arrange connections and interfaces such that circuits are monitored for integrity as required by NFPA 72.

D. Interface to premises systems and components requiring fire alarm supervision of status with addressable interface monitor modules.

E. Interface to premises systems and components requiring Emergency Control Function Interface with addressable interface relay modules installed within 36 inches of the interface wiring termination point.

F. Each addressable interface relay module used for Emergency Control Function Interface shall include one (1) set of spare contacts for monitoring connection to the premises Building Management System, Security System, or similar secondary premises system.

G. For each HVAC air distribution unit, coordinate with Division 23 for exact interface requirements, quantity of fan drives, and detailed sequencing for proper shutdown of the associated air distribution equipment.

3.13 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Label addressable initiating devices and bases and notification appliances. Comply with Drawings.

C. Install framed instructions adjacent to the fire alarm control unit. Installed instructions shall be typewritten computer printout instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

3.14 GROUNDING

A. Comply with fire alarm system manufacturer installation guidelines for grounding.

B. Ground fire alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control unit

3.15 FIELD QUALITY CONTROL

A. End-to-end cabling shall be considered defective if it does not pass tests and inspections.

B. Perform visual wiring inspections in accordance with fire alarm system manufacturer recommendations. Correct deficiencies.

C. Test wiring in accordance with fire alarm system manufacturer requirements and NFPA 72 for Initial Acceptance Testing of conductors. Correct deficiencies.

D. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

E. Devices placed in service before all other trades have completed cleanup shall be replaced.

F. Field inspections and testing shall be performed by fire alarm system manufacturer's factory-authorized service technicians.

G. Smoke Control Systems: In addition to Div. 28 fire alarm system inspection and testing requirements, perform additional inspections and integrated functional testing as required to support smoke control system Special Inspections commissioning.

H. Prepare a typewritten computer-output Test Plan that clearly establishes the scope of fire alarm and signaling system testing. Include at a minimum testing methods, personnel, duration, planned impairments, and required coordination for integrated testing of emergency control function interfaces.

I. Functional field tests shall be witnessed by the Construction Manager (CM) and their designees; provide notifications a minimum of two (2) weeks in advance.

J. Acceptance field testing shall be witnessed by the CM, their designees, and authorities having jurisdiction (AHJ); provide notifications a minimum of two (2) weeks in advance.

K. Perform visual inspections in accordance with fire alarm system manufacturer recommendations and NFPA 72 for Initial Acceptance Inspections. Correct deficiencies.

L. Document inspections by completing applicable sections of the NFPA 72 "System Record of Inspection and Testing" report.

M. Provide written notifications for functional field tests; include Test Plan.

N. Perform functional testing in accordance with accordance with fire alarm system manufacturer recommendations and NFPA 72 for "Initial Acceptance Testing". Correct deficiencies. Repeat functional testing including retesting of unaffected components in accordance with NFPA 72 for "Reacceptance Testing".

O. Document 100 percent satisfactory functional tests by completing remaining sections of the NFPA 72 "System Record of Inspection and Testing" report.

P. Submit NFPA 72 "Statement of Completion" and completed NFPA 72 "System Record of Inspection and Testing" report.

Q. Provide written notifications for acceptance field tests; include Test Plan, NFPA 72 "Statement of Completion", NFPA 72 "System Record of Inspection and Testing" report, and NFPA 72 "System Record of Completion".

R. Perform acceptance field testing. Demonstrate system operation to the satisfaction of the AHJ. Correct AHJ noted deficiencies. Repeat functional testing including retesting of unaffected components in accordance with NFPA 72 for "Reacceptance Testing". Amend NFPA 72 "System Record of Inspection and Testing" report, and NFPA 72 "System Record of Completion".

S. Place system into normal operating service without system faults or outstanding work.

3.16 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve (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 shall be manufacturer's authorized replacement parts and supplies.

1. Perform visual inspections at intervals required by NFPA 72 Chapter “Inspection, Testing, and Maintenance”.
2. Perform tests at intervals required by NFPA 72 Chapter “Inspection, Testing, and Maintenance”.

3.17 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

3.18 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

B. The Contractor shall submit a proposed training agenda for review at least 60 days prior to authorization to proceed.

C. The final, approved training agenda shall be submitted at least 30 prior to the final system acceptance test.

D. Provide three (3) four (4) hour training sessions in the operation and use of the system.

END OF SECTION