

SECTION 28 31 11 - FIRE ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This specification describes an Addressable Voice Fire Detection and Evacuation System. Provide evacuation alarm tone signaling or pre-recorded messages using sounding devices to sound the alarm evacuation, and strobe lights, including firemen's HVAC override control panel. The system shall be analog addressable, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. This system shall be an extension of existing hospital Honeywell System.
- B. Install, program, test, and deliver to the Owner in fully operational condition including all required hardware, software, raceways and interconnecting wiring as required. The system shall consist of, but not be limited to, the following:
 - 1. Addressable Manual Dual Action Fire Alarm Pull Stations.
 - 2. Addressable Analog Duct Smoke Detectors
 - 3. Addressable Area Heat Detectors
 - 4. Addressable Interface and Control Modules.
 - 5. Audible and Visual Notification Devices.
 - 6. Hand On-Off-Auto Control Switches for HVAC and/or Purge Systems.
 - 7. Interface Monitoring and/or Control of Fixed Fire Suppression Systems.
 - 8. Magnetic Hold Open Door Release.
 - 9. Security Interface
- C. Non-addressable alarm initiating, supervisory and status monitored devices shall be integrated into the fire alarm system, as applicable, via the addressable interface module:
 - 1. Sprinkler water flow alarm (alarm initiating)
 - 2. Sprinkler standpipe water flow (alarm initiating)
 - 3. Sprinkler valve tamper switch (supervisory)

4. HVAC systems "AUTO-OFF" status (status monitoring).
 5. HVAC systems "PURGE ON-AUTO-OFF" (status monitoring), and fire/smoke dampers closure (status monitoring).
 6. Magnetic Hold Open Door Release.
 7. Security interface.
 8. Audible / visual signaling devices and communicating devices to be controlled by the Fire Alarm Control Panel (FACP) and/or Data Gathering Panels (FDGP, transponder panels):
 - a. Speakers
 - b. Strobe Lights
 - c. Combination Speaker-Strobe
 - d. Horns
 - e. Combination Horn-Strobe
 9. Devices to be controlled by the Fire Alarm Control Panel (FACP) and/or Data Gathering Panels (FDGP), programmable relays, and/or addressable interface module relays:
 - a. Connections to the appropriate Receiving Agency for manual station alarm, sprinkler alarm, smoke alarm, interfaced suppression system alarm, supervisory and system trouble conditions.
 - b. Magnetic door holders release control.
 - c. Magnetic door lock release control.
 - d. Air handling fan systems alarm shutdown operations.
 - e. Fire/smoke dampers operations.
 - f. Material Lift shaft smoke hatch/vent release control.
- D. Prior to the commencement of work, obtain all permits necessary for installation of the work. All permit costs and inspections fees shall be included as part of the required work. After completion of work, notify all authorities having jurisdiction.
- E. Local requirements shall be adhered to with regard to submitting specifications, wiring diagrams, shop drawings and plans. Responsibility for furnishing the quantities of copies on mylar and/or paper, as directed by such requirements, shall be included as part of the work of this Section.

- F. Submit a letter of approval of the installation, from the local code authority, before requesting final acceptance of the system.
- G. Related Sections include the following:
 - 1. Division 8 Section "Hardware" for door closers/holders/smoke detectors, electric door locks, and release devices that interface with fire alarm systems.
 - 2. Wire and Cable.
 - 3. Raceways.
- H. Coordinate with the mechanical contractor for installation of duct mounted smoke detectors and interface with motor controls.
- I. Coordinate with fire protection contractor for interface with fire protection devices and coordinate with elevator contractor for interface with terminal recall relay.
- J. Coordinate with the Architect for final locations and appearance of devices.
- K. Electronic component models must have been commercially available for at least one year prior to bid.

1.3 SUBMITTALS

- A. Prior to the start of work, provide a complete and comprehensive submittal for review. Describe the proposed system and its equipment. Failure to provide a complete submittal shall be grounds for rejection of submission. Submittal shall include, but not be limited to, all of the following material:
 - 1. Battery capacity: Minimum of 125% of the operating requirement.
 - 2. Power requirements for all equipment: Minimum 25% spare capacity.
- B. Shop Drawings: Show details of graphic annunciator.
 - 1. Drawing or catalog page showing actual dimensions of system components.
 - 2. Single line riser diagram showing all equipment, all connections and number and size of all conductors and conduits.
 - 3. Wiring Diagrams: Detail wiring, differentiate between manufacturer-installed and field-installed wiring.
 - 4. Provide samples when so requested by the Architect/Engineer.
 - 5. Floor Plans: Indicate final outlet locations and raceway routing.
 - 6. Device Address List: Coordinate with final system programming.

7. System Operation Description: Detailed description for this specific Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 - C. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
 - D. Field Test Reports: Comply with NFPA 72.
 - E. Maintenance Data: Comply with NFPA 72.
 - F. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 1 Section "Submittals," make an identical submission to authorities having jurisdiction. Include copies of annotated Contract Drawings to depict component locations to facilitate review. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
 - G. Certificate of Completion: Comply with NFPA 72.
 - H. Provide the address, telephone number, and contact person(s) of the manufacturer's local service facility for normal and off hour warranty issues.
 - I. Provide a fire alarm system input output function matrix. Matrix shall illustrate alarm output events in association with initiating devices input events. Include any and all departures, exceptions, variances or substitutions from these specifications and/or project drawings at the time of bid.
- 1.4 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
 - B. Installer Qualifications: An experienced installer who is an authorized representative of the manufacturer for both installation and maintenance of units required for this Project.
 - C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.
 - D. Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
 - E. Comply with NFPA 72 and NFPA 70 Article 760.
 - F. Comply with NFPA 90A, Air Conditioning and Ventilation Systems.
 - G. Fire alarm system shall be UL listed.

- H. Submit three copies of all required Licenses and Bonds.

1.5 SEQUENCING AND SCHEDULING

- A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted.

1.6 EXTRA MATERIALS

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

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
3. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than one unit of each type.
5. Printer Ribbons: Six spares.
6. Keys and Tools: One extra set for access to locked and tamperproof components.

1.7 COORDINATION

- A. Coordinate work in this Section with all related trades.
- B. Air handling system, smoke damper control circuits shall be monitored by and connected to the fire alarm system.
- C. Sprinkler water flow alarm and valve tamper switches shall be wired and connected to the fire alarm system.
- D. Elevator recall control equipment shall be wired and connected to the fire alarm system.
- E. Material Lift shaft smoke hatch/vent control equipment shall be wired and connected to the fire alarm system.
- F. Fire watch responsibilities: Fire watch responsibilities shall be coordinated with the owner.

1.8 EXISTING CONDITIONS

- A. The Contractor shall visit the site to determine and verify all existing conditions, devices, conduct, riser, etc., before bidding.
- B. Verification testing: Test and document the operation of existing fire protection system(s) prior to new installation. Maintain the condition and integrity of existing fire alarm system.

1.9 PERMITS AND FEES

- A. The Contractor shall give necessary notice, file drawings and specifications with the department having jurisdiction, obtain permits or licenses necessary to carry out this work and pay all fees therefor. The Contractor shall arrange for inspection and tests of any or all parts of the work if so required by authorities and pay all charges for same. The Contractor shall pay all costs for, and furnish to the Owner before final billing, all certificates necessary as evidence that the work installed conforms with all regulations where they apply to this work.
- B. This contractor shall prepare or hire the necessary consultants to prepare and file all plans, calculation, forms, etc. required for filing with all agencies required for this work. including but not limited to the Portland Fire Department, etc.

1.10 INSPECTIONS / TESTING

- A. Independent testing and inspections shall be provided by this contractor who shall hire the inspector or testing agency

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work included, but are not limited to, the following:
- B. Subject to compliance with requirements, provide products by one of the following:
 - 1. Honeywell, Inc. (XLS 1000, match existing system components).

2.2 STANDARDS AND CODES

- A. All equipment shall be installed and complied with the current adopted provisions of the applicable electrical and building codes, and following codes and standards listed in 2.06.B (below).
- B. All equipment shall be UL listed for its intended use, as a minimum, the following standards shall apply:
 - 1. Underwriters Laboratories Standards
 - a. UL 228 - Door Holders for Fire Protective Signaling Systems.

- b. UL 268 and 268A-Smoke Detectors for Fire Protective Signaling Systems-Duct Application.
 - c. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
 - d. UL 464 - Audible Signaling Appliances.
 - e. UL 864 - Control Units for Fire Protective Signaling Systems.
 - f. UL 1480 - Speakers for Fire Protective Signaling Systems.
 - g. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
 - h. UL 1971 - Signaling Devices for the Hearing Impaired.
 - i. UUKL – Smoke Control.
2. National Fire Protection Association Standards.
- a. NFPA No. 13 – Maine Adopted Edition - Sprinkler Alarm and Supervision.
 - b. NFPA No. 20 – Maine Adopted Edition - Fire Pump Supervision.
 - c. NFPA No. 70 – Maine Adopted Edition - National Electrical Code.
 - d. NFPA No. 72 – Maine Adopted Edition - National Fire Alarm Code.
 - e. NFPA No. 72, 4-5 Remote Supervising Station Fire Alarm Systems (If Required)
 - f. NFPA No. 72, 4-7 Auxiliary Fire Alarm Systems.
 - g. NFPA No. 72, 3-12 Emergency Voice/Alarm Communications.
 - h. NFPA No. 90A – Maine Adopted Edition - Installation of Air Conditioning & Ventilating Systems.
 - i. NFPA No. 101 – Maine Adopted Edition - Life Safety Code
- C. All devices being reused, where permitted, shall be UL cross listed with the fire alarm system; otherwise, new devices are required. Submit approval documents.
- D. The fire alarm system and its installation shall comply with all other local codes and authorities having jurisdiction, including but not limited to, owners engineering design guidelines.
- E. The fire alarm system and its installation shall comply with all applicable requirements of the Americans With Disabilities Act (ADA-latest edition), in areas of new work.

2.3 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Basic System Equipment, Circuiting, Addressing and Operating Capabilities

1. The Fire Command Station, remote control modulation panels shall communicate via a RS-485, Multiple Access Protocol: Carrier Sense, Multiple Access, Collision Detect, also known as CSMA/CD an ETHERNET type protocol network. System modulation panels shall be connected as network "nodes". Network data communication wiring shall be NFPA Standard 72 Class A, Style 7, two-circuit system, wherein a single open, single ground or wire-to-wire short shall not degrade the network operation.
2. Connect no more than 80% of the maximum number of devices allowed on any addressable loop.
3. System power supplies, including necessary transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. All system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.
4. System primary power: Primary power for the FACP and the secondary power battery chargers shall be obtained from dedicated emergency power circuits. Fuse cut-outs shall protect each circuit. Each cut-out shall be two (2) pole with a solid neutral. Each circuit used for fire alarm purposes shall be permanently labeled for function.
5. Secondary power supply: Provide sealed gelled electrolyte batteries as the secondary power supply for all fire alarm functions. The battery supply shall be calculated to operate loads in a supervisory mode for twenty four (24) hours for proprietary and central station systems, sixty (60) hours for municipal or remote supervisory systems, with no primary power applied, and after that time, operate in alarm mode for fifteen (15) minutes.
6. Provide battery charging circuitry for each standby battery bank.
7. Total system response time shall not exceed 2.5 seconds on a system configured to maximum capacity. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with single watchdog circuits for all processors shall not be acceptable. Provide digital communication capabilities for the control panel to communicate with remote annunciators, input/output drivers and displays.
8. Where multiple visual signals are visible from any location, circuitry shall be incorporated for the synchronization of flash rate. Maintain a minimum of 40% spare capacity in each strobe circuit. Include one (1) additional circuit per floor.

9. System shall be configured to provide the following types of alarm sounding and communicating devices with NFPA 72, Style Y, two-wire (formally Class B), supervised, alarm indicating appliance (signal) and/or communicating circuits, as follows:
 - a. General floor audible notification appliance circuits shall consist of two (2) circuits. Circuits shall be installed in an alternate style, so that 50% of the audible devices installed would be operationally functional should one circuit fail.
 - b. In no case shall audible or visual circuits serve more than one floor area.
10. System shall provide status indicators and control switches for the following functions:
 - a. HVAC supply and return fans.
 - b. Status indicators for sprinkling system water flow and valve supervisory devices.
 - c. Any additional status or control functions as indicated on the drawings, including but not limited to, door unlocking and security with bypass capabilities.
 - d. Fire and/or smoke dampers.
11. HVAC supply-exhaust units, fire and smoke dampers shall be provided with a "HAND OFF-ON-AUTO" switch module with LED indicators. LED indication shall be red for "OFF", green for "ON" and amber for monitoring circuit integrity.
12. Smoke detectors shall alarm at their programmed sensitivity settings.
13. Software and Firmware Control:
 - a. All software and firmware provided with a fire alarm system shall be listed for use with the fire alarm control unit.
 - b. A record of installed software and firmware version numbers shall be maintained at the location of the fire alarm control unit.
 - c. All software and firmware shall be protected from unauthorized changes through the use of "access levels."

B. System Alarm Operation

1. Activation of any addressable activation or interface device shall cause the following functions and indications:

- a. Activate "ALARM" notification to the FACP (CD, remote annunciators) computer terminal display indicating device address, type, location, time and date. Activate red flashing device symbol on the CRT terminals.
 - b. Activate "ALARM" notification to the appropriate receiving agency and/or on site location as shown on the drawings.
 - c. Activate emergency evacuation audible and visual notification devices.
 - d. Activate fire emergency HVAC operational shutdowns and/or purge requirements.
 - e. Annunciate alarm notification on remote annunciators.
 - f. Record all events at the system alarm printer.
 - g. Release all magnetically held doors.
 - h. Unlock all magnetically locked doors.
 - i. Record event to the system historical log.
 - j. Activate the associated device alarm LED alarm indicator.
 - k. Actuation shall also cause an additional visual and audible annunciation in the elevator cab and required annunciators to alert all building occupants, fire fighters, and other emergency personnel that the elevators are no longer safe to use.
2. Elevator lobby smoke detectors shall sound an alarm on the floor of activation and the floor above the floor of activation. All elevator lobbies shall have one smoke detector utilizing alarm verification.
 - a. Upon first activation of the smoke detector, an alarm condition shall be noted on the fire alarm control panel and at any remote annunciation panels, no system audible indication.
 - b. Upon the re-activation of the smoke detector, an alarm shall be sounded on the floor of activation and the floor above activation and all elevators shall be recalled to a designated floor.
3. Alarm activation of an elevator lobby smoke detector, elevator machine room smoke detector or any single elevator shaft smoke detector shall automatically:
 - a. Provide those automatic alarm functions as described above.
 - b. Shall cause the recall of that bank of elevators to the terminal floor and the lockout of controls. In the event of recall initiation by detector(s) in the first floor lobby, the recall shall be to the alternate floor.

- c. Elevator recall activation shall also cause activation of all required hoist-way vents to open and mechanical ventilation fans to operate in fire emergency smoke evacuation mode.

C. System Supervisory Functions:

1. Activation of any supervisory circuit shall cause the following actions and indications:
 - a. Activate "SUPERVISORY ALARM" notification to the FACP computer terminal display indicating device address, device type, device location, time and date. Activate yellow flashing device symbol on the graphic terminal.
 - b. Activate "SUPERVISORY ALARM" notification to the appropriate receiving agency and/or on site location as shown on the drawings.
 - c. Annunciate alarm notification on system remote annunciators.
 - d. Audible signals shall be silence able from the control panel by an acknowledge switch.
 - e. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.
 - f. Record all events at the system alarm printer.

D. System Trouble Functions

1. Receipt of a system trouble alarm, shall cause the following actions and indications similar to "System Supervisory Functions" above.
2. The fire alarm system wiring (except control wiring to fans, dampers) shall be electrically supervised to automatically detect and report trouble conditions to the FACP.
 - a. Any opens or grounds shall initiate a system trouble condition.
 - b. System addressable devices shall be supervised for placement and normal operation. Removal of an addressable device or the failure of its internal electronic circuitry shall initiate a system trouble condition.
 - c. The following FACP and/or remote transponder control panels shall initiate a system trouble condition when the following occurs:
 - 1) Primary 120/220 VAC power loss.
 - 2) Battery disconnect.
 - 3) Battery low voltage.

- 4) FACP remote transponder or graphic LCD annunciator panel power loss.
 - 5) FACP primary alarm printer power loss.
 - d. Operating a central station agency alarm disconnect switch, or any manual control commands that alter the system from its normal programmed standby configuration shall initiate a trouble condition.
 - e. Trouble conditions shall automatically activate an audible signal and flash the general system trouble LED indicator at the FACP. Pressing the trouble acknowledge key on the FACP shall silence the audible signal and continuously light the LED indicator, until the trouble condition is repaired. Subsequent trouble conditions shall resound the audible signal and again flash the LED. Each trouble condition must be individually acknowledged.
 - f. Removal of or failure of internal electronic circuitry of any addressable device shall initiate a system trouble condition.
3. One-Way Voice Communication
- a. The fire alarm tone signal and alert tone signal shall be capable of being initiated automatically from the Fire Alarm Control Panel (FACP), and transmitted to any speaker circuit, selected speaker circuits or all speaker circuits.
 - b. The fire alarm tone signal, alert tone signal and live voice announcements shall be capable of being manually transmitted from the FACP to any speaker circuit (including elevators), selected speaker circuits or all speaker circuits by manual selection of the associated speaker circuit control switches.
 - c. Manual override, for live voice announcements, via the hand-held microphone and speaker circuit control switches shall take priority over any and all alarm tone signals or alert tone signals, including all stack area bells and horns.
 - d. Alarm speaker amplification equipment shall be sized to provide two (2) watts of input power to each speaker shown on the Drawings, with the allowance of fifty percent (50%) spare capacity in the system to permit the addition of future alarm speakers.
 - e. One (1) back-up alarm speaker amplifier shall be provided for the system or at each distributed amplifier location. If any primary alarm speaker amplifier fails, its function shall be taken over by the backup amplifier.

4. Air Handling Systems Control/Status
 - a. Air handling systems shall be automatically controlled from the fire alarm system control relays, as previously described.
 - b. Air handling systems shall not be permitted to restart to normal operation from the simple operation of the system reset switch. A separate air handling systems restart switch shall be provided on the FACP to permit air handling systems to be restarted after the fire alarm system has been reset to normal.
 - c. In order to limit electrical demand, FACP central processing unit (CPU) software generated time intervals (time delay relays shall not be acceptable) shall control the air handling systems reset sequence so that each air handling system shall be permitted to restart at sequential, fifteen (15) second (adjustable) intervals.
5. System Supervision For Trouble Conditions
 - a. The fire alarm system wiring (except control wiring to fans, door holders, etc.) shall be electrically supervised to automatically detect and report trouble conditions to the FACP.
 - b. Any opens or grounds on Monitor Addressable Module alarm initiating or supervisory circuit wiring and any opens, grounds or shorts across MAPNET addressable data communications, remote annunciator panel data communications, alarm signal, alarm speaker or alarm strobe light circuit wiring shall initiate a system trouble condition.
6. Fire Alarm Control Panel (FACP) relays, system transponder panel relays and Control Zone Addressable Module relays shall be provided to connect to and provide fire alarm system control of associated equipment such as central station transmitter connections and door holders. Assignment of individual relays for control operation shall be accomplished during the programming of the FACP central processing unit (CPU) software. Each of the following types of remote equipment shall be provided with a control relay typically as follows or indicated on plans:
 - a. Central station agency connections: Provide five (5) contacts (manual station alarm condition, sprinkler alarm condition, smoke alarm condition, system supervisory off-normal condition and system trouble condition) for connection to the central station agency transmitter.
 - b. Magnetic door holders: Provide one (1) release control contact for magnetic door holders.
 - c. Duct smoke sensor addressable relays and addressable relays shall be provided to connect to and provide fire alarm system control of remote equipment such as air handling systems, elevator controls, etc. Each relay shall be individually addressable and provide double-pole, double-throw (DPDT) contacts fused at two Amperes (2.0 A.) @ 120 VAC or 28

VDC (Non-inductive). Assignment of individual relays for control operation shall be accomplished during the programming of the FACP central processing unit (CPU) software.

7. The FACP shall provide each of the following types of equipment and circuits associated with the fire alarm system with a manual control switch, as required by the functional requirements of these Specifications, which shall be typically as follows:
 - a. Central station alarm disconnect: Provide one (1) switch with one (1) green, "ACTIVATED" status LED indicator to disable the central station alarm transmission function.
 - b. Central station alarm transmit: Provide one (1) switch with one (1) green, "ACTIVATED" status LED indicator to initiate the transmission of an alarm signal to the central station agency.
 - c. Alarm speaker circuits: Provide one (1) control switch for each floor and stack area.

E. Conductors

1. Each conductor shall be identified with wire markers at terminal points. Attach permanent VISIBLE wire markers within 2 inches of the wire termination.
2. All wiring shall be code compliant (Fire Alarm MC Cable or individual conductors in conduit).
3. Wiring for analog loop circuits, conventional detection circuits and telephone circuits shall be per fire alarm manufacturer's wiring requirements, but shall not be smaller than #14 AWG.
4. Conductor size shall be increased as required so as to limit voltage drop to a maximum of 2.5%.
5. Plenum rated cable, if approved by the AHJ and Owner, shall be rated for 150° degrees Celsius with insulation of Teflon or its equivalent.
6. Splices are not permitted except at termination devices and then shall be made with UL listed mechanical connectors.
7. Crimp-on type spade lugs shall be used for terminations of stranded conductors. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
8. Wire nuts or other solder-less splicing devices shall not be used.
9. Provide a consistent color code for fire alarm system conductors. Submit for approval prior to installation of wire, a proposed color code for system conductors.

10. Color coding of all system wiring shall be in accordance with state and local codes.
11. All nominal voltage branch circuit power feeds (120 VAC) shall be identified "labeled" at both ends of the circuit to indicate its source and purpose.
12. Wiring within system control panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance and to isolate nominal voltage wiring from system low voltage wiring.
13. Splices in electrical conductors in vertical risers are prohibited except when the length of conductors exceeds 150 feet in vertical risers, in which case terminal cabinet shall be used.

2.4 MANUAL PULL STATIONS

- A. Description: Fabricated of metal and finished in red with molded, raised-letter operating instructions of contrasting color.
 1. Single-action mechanism initiates an alarm.
 2. Double-action mechanism requires two actions, such as a push and a pull, to initiate an alarm.
 3. Station Reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
 4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false alarm operation.
 5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.
 6. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

2.5 SMOKE DETECTORS

- A. General: Include the following features:
 1. Operating Voltage: 24-V dc, nominal.
 2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.

4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

B. Photoelectric Smoke Detectors: Include the following features:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
3. Integral Thermal Detector: Fixed-temperature type with 135 deg F setting.

C. Duct Smoke Detector: Photo-Electric.

1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
2. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 OTHER DETECTORS

A. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate of rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.

1. Mounting: Adapter plate for outlet box mounting.
2. Mounting: Plug-in base, interchangeable with smoke detector bases.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

B. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Adapter plate for outlet box mounting.
2. Mounting: Plug-in base, interchangeable with smoke detector bases.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.7 NOTIFICATION APPLIANCES

- A. Description: Equip for mounting as indicated and have screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - 1. Strobes shall produce a flash rate of one flash per second minimum per the listed input voltage (20 VDC – 31 VDC) range.
 - 2. Rated Light Output: 75 candela.
 - 3. Rated Light Output: 110 candela.
 - 4. Strobe Leads: Factory connected to screw terminals.
- C. Voice/Tone Speakers:
 - 1. High-Range Units: Rated 2 to 15 W.
 - 2. Low-Range Units: Rated 1 to 2 W.
 - 3. Mounting: Flush; bidirectional as indicated.
 - 4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.

2.8 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

- A. Description: LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

2.9 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
 - 1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 - 2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.

3. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.10 CENTRAL FACP (EXISTING)

A. Alarm and Supervisory Systems: Separate and independent in the FACP. Alarm-initiating zone boards consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.

B. Control Modules: Include types and capacities required to perform all functions of fire alarm systems.

C. Voice Alarm: An emergency communication system, includes central voice alarm system components complete with preamplifiers, amplifiers, and tone generators. Features include the following:

1. Two alarm channels permit simultaneous transmission of different announcements to different zones or floors automatically or by using the central control microphone. All announcements are made over dedicated, supervised communication lines.
2. Status annunciator indicates the status of various voice alarm speaker zones.

D. Instructions: Printed 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.

2.11 REMOTE ANNUNCIATOR

A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, reset, and test.

1. Mounting: Flush cabinet, NEMA 250, Class 1.

B. Display Type and Functional Performance: Individual LED for each type of alarm and supervisory device, and LEDs to indicate "NORMAL POWER" and "TROUBLE."

1. An alarm or supervisory signal causes the illumination of a zone light, floor light, and device light.
2. System trouble causes the illumination of all lights above and also the trouble light.
3. Additional LEDs indicate normal and emergency power modes for the system.
4. A test switch tests LEDs mounted on the panel. Switch does not require key operation.

- C. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.
- D. Graphic Display Panel for Remote Annunciator: Wall-mounted engraved panel indicating the building floor plan with a "YOU ARE HERE" designation. Engrave zone, area, and floor designations on the face of the panel.
 - 1. Materials: Satin-finished stainless steel or brushed aluminum.
 - 2. Floor Plan and Zone Boundary Lines: Engraved in the surface and filled with colored paint. Floor plan lines are black and 1/4 inch wide; zone boundaries are red and 1/8 inch wide.
 - 3. Engraved Legends: 1/4-inch- high minimum, in letters filled with red paint.
 - 4. Mounting: Adjacent to remote annunciator.

2.12 EMERGENCY POWER SUPPLY

- A. General: Components include valve-regulated, recombinant lead acid battery; charger; and an automatic transfer switch.
 - 1. Battery Nominal Life Expectancy: 10 years, minimum.
- B. Battery Capacity: Comply with NFPA 72.
 - 1. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
- C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.
- D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

2.13 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.

2.14 GUARDS FOR PHYSICAL PROTECTION

- 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 the manufacturer of the device.
 - 2. Finish: Paint of color to match the protected device.

2.15 WIRE

- A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 14 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
- B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Manual Pull Stations: Mount semiflush in recessed back boxes.
- B. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.
- C. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. On smooth ceilings, install not more than 30 feet apart in any direction.
- D. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.
- E. Smoke Detectors near Air Registers: Install no closer than 60 inches.
- F. Duct Smoke Detectors: Comply with manufacturer's written instructions.
 - 1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 2. Install sampling tubes so they extend the full width of the duct in which they are installed.
- G. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- H. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating

mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.

- I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- J. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- K. Annunciator: Install with the top of the panel not more than 72 inches above the finished floor.

3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceway. Conceal raceway except in unfinished spaces and as indicated.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors 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. 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. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- E. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.
- F. Wiring to Remote Alarm Transmitting Device (FDGP): 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

- A. Identify all system components, wiring, cabling, and terminals.
- B. Identify all system components, wiring, cabling, and terminals.
- C. Install instructions frame in a location visible from the FACP.

- D. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes of type, size, location, and quantity as indicated.
- D. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
- E. Ground radio alarm transmitter system and equipment as recommended by the manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Certificate of Compliance
 - 1. Complete and submit to the Project Engineer in accordance with NFPA 72, paragraph 1.7.2. and Maine Building Code.
 - 2. As required by the installation and phasing. The contractor shall include pre-testing and fire department testing in phases.
- B. Field - Testing General
 - 1. All equipment shall be pre-tested by the contractor and witnessed by the Owner's representative prior to Portland Fire Department testing.
 - 2. As required by the installation and phasing. The contractor shall include pre-testing and fire department testing in phases.
 - 3. NFPA 72 - Detectors shall not be installed until after the construction cleanup of all trades is complete and final. Exception: Where required by the authority having jurisdiction for protection during construction. Detectors that have been installed prior to final cleanup by all trades shall be cleaned or replaced in accordance with NFPA 72 – latest Edition.
 - 4. Each addressable analog smoke detector shall be individually field tested prior to installing the device at it's designated location to ensure reliability after shipment and storage conditions. A dated log indicating correct address, type of device, sensitivity and initials of the technician performing test using test equipment specifically designed for that purpose shall be prepared and kept

for final acceptance documentation. After testing, the detection devices and base shall be labeled with the system address, date and initials of installing technician. Labeling shall not be visible after installation is complete.

5. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
 - a. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
6. The acceptance inspector shall be notified before the start of any required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector, shall be corrected.
7. Test reports shall be delivered to the acceptance inspector as completed.
8. All test equipment, instruments, tools, and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
 - a. Ladders and scaffolds as required to access all installed equipment.
 - b. Multimeter for reading voltage, current, and resistance.
 - c. Intelligent device programmer-tester.
 - d. Laptop computer with programming software for any required program revisions.
 - e. Two way radios, flashlights, smoke generation devices and supplies.
 - f. Spare printer paper. (If required)
 - g. An approved device for measuring air flow through air duct smoke detector sampling assemblies.
 - h. Decibel meter.
 - i. Testing documentation.
9. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance fire and building department inspectors.

C. Final Acceptance Testing

1. An acceptance test of the fire alarm system shall be conducted by the contractor and the fire alarm equipment vendor as directed by the owner

after the fire alarm equipment vendor has performed a 100% test of the system.

2. A written "Acceptance Test Procedure" (ATP) for testing the fire alarm system components and installation will be prepared by the contractor, for approval by the engineer in accordance with NFPA 72 and this Specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits and programming.
3. A final "As-Built Function Matrix" shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm, trouble or supervisory condition on that input. In the case of outputs programmed using more complex logic functions involving "any", "or", "not", "count", "time", and "timer" statements; the complete output equation shall be referenced in the matrix.
4. A complete listing of all device labels for alpha-numeric annunciator displays and logging printers shall be prepared by the installing contractor prior to the ATP.
5. The acceptance inspector shall use the system record drawings in combination with the specified documents during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
 - a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
 - 1) Open, shorted and grounded intelligent analog signaling circuit.
 - 2) Open, shorted and grounded network signaling circuit.
 - 3) Open, shorted and grounded conventional zone circuits.
 - 4) Open, shorted and grounded speaker, telephone circuits.
 - 5) Intelligent device removal.
 - 6) Primary power or battery disconnected.
 - 7) Incorrect device at address.
 - 8) Printer trouble, off line or out of paper.
 - 9) Loss of data communications between system control panels.
 - 10) Loss of data communications between system annunciators.

6. System evacuation alarm indicating appliances shall be demonstrated as follows:
 - a. All alarm notification appliances actuate as programmed.
 - b. Audibility and visibility at required levels.
 - c. System indications shall be demonstrated as follows:
 - 1) Correct message display for each alarm input at the control panel, each remote alpha-numeric LCD display and graphic display.
 - 2) Correct annunciator light for each alarm input, at each annunciator and color graphic terminal.
 - 3) Correct printer logging for all system activity.
 - d. System on-site and/or off-site reporting functions shall be demonstrated as follows:
 - 1) Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
 - 2) Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
 - 3) Trouble signals received for disconnect.
 - e. Secondary power capabilities shall be demonstrated as follows:
 - 1) System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
 - 2) System primary power shall be restored for forty eight hours and system charging current shall be normal trickle charge for a fully charged battery bank.
 - 3) System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
7. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
 - a. The installing contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.

- b. In the event that software changes are required during the ATP, a utility program shall be furnished by the system manufacturer to compare the edited program with the original. This utility shall yield a printed list of the changes and all system functions, inputs and outputs effected by the changes. The items listed by this program shall be the minimum acceptable to be retested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete retesting.

D. Documentation

1. System documentation shall be furnished to the owner and shall include but not be limited to the following:
 - a. System record drawings and wiring details including one set of reproducible masters and drawings on a Compact Disk in a DXF format suitable for use in a CAD drafting program.
 - b. System operation, installation and maintenance manuals.
 - c. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
 - d. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
 - e. System program "hard copy" showing system functions, controls and labeling of equipment and devices. Also provide a compact disk with system file.
 - f. All specified documentation as required under submittals of the sections of the specifications.

E. Test Equipment

1. The contractor shall furnish to the owner all test equipment as required to program the field analog devices, specifically an intelligent device programmer-tester or a calibrated smoke generator with power source.

F. Warranty/Services

1. The contractor shall submit three manufacturer's certified service companies that are in a 50 mile radius of the project. The Owner shall have the ability to utilize any of these firms for service, maintenance, and warranty work if the present company fails to comply with the stated guarantee and warranty conditions.

2. The contractor shall warrant and maintain the entire system against system hardware and electrical defects including programming software defects, bi-yearly maintenance and complete system testing as per Portland Building code requirement, for the two year warranty period. This period shall begin upon satisfactory completion and certification of final acceptance testing by the "authority having jurisdiction" of the system and sign acceptance of Engineer. Contractor shall provide to owner a letter stating the owner accepted start-date and end-date of warranty period.
3. The fire alarm vendor shall provide pricing for the next three years after the two year warranty period, (third, fourth, and fifth year) after the expiration of the two year warranty period. The pricing shall be separated into two categories; parts and labor and bi-yearly maintenance and testing required.
4. Provide complete hardware and software unit pricing which shall be in effect for the two year warranty period for purchase by the Owner or Owner's representative.
5. The contractor responsible for the system, must also additionally provide an updated list of name(s) and phone number(s) for normal and off hours contacts necessary to respond to warranty issues. Response to warranty notification shall require a field reply within 24 hours of initial contact.
6. The manufacturer shall allow for three complete reprogrammings of the fire alarm system after successful completion of final acceptance test, at no expense to the Owner.
7. The Fire Alarm Vendor shall guarantee that a copy of the software programming of the fire alarm system is given to the client upon successful completion of acceptance testing. The Fire Alarm Vendor shall also guarantee a new copy of the software will be provided to the Owner upon incorporating any new changes into the system.
8. The Fire Alarm Vendor shall guarantee a copy of the most up-to-date software programming to any other maintenance company, anytime, at no charge to the Owner. This will insure that the Owner is not dependent upon the Fire Alarm Manufacturer, or limited to one maintenance company.

G. Training

1. The fire alarm contractor shall furnish an onsite video taped training session as follows for a minimum of four employees of the system user.
 - a. Training in the receipt, handling and acknowledgment of alarms.
 - b. Training on system operation including manual control of output functions from the FACP.
 - c. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.

- d. The total training shall be a minimum of eight (8) hours, but shall be sufficient to cover all items specified.

3.6 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours' training.
 - 2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.8 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

END OF SECTION