

SECTION 28 31 13

FIRE ALARM & SMOKE DETECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, analog addressable intelligent fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be supervised either electrically or by software-directed polling of field devices.
- C. The system shall also be listed by Underwriter's Laboratories under the category of Control Unit System (UOJZ) and Control Unit Accessories (UOXX).
- D. The system shall be an active/interrogative type system where each transponder and/or addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.
- E. The system shall conform to all requirements listed in the City of Portland Standard for Signaling Systems for the Protection of Life and Property 2010 Edition. The Contractor shall be responsible for assuring that all operational features of the fire alarm system meet the City's listed standards.
- F. The Contractor shall be responsible for obtaining the City of Portland Fire Alarm Permit.

1.2 RELATED SECTIONS

- A. Section 26 05 33 – Raceway and Boxes.

1.3 REFERENCES

- A. No. 70 National Electric Code (NEC).
- B. No. 72-1996 National Fire Alarm Code.
- C. No. 90A Air Conditioning Systems.
- D. No. 92A Smoke Control Systems.

- E. No. 92B Smoke Management Systems in Malls, Atria, Large Areas.
- F. No. 101 Life Safety Code.
- G. UL50 - Cabinets and Boxes.
- H. UL268 - Smoke Detectors for Fire Protective Signaling Systems.
- I. UL864 - Control Units for Fire Protective Signaling Systems.
- J. UL268A - Smoke Detectors for Duct Applications.
- K. UL521 - Heat Detectors for Fire Protective.
- L. UL228 - Door Closers/ HOLDERS for Fire Protective Signaling Systems.
- M. UL464 - Audible Signaling Appliances.
- N. UL38 - Manually Actuated Signaling Boxes.
- O. UL346 - Waterflow Indicators for Fire Protective Signaling Systems.
- P. UL1481 - Power supplies for Fire Protective Signaling Systems.
- Q. UL1076 - Control Units for Burglar Alarm Proprietary Protective Signaling Systems.
- R. UL1971 - Visual Notification Appliances.
- S. Local Electrical Codes: The system shall be installed in accordance with national and local electrical codes.

1.4 SYSTEM DESCRIPTION

- A. A new intelligent reporting, microprocessor controlled fire detection and emergency voice alarm communication system shall be installed in accordance with the specifications and drawings.
- B. The system shall be designed such that each signaling line circuit (SLC) shall be limited to only 80% of its total capacity is used during the initial installation.
- C. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).
- D. Existing fire detection equipment may be reused where the equipment:
 1. meets this specification's requirements;
 2. is listed or approved by a recognized national agency (UL,FM, etc.);
 3. is compatibility tested and listed with new equipment being installed;
 4. is approved by the local Authority Having Jurisdiction (AHJ).

- E. Basic Performance:
1. Alarm and trouble signals from each transponder shall be digitally encoded by listed electronic devices onto an NFPA Style 6 looped multiplex communication system.
 2. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Style 6 Signaling Line Circuits.
 3. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
 4. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y).
 5. Digitized electronic signals shall employ check digits or multiple polling.
 6. Transponder devices are to consist of low current, solid-state integrated circuits, and shall be powered from local a primary power and standby battery power source.
 7. Power for initiating devices and notification appliances must be from the main fire alarm control panel or the transponder to which they are connected.
 8. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
 9. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

1.5 BASIC SYSTEM FUNCTIONAL OPERATION

- A. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
1. The System Alarm LED shall flash.
 2. A local piezo-electric signal in the control panel shall sound.
 3. The 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 4. Printing and history storage equipment shall log the information associated with the fire alarm control panel condition, along with the time and date of occurrence.
 5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
 6. The audio portion of the system shall sound the proper signal to the appropriate zones.

1.6 QUALIFICATIONS

- A. All bidders must provide a listing of five similar size projects having the same scope of work using the proposed information delivery equipment. This listing shall be complete with facility names, completion dates, names of contacts and their telephone numbers.
- B. The Contractor shall be an authorized factory agent or distributor of the system proposed. An electrical contractor shall not be acceptable unless proof of factory qualification is provided with the bid documents. The system provider shall have ready access to spare parts. A documented minimum of five years' experience in the application of similar systems and equipment is required.

- C. The Contractor shall employ factory-trained technical service personnel with a minimum of 2 years of experience installing the proposed system.

1.7 SUBMITTALS

- A. Submit under provisions of Division 1 and Section 26 00 00.
- B. Submit manufacturer's specification sheets on each type of equipment proposed for use in the system. Each specification sheet provided shall be clearly marked to indicate the exact item provided. The submittal package shall include a system functional block diagram and a system riser diagram showing interconnection of all major equipment and devices required for an operational system. The submittals shall include scaled drawings indicating fronts of annunciator layout and main control panel module layout, configurations, terminations, descriptive title, manufacturer and model number.
- C. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
- D. Submit battery calculations for power supply panels.
- E. Certifications:
 - 1. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.8 MAINTENANCE SERVICE

- A. The bidder supplying the equipment shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including replacement parts. The vendor shall be prepared to offer a service contract for the maintenance of the system after the guarantee period. The bidder shall produce evidence that they have had a fully experienced and established service organization for at least five years and proven satisfactory installations during that time.
- B. Furnish service and maintenance of Communication Systems for one year from Date of Substantial Completion. A preventive maintenance schedule shall be provided which describes the protocol for preventative maintenance. The schedule shall include:
 - 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, water flow switches and all accessories of the fire alarm system.
 - 2. Each circuit in the fire alarm system shall be tested semiannually.
 - 3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72.
- C. Software Modifications:

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
- D. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

1.9 WARRANTY

- A. All The Contractor shall warranty all electronic components for five (5) years and workmanship and labor for a period of one (1) year from the date of system acceptance or beneficial usage by the Owner. Neither the final payment, nor any provisions in the contract documents shall relieve the Contractor (or General Contractor) of the responsibility for faulty materials and/or workmanship for a period of one year. This Contractor shall remedy any defects due thereto, and pay for any damage to work resulting therefrom.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide written operating and maintenance instructions as specified in Section 26 00 00. Include product data and operation/maintenance information for all system components.
- B. The Owner may assign personnel to participate with the Contractor during installation. Without delaying work, familiarize the Owner's personnel with the installation, equipment, and maintenance.
- C. During tests and adjustments, permit the Owner's personnel to observe. When feasible, explain the significance of each test.
- D. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.
- E. Employ manufacturer's field representative to demonstrate system operation to designated Owner personnel.
- F. Conduct walking tour of project and briefly describe function, operation, and maintenance of each component.
- G. Use submitted operation and maintenance manual as reference during demonstration and training.
- H. Provide the owner with a training program designed to make all administrative control station users familiar with the operation of the communications system.

1.11 COORDINATION

- A. The Contractor shall provide all miscellaneous items and accessories required to make the system operational whether or not such items are specifically mentioned in the plans and specifications. It is the Contractor's responsibility to review the architectural, structural, mechanical, and electrical drawings, as well as the specifications, for any details that may impact the installation or provisioning of the system. Any discrepancies discovered shall be brought to the attention of the engineer and Owner.

1.12 POST CONTRACT EXPANSIONS

- A. As part of the submittal include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).
- B. Quotation shall include installation and test labor and labor to reprogram the system for this 10% expansion. If additional loop interface hardware is required, include the material and labor necessary to install this hardware.
- C. Do not include cost of conduit or wire or the cost to install conduit or wire.
- D. Submittals which do not include this estimate of post contract expansion cost will not be accepted.

1.13 APPROVALS

- A. The system must have proper listing and/or approval from the following nationally recognized agencies:
 1. UL Underwriters Laboratories Inc.
 2. FM Factory Mutual
- B. The Fire Alarm Control Panel and all transponders shall meet the modular listing requirements of Underwriters Laboratories, Inc. Each subassembly, including all printed circuits, shall include the appropriate UL modular label. This includes all printed circuit board assemblies, power supplies, and enclosure parts. Systems which do not include modular labels may require return to the factory for system upgrades, and are not acceptable.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Acceptable system manufacturers:
 1. *Notifier*
 2. *Edwards*

3. *ESI*
4. Substitutions: Or Approved Equal.

2.2 EQUIPMENT AND MATERIAL

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- B. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.
- C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.3 CONDUIT AND WIRE

- A. Conduit:
 1. Conduit shall be in accordance with Specification Section 16111.
 2. Conduit shall be provided from device boxes in walls, vertically to accessible ceiling spaces above. Provide conduit bushings at tops of conduit stubbed into ceiling spaces.
 3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
 4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
- B. Wire:
 1. All fire alarm system wiring must be new. Initiating and Notification Circuits wiring shall be power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.
 2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 16 AWG (1.32 mm) for Notification Appliance circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. The system shall permit the use of IDC and NAC wiring in the same conduit with the multiplex communication loop.
6. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
7. All voice speaker and telephone circuits shall use twisted/shielded pair to eliminate cross-talk.

C. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their intended purpose and shall be as specified in Section 16130.
2. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
3. The main fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution Panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.4 MAIN FIRE ALARM CONTROL PANEL

- A. The main FACP Central Console shall be a *NOTIFIER* Model AM2020, or approved equal, and shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, transponders, local and remote operator terminals, printers, annunciators, and other system controlled devices.
- B. The main FACP and Central Console shall perform the following functions:
 1. Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
 2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to transponders.
 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
 4. Visually and audibly announce any trouble, supervisory or alarm, condition on operator's terminal, panel display, and annunciators.
 5. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 - a. The system alarm LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 80-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

- d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
6. When a trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
- a. The system trouble LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 80-character backlit LCD display shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
 - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.
7. When a supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
- a. The system trouble LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 80-character backlit LCD display shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
 - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.
8. System Capacity and General Operation
- a. The control panel shall be capable of expansion by 198 analog/addressable devices for a maximum system capacity of 1980 points. The system shall be capable of 2048 annunciation points per system regardless of the number of addressable devices.
 - b. The fire alarm control panel shall include a full featured operator interface control and annunciation panel which shall include a backlit 80-character liquid crystal display, individual, color coded system status LEDs, and an alpha-numeric keypad for field programming and control of the fire alarm system.
 - c. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.
 - d. The system shall include emergency voice communications utilizing distributed amplification and intelligence such that loss of operation by the main FACP will not result in the loss of evacuation signal throughout the balance of the building.
9. The FACP shall provide the following features:
- a. Block Acknowledge for Trouble Conditions
 - b. Rate Charger Control

- c. Control-By-Time (Delay, Pulse, time of day, etc.)
- d. Automatic Day/Night Sensitivity Adjust (high/low)
- e. Device Blink Control (turn of detector LED strobe)
- f. Environmental Drift Compensation (selectable ON or OFF)
- g. Smoke Detector Pre-alarm Indication at Control Panel
- h. NFPA 72 Smoke Detector Sensitivity Test
- i. System Status Reports
- j. Alarm Verification, by device, with tally
- k. Multiple Printer Interface
- l. Multiple CRT Display Interface
- m. Non-Fire Alarm Module Reporting
- n. Automatic NFPA 72 Detector Test
- o. Programmable Trouble Reminder
- p. Upload/Download System Database to PC Computer
- q. One-Man Walk Test
- r. Smoke Detector Maintenance Alert
- s. Security Monitor Points
- t. Alpha-numeric Pager Interface
- u. On-line or Off-line programming

C. Central Processing Unit (CPU):

1. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the central processing unit.
2. The CPU shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The Central Processing Unit shall also provide a real-time clock for time annotation of all system displays. The Time-Of-Day and date shall not be lost if system primary and secondary power supplies fail.
4. The main FACP central console shall be designed so as to permit continued local operation of remote transponders under both normal and abnormal network communication loop conditions. This shall be obtained by having transponders operate as local control panels upon loss of network communication.
5. The FACP and CPU shall be modular in construction to allow ease of servicing. The CPU and transponders shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems which require use of external programmers or change of EPROMs are not acceptable.
6. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients including RFI and EMI.
7. Each transponder and peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU, transponders, and peripheral devices shall be reliable and error free. The transmission scheme used should employ dual transmission or other equivalent error checking techniques. Failure of any transponder or peripheral device to respond to an interrogation shall be annunciated as a trouble condition.

D. Display:

1. The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
 2. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
 3. The system display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 light-emitting-diodes (LEDs), which will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM; SYSTEM TROUBLE, DISPLAY TROUBLE, and SIGNAL SILENCE.
 4. The system display shall provide a 25-key touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels will be accessible through the display interface assembly to prevent unauthorized system control or programming.
 5. The system display shall include the following operator control switches: SIGNAL SILENCE, LAMP TEST, RESET, SYSTEM TEST, and ACKNOWLEDGE.
- E. Loop Interface (Signaling Line Circuit) Board:
1. The SLC board shall monitor and control a minimum of 198 intelligent addressable devices. This includes 99 intelligent detectors (Ionization, Photoelectric, or Thermal) and 99 monitor or control modules.
 2. The SLC interface board shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
 3. The SLC interface board shall not require any jumper cuts or address switch settings to initialize operations.
 4. The SLC interface board shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 6 (Class A) circuit.
 5. The SLC interface board shall be able to drive an NFPA Style 4 twisted shielded circuit up to 12,500 feet in length. The SLC Interface shall also be capable of driving an NFPA Style 4, no twist, no shield circuit up to 3,000 feet in length. In addition, SLC wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall be allowed in either case.
 6. The SLC interface board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.
- F. Serial Interface Board (SIB):
1. The Serial Interface Board shall provide the EIA-232 interface between the fire alarm control panel and UL-Listed Electronic Data Processing (EDP) peripherals.
 2. The SIB shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports.
 3. The Serial Interface Board shall provide one EIA-485 port for the serial connection of the optional annunciator and control subsystem components.
 4. The SIB shall include LEDs which indicate that it is in regular communication with the annunciators and other EIA-485 connected peripheral devices.

5. All EIA-232 circuits shall be optically isolated and power limited.
- G. Enclosures:
1. The control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
 2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
 3. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
 4. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.
- H. Power Supply:
1. The main power supply shall operate on 120/240 VAC, 50/60Hz, and shall provide all necessary power for the FACP.
 2. It shall provide 3.0 amps of usable notification appliance power, using a switching 24 VDC regulator.
 3. It shall be expandable for additional notification appliance power in 3.0 ampere steps.
 4. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. It shall charge 55 Amp Hour batteries within a 48 hour period.
 5. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
 6. It shall be power-limited per 1995 UL864 requirements.
 7. It shall provide meters to indicate battery voltage and charging current.
- I. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.
1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
 2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
 3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
 4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
 5. Communication shall include vital system status such as:
 - a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - b. Independent Addressable Device Status
 - c. AC (Mains) Power Loss
 - d. Low Battery and Earth Fault
 - e. System Off Normal
 - f. 12 and 24 Hour Test Signal

- g. Abnormal Test Signal (per UL requirements)
 - h. EIA-485 Communications Failure
 - i. Phone Line Failure
6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
- J. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
- 1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
 - 2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
 - 3. The FCPS shall include an attractive surface mount backbox.
 - 4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per 1993 NFPA requirements.
 - 5. The FCPS include power limited circuitry, per 1995 UL standards.
- K. System Circuit Supervision
- 1. The FACP shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communications with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information in the history buffer and on the printer.
 - 2. Transponders that lose communication with the CPU shall sound an audible trouble and light an LED indicating loss of communications.
 - 3. Transponder Circuit Supervision: Transponders shall be designed such that they continuously scan all of their initiating and notification circuits. With normal communications between the FACP and the transponders, the transponders shall transmit initiating and notification circuit trouble conditions to the FACP for audible annunciation and printout. With or without communication with the FACP, the transponders shall supervise their circuits and annunciate any initiating circuit and notification circuit failures on LEDs located on the transponder.
 - 4. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.
- L. Field Wiring Terminal Blocks
- 1. For ease of service, all wiring terminal blocks shall be the plug-in/removable type and be capable of terminating up to 12 AWG wire. Fixed terminal blocks are not acceptable.
- M. Field Programming
- 1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers or electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.

2. It shall be possible to program through the standard FACP keyboard all standard functions.
 3. All field defined programs shall be stored in non-volatile memory.
 4. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands(Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
 5. The system programming shall be "backed" up on a 3.5" floppy diskette utilizing an upload/download program. This system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
 6. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.
- N. Specific System Operations
1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
 2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
 3. System Point Operations:
 - a. Any device in the system may be enabled or disabled through the system keypad or video terminal.
 - b. Any system output point may be turned on, or off, from the system keypad or the video terminal.
 4. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point will be annunciated for the parameters listed:
 - a. Device Status.
 - b. Device Type.
 - c. Custom Device Label.
 - d. Software Zone Label.
 - e. Device Zone Assignments.
 - f. Detector Analog Value.
 - g. All Program Parameters.
 5. System Status Reports: Upon command from a password-authorized operator of the system, a status report will be generated, and printed, listing all system statuses.

6. System History Recording and Reporting: The fire alarm control panel shall contain a History Buffer that shall be capable of storing up to 400 system events. Each of these events will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the History Buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and or printed.
 - a. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
8. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
9. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personel when a detector is at 80% of its alarm threshold in a 60 second period.

2.5 SYSTEM COMPONENTS

- A. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
 1. The maximum pulse duration shall be 2/10 of one second.
 2. Strobe intensity shall meet the requirements of UL 1971.
 3. The flash rate shall meet the requirements of UL 1971.
- B. Audible/Visual Combination Devices:
 1. Shall meet the applicable requirements of Section A listed above for audibility.
 2. Shall meet the requirements of Section B listed above for visibility.
- C. Addressable Devices - General
 1. Addressable devices shall provide an address-setting means using rotary decimal switches.
 2. Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches. Devices which use a binary address or special tools for setting the device address, such as a dip switch are not an allowable substitute.
 3. Detectors shall be Analog and Addressable, and shall connect to the fire alarm control panel's Signaling Line Circuits.
 4. Addressable smoke and thermal detectors shall provide dual (2)status LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs can be programmed off via the fire control panel program.
 5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity can be automatically adjusted by the panel on a time-of-day basis.

6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
 7. The detectors shall be ceiling-mount and shall include a separate twist-lock base which includes a tamper proof feature.
 8. The following bases and auxiliary functions shall be available :
 - a. Sounder base rated at 85 DBA minimum.
 - b. Form-C Relay base rated 30VDC, 2.0A
 - c. Isolator base
 9. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
 10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
- D. Addressable Pull Box (manual station):
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.
- E. Intelligent Photoelectric Smoke Detector: The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
- F. Intelligent Thermal Detectors: Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.
- G. Intelligent Duct Smoke Detector:
1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
 2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
- H. Addressable Control Module:
1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual

notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.

2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
 3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
 4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
 5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.
- I. Isolator Module:
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
 2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
 3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
 4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
- J. Waterflow Indicators:
1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
 2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
 3. All waterflow switches shall come from a single manufacturer and series.
 4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
 5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.
- K. Sprinkler and Standpipe Valve Supervisory Switches:
1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
 2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
 3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the

valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
 5. The switch housing shall be finished in red baked enamel.
 6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
 7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.
- L. Electromagnetic Door Holders
1. 24 Volt surface wall mount magnetic door holder with 40 pounds of holding power, with a field intensity of 5.6 oersteds at 1 meter (min.). Magnet shall be protected against transients and surges up to 600 volts. Door holders shall be configured for fail-safe operation so that power failure releases door to close.

2.6 BATTERIES AND EXTERNAL CHARGER:

A. Battery:

1. Shall be 12 volt, Gel-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

B. External Battery Charger:

1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt 60 hertz source.
2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.

2.7 MUNICIPAL FIRE ALARM MASTER BOX

- A. Provide radio operated municipal fire alarm master transmittal box as directed by the City Fire Department to match the City's standard.

2.2 REMOTE ANNUNCIATOR

- A. Provide an LCD flush-mounted remote annunciator *Notifier* LCD-80 or equal. Annunciator shall include an 80-character back-lit liquid Crystal Display (20 characters times 4 lines). Annunciator shall include control switches for system acknowledge, signal silence, and system re-set.

2.3 FIRE ALARM DOCUMENTS AND SIGNAGE

- A. Provide a lockable fire alarm records cabinet next to the fire alarm control panel, keyed alike with the control panel. Label the cabinet "FIRE ALARM DOCUMENTS" A record of System Installation (#14 of the Fire Alarm Emergency Communication System Record of Completion) shall be laminated and affixed to the inside of the cabinet.
- B. Provide a laminated sign to be affixed to the outside of the door of the main electrical room where the fire alarm control panel is located reading: "FIRE ALARM CONTROL PANEL".

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
 - 1. Manual Pull Stations shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.
- D. Initiation devices shall be labeled with a unique identity number visible from the floor for tracking of maintenance.

3.2 TYPICAL OPERATION

- A. Actuation of any manual station, smoke detector, heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:

1. Actuate horn/strobe units until the panel is reset.
2. Release all magnetic door holders to doors to adjacent zones on the floor from which the alarm was initiated.
3. Interlock alarm system heat detectors at the top and bottom of elevator shafts, and in the Elevator Machine Rooms with the elevator power service shunt trips such that an alarm condition at any of these detectors shall automatically disable the associated elevator electrical service feeder. Provide an interlock between the fire alarm system smoke detectors at the Elevator Lobbies on each floor, and the smoke detector in the Elevator Machine Room, such that:
 - a. An alarm activation by either the detector at the second floor Lobby or at the detector in the Elevator Machine Room, shall automatically send the elevator to the first floor Lobby.
 - b. An alarm condition activated by the first floor Lobby smoke detector shall automatically send the elevator car to the second floor.
4. Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as appropriate.
5. Activation of any sprinkler system low pressure switch, on valve tamper switch, shall cause a system supervisory alarm indication.

3.3 TEST

- A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
- B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- D. Verify activation of all flow switches.
- E. Open initiating device circuits and verify that the trouble signal actuates.
- F. Open signaling line circuits and verify that the trouble signal actuates.
- G. Open and short notification appliance circuits and verify that trouble signal actuates.
- H. Ground initiating device circuits and verify response of trouble signals.
- I. Ground signaling line circuits and verify response of trouble signals.
- J. Ground notification appliance circuits and verify response of trouble signals.
- K. Check alert tone and prerecorded voice message to all alarm notification devices.
- L. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.

- M. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- N. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.4 FINAL INSPECTION

- A. At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.5 INSTRUCTION

- A. Provide instruction as required for operating the system. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION 28 31 13