

SECTION 16721

FIRE ALARM AND SMOKE DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section of the specification includes the furnishing, installation, and connection of a “house” fire alarm system consisting of a microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
- B. This section of the specification also includes furnishing, installation and connection of “local” fire alarm detection/notification means within individual living units. Local fire alarm means shall include, but not be limited to, alarm initiating devices, alarm notification appliances and wiring as shown on the Drawings and specified herein.
- C. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
- D. This section also requires a connection to an off-site monitoring agency for reporting a “house” alarm condition.

1.2 RELATED SECTIONS

- A. Section 16180 – Equipment Wiring Systems.

1.3 “HOUSE” FIRE ALARM SCOPE

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.
- B. Basic Performance:
 - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on an NFPA Style 7 (Class A) Signaling Line Circuit (SLC).
 - 2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
 - 3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).
 - 4. Digitized electronic signals shall employ check digits or multiple polling.
- C. A single ground or open on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

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- D. 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.
- E. Interlock the “House” fire alarm system with the elevator operation as described in Section 16180.
- F. Interlock the “House” fire alarm system with the elevator shaft relief vent as described in Section 16180.

1.4 “HOUSE” FIRE ALARM SYSTEM FUNCTIONAL OPERATION

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

1.5 “LOCAL” FIRE ALARM SCOPE

- A. Multiple-station, hard-wired unitary equipment conforming to NFPA 72 shall be provided for all living units and shall be installed in accordance with the project specifications and Drawings.
- B. Basic Performance:
 - 1. Living Units : Actuation of any automatic fire alarm initiating device causes all local audible and visual alarms to activate within the given unit.

1.6 SUBMITTALS

- A. General:
 - 1. Submit shop drawings and product data under provisions of Division 1 and Section 16010.
 - 2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment (compatible UL Listed) from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
 - 3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

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- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
 - 3. Show annunciator layout, configurations, and terminations.
- C. Manuals:
 - 1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
 - 2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
 - 3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
- D. Software Modifications:
 - 1. Provide the services of a factory-trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
 - 2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
- E. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.7 GUARANTY

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.8 POST CONTRACT MAINTENANCE

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

1.9 POST CONTRACT EXPANSIONS

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- A. The contractor shall provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

1.10 APPLICABLE STANDARDS AND SPECIFICATIONS

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards.
 - 1. National Fire Protection Association (NFPA) - USA:
 - a. No. 12 CO2 Extinguishing Systems.
 - b. No. 12A & 12B Halon Extinguishing Systems.
 - c. No. 15 Water Spray Systems.
 - d. No. 16 Foam/Water Deluge and Spray Systems.
 - e. No. 72-1993 National Fire Alarm Code.
 - f. No. 101 Life Safety Code.
 - 2. Underwriters Laboratories Inc. (UL) - USA:
 - a. No. 268 Smoke Detectors for Fire Protective Signaling Systems.
 - b. No. 864 Control Units for Fire Protective Signaling Systems.
 - c. No. 268A Smoke Detectors for Duct Applications.
 - d. No. 521 Heat Detectors for Fire Protective
 - e. No. 464 Audible Signaling Appliances.
 - f. No. 38 Manually Actuated Signaling Boxes.
 - g. No. 346 Waterflow Indicators for Fire Protective Signaling Systems.
 - h. No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems.
 - i. No. 1971 Visual Notification Appliances.
- B. Local and State Building Codes.
- C. All requirements of the City of Biddeford Fire Department.

1.11 APPROVALS

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
 - 1. UL Underwriters Laboratories Inc.
 - 2. FM Factory Mutual
- B. The fire alarm control panel shall meet UL Standard 864, (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).
- C. The system shall be listed by the national agencies as suitable for extinguishing release applications.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

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- 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 protective signaling system, meeting the National Fire Alarm Code.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE

- A. Conduit:
 - 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements, and shall be as specified in Section 16111.
 - 2. Where possible, all wiring shall be concealed within partitions or above ceilings. Where exposed wiring is necessary, it shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
 - 3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
 - 4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 - 5. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
 - 6. Conduit shall be 3/4-inch (19.1 mm) minimum.
- B. Wire:
 - 1. All fire alarm system wiring shall be new.
 - 2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
 - 3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
 - 4. 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).

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5. Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. The system shall support up to 1,000 ft. of untwisted, unshielded wire. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop.
 6. All field wiring shall be completely supervised.
 7. The Fire Alarm Control panel shall be capable of T-Tapping Class B (NFPA Style 4) Signaling Line Circuits (SLC's). Systems that do not allow or have restrictions in, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.
- C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.
- D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
- E. The Fire Alarm Control Panel 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.

2.3 "HOUSE" FIRE ALARM CONTROL PANEL:

- A. The FACP shall be a *Notifier* Model FireWarden-100-2(E), or approved by *Gamewell* or *Fire-Lite* and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.
- B. System Capacity and General Operation:
1. The control panel shall provide, or be capable of expansion to 198 intelligent/addressable devices.
 2. The system shall include Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) programmable Notification Appliance Circuits.
 3. The system shall support up to 99 programmable EIA-485 driven relays for an overall system capacity of 301 circuits.
 4. The Fire Alarm Control Panel shall include a full-featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
 5. 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.
 6. The FACP shall provide the following features:
 - a. Drift Compensation to extend detector accuracy over life.
 - b. Sensitivity Test, meeting requirements of NFPA 72, Chapter 5.

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- c. Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.
 - d. System Status Reports to display or printer.
 - e. Alarm Verification, with verification counters.
 - f. PAS presignal, meeting NFPA 72 3-8.3 requirements.
 - g. Rapid manual station reporting (under 2 seconds).
 - h. Non-Alarm points for general (non-fire) control.
 - i. Periodic Detector Test, conducted automatically by software.
 - j. Pre-alarm for advanced fire warning.
 - k. Cross Zoning with the capability of: counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
 - l. March time and temporal coding options.
 - m. Walk Test, with check for two detectors set to same address.
 - n. UL 1076 Security Monitor Points.
 - o. Control-By-Time for non-fire operations, with holiday schedules.
 - p. Day/Night automatic adjustment of detector sensitivity.
 - q. Device Blink Control for sleeping areas.
7. The FACP shall be capable of coding Notification circuits in March Time (120 PPM), Temporal (NFPA 72 A.2.2.2), and California Code.
- C. Central Microprocessor:
1. The Microprocessor shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
 2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
 3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
- D. Display:
1. The 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 shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
 3. The display shall provide an 80-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, FIRE ALARM, SYSTEM TROUBLE, ALARM SILENCED, SUPERVISORY, MAINTENANCE/PRE-SIGNAL, DISABLED, BATTERY FAULT, and GROUND FAULT.
 4. The Display shall provide a 16-key touch keypad with control capability to command all system functions, entry of alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

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5. The Display shall include the following operator functions: ALARM SILENCE, SYSTEM RESET, DRILL, and ACKNOWLEDGE/STEP.
- E. Signaling Line Circuit (SLC):
1. The SLC interface shall provide power to and communicate with up to 99 intelligent detectors (Ionization, Photoelectric, or Thermal) and 99 intelligent modules (monitor or control) for a system capacity of 198 devices. This shall be accomplished over a single SLC loop and shall be capable of NFPA 72 Style 4, Style 6, or Style 7 wiring.
 2. The loop interface shall receive analog information from all intelligent detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
 3. The detector software shall meet NFPA 72, chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.
 4. The detector software shall allow manual or automatic sensitivity adjustment.
- F. Serial Interfaces:
1. An EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) peripherals shall be provided.
 2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible computers.
 3. The EIA-232 interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.
 4. An EIA-485 interface shall be available for the serial connection of remote annunciators and LCD displays.
 5. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.
- G. Enclosures:
1. The control panel shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
 2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- H. All interfaces and associated equipment are to be protected so that voltage surges or line transients, consistent with UL standard 864, will not affect them.
- I. Optional plug-in modules shall be provided for by NFPA 72, Chapter 4, Transmitters.

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- J. An optional module shall be available which provides 8 Form-C relays rated at 5.0. The relays shall track programmable software zones.
- K. Power Supply:
1. The Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
 2. It shall provide 5.0 amps of usable Notification appliance power, using a switching 24 VDC regulator. A 3.0 amp Notification expansion power supply shall be available for the demanding requirements of UL 1971 and ADA devices, for a total system capacity of 8 amps.
 3. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
 4. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
 5. It shall be power-limited per 1995 UL864 standards.
 6. It shall provide optional meters to indicate battery voltage and charging current.
- L. 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 a 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.
- M. Field Wiring Terminal Blocks: For ease of service all panel I/O wiring terminal blocks shall be a removable, plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.
- N. Operator's Controls:
1. Acknowledge/Step Switch: Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and Trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
 - a. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
 2. Alarm Silence Switch: Activation of the Signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field-programmable within the confines of

all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. System Reset Switch: The system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
 - a. Holding the system RESET switch shall perform a lamp test function.
4. Drill (Evacuate) Switch: The drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

O. Field Programming:

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All programming may be accomplished through the standard FACP keypad.
3. All field-defined programs shall be stored in non-volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.
5. Program edit shall not interfere with normal operation and fire protection. If a fire condition is detected during programming operation, the system shall exit programming and perform fire protection functions as programmed.
6. A special program check function shall be provided to detect common operator errors.
7. An Auto-Program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
8. For flexibility, an off-line programming function, with batch upload/download, shall also be available.

P. Specific System Operations:

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all-analog intelligent smoke detectors in the system from the control panel. Sensitivity range shall be within the allowed UL window.
2. Alarm Verification: Each intelligent addressable smoke detector in the system shall be independently selected and enabled to be alarm verified. The alarm verification delay shall be programmable from 5 to 30 seconds. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any device in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Device status.
 - b. Device types.
 - c. Custom device labels.
 - d. View analog detector values.
 - e. Device zone assignments.
 - f. All program Parameters.

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5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing system status.
6. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that will be capable of storing up to 650 system alarms/troubles/operator actions. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the History Buffer may be manually reviewed, one event at a time, or printed in its entirety.
 - a. Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 650 system events.
 - b. The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
7. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each intelligent smoke detector and shall analyze the detector responses over a period of time.
 - a. If any intelligent smoke 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 detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field-adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 99 software zones. All addressable devices may be field-programmed to be grouped into software zones for control activation and annunciation purposes.

2.4 "HOUSE" FIRE ALARM COMPONENTS:

- A. Programmable Electronic Sounders:
 1. Electronic sounders shall operate on 24 VDC nominal.
 2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, Temporal or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
 3. Shall be flush or surface mounted as shown on plans.
- B. Strobe Lights:
 1. Shall operate on 24 VDC nominal.
 2. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:
 - a. The maximum pulse duration shall be 2/10ths of one second.
 - b. The strobe intensity shall meet the requirements of UL 1971.
 - c. The flash rate shall meet the requirements of UL 1971.

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- d. The appliance shall be placed 80 in (2,030 mm) above the highest floor level within the space, or 6 in (152 mm) below the ceiling, whichever is the lower.
 - e. Fire alarm notification appliances in sleeping areas within living units shall have a visual intensity of 110 candela where the appliance is mounted 24" or more below the ceiling, or 177 candela where the appliance is mounted less than 24" below the ceiling. Notification appliances shall be installed at 80" above finished floor. All other notification appliances located within living units shall have a visual intensity of 15 candela.
- C. 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.
- D. 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 1 to 10) type address switches. Devices that use a binary address setting method, such as a dipswitch, are not an allowable substitute.
 - 3. Detectors shall be intelligent and addressable, and shall connect with two wires to the Fire Alarm Control Panel Signaling Line Circuits.
 - 4. Addressable smoke and thermal detectors shall provide dual alarm and power 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 shall be optional through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
 - 5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall 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 with tamper proof feature. An optional base shall be available with a built-in (local) sounder rated at 85 DBA minimum.
 - 8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
 - 9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
- E. 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.

F. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
2. The detectors shall be ceiling-mounted and available in an alternate model with an integral fixed 135-degree heat-sensing element.
3. Each detector shall contain a remote LED output and a built-in test switch.
4. Detector shall be provided on a twist-lock base.
5. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
6. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall periodically flash to indicate that the detector is in communication with the control panel.
7. The detector shall not go into alarm when exposed to air velocities of up to 1500 feet per minute (fpm).
8. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
9. All field wire connections shall be made to the base through the use of a clamping plate and screw.

G. 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.

H. Addressable Dry Contact Monitor Module:

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.

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- I. Two-Wire Detector Monitor Module:
 - 1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
 - 2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
 - 3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

- J. 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 contract 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.

- K. 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.

- L. Waterflow Indicators:
 - 1. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
 - 2. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30 Å 45 seconds.

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3. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve.

M. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser or zone control valve, and each 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. Each Post Indicator Valve (PIV) or main gate valve shall be equipped with a supervisory switch.
3. Mount switch so as not to interfere with the normal operation of the valve and adjust 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 mechanism shall be contained in a weatherproof aluminum housing that shall provide a 3/4-inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. Switch housing to 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.

N. Remote Annunciators

1. The remote annunciator shall be as manufactured by *Notifier* Model LCD-80/ABF-1B, or approved equal. The annunciator shall include an 80 character LCD display and shall include control switches for system acknowledge, signal silence and system reset period. The annunciator cabinet shall be flush recessed type.

O. House Fire Alarm Control Panel Batteries

1. Shall be 12 volt, Gell-Cell type (two required).
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.

2.5 "LOCAL" FIRE ALARM COMPONENTS

A. Living Unit Combination Smoke Detector/Horn/Strobe: *Gentex* Model 7109CS, or approved equal. Wall or ceiling mounted station with integral photoelectric smoke detector, horn and strobe. Unit shall be equipped with status light and test switch. Provide a quantity of six (6) detectors for future installation by Owner.

1. Power: 120 VAC with integral 9 VDC battery.
2. Contacts: Form C
3. Horn: 90 dB.
4. Smoke Sensitivity: 3%.
5. Strobe: UL1971, 177 cd.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All wiring shall be concealed in finished areas. Exposed wiring in conduit may be used in areas where concealed wiring is not possible; however, prior approval from the Architect must be obtained for any exposed work prior to installation.
- C. 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.
- D. 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.
- E. Connect the remote annunciator to the main fire alarm control panel with one-pair EIA-485 cable and with two 24 VDC conductors, size #18 AWG.
- F. Verify installation detail with Architect for door holders prior to installation.

3.2 TEST

- A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.
 - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - 2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
 - 3. Verify activation of all flow switches.
 - 4. Open initiating device circuits and verify that the trouble signal actuates.
 - 5. Open and short signaling line circuits and verify that the trouble signal actuates.
 - 6. Open and short Notification Appliance Circuits and verify that trouble signal actuates.
 - 7. Ground all circuits and verify response of trouble signals.
 - 8. Check presence and audibility of tone at all alarm notification devices.
 - 9. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.
 - 10. 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.
 - 11. 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

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address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 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.

3.4 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