SECTION 28 31 00 – FIRE ALARM AND DETECTION SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the work specified in this Division.

B. The requirements of this section apply to the Fire Alarm and Detection System.

C. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the Drawings and/or in these Specifications, include all design, labor, supervision, services, permits, fees, and incidentals necessary and required to provide a complete and operable facility with a complete system required by applicable codes. Provide all labor, materials, and perform such other services necessary and reasonable incidental to the design and installation of a monitoring system, required by the Authority Having Jurisdiction.

D. The fire alarm and detection system is a deferred submittal system, to be completed by the contractor in permit ready form. The fire alarm devices shown on the plans and described in the specification are provided to assist the contractor in their design process to provide a code compliant (at minimum) system.

1.02 QUALITY ASSURANCE

A. The system shall comply with the applicable provisions of the National Fire Protection Association Standard Number 70, “National Electrical Code,” Standard Number 72, “National Fire Alarm Code,” and meet all requirements of the local authorities having jurisdiction.

B. All equipment and devices shall be listed by the Underwriters Laboratories, Inc., or approved by Factory Mutual Laboratories and shall meet Federal Specification Standards per the latest edition.

C. All material and equipment shall be the latest standard products of a manufacturer regularly engaged in the manufacture of the products.

D. Equipment shall be represented by a firm with a local service organization that is factory trained and certified. The name of this organization shall be furnished to the Owner.

E. The contractor shall include in the basic bid all installation charges rendered by the supplier.

F. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

G. The fire alarm and detection system is a deferred submittal system, to be completed by the contractor in permit ready form. The fire alarm devices shown on the plans and described in the specification are provided to assist the contractor in their design process to provide a code compliant (at minimum) system.

H. Design Requirements

1. Comply with latest adopted edition of the NFPA 72.
2. Design, layout, and install a system based on the occupancy type and occupant load provided by the architect.
3. Provide all necessary design and materials for connection to:
   a. Elevator
   b. Sprinkler
   c. Duct Detectors
   d. Kitchen Hood

I. Code required fire alarm and detection, per occupancy and occupant load, will be the minimum of the design. Items requested above and beyond code.

J. Revisions to the Contractor's design, required by the Governing Agency/Authority Having Jurisdiction, shall be at the Contractor's expense.

K. The system and all associated operations shall be in accordance with the following:

1. National Fire Protection Association (NFPA)
2. National Electric Code (NEC)
3. Americans with Disabilities Act (ADA)
4. Institute of Electrical and Electronics Engineers (IEEE)
5. Underwriters Laboratories (UL)
6. International Building Code (IBC)
7. International Fire Code (IFC)
8. Occupational Safety and Health Administration (OSHA)
9. Authorities Having Jurisdiction (AHJ)
10. Oregon Structural Specialty Code (OSSC)

1.03 SYSTEM OPERATION

A. Basic System Function Operation: When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the FACP shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. A backlit 80-character LCD display on the FACP 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 on the FACP and history storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via control-by-event interlock programming 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.

B. System shall have style 4, class B and style Y class B on the Signaling Line Circuits and Notification Appliance Circuits. Any fault in the circuits shall be annunciated on the display and printed with time, date, location and a list of the system fault(s).

C. 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.

1.04 SUBMITTALS

A. General:

1. A minimum of (3) copies (more if directed by architectural documents) of all submittals shall be submitted to the Architect/Engineer for review.
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 compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
3. All substitute equipment proposed as equal to the equipment specified herein, shall meet or exceed the following standards. 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.

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.
4. Approvals will be based on complete submissions of manuals together with shop drawings.

D. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software installations, 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.

F. Fire alarm cut sheets and plans are to be submitted together for review.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Siemens, Notifier, Gamewell-FCI, EST, Silent Knight, Hochiki, or approved equal.

B. Documentation from the manufacturer shall be presented to the Architect and Engineer certifying that the persons making the final connections, system programming, check-out and providing the warranty are factory trained technicians in the employ of the factory authorized representative.

2.02 MAIN FIRE ALARM CONTROL PANEL:

A. The FACP 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 addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. Operator Control:

1. Acknowledge Switch:

a. 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.
b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch: Activation of the alarm 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 can be silenced 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. Alarm Activate (Drill) Switch: The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
4. System Reset Switch: Activation of 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.
5. Lamp Test: The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

C. System Capacity and General Operation:

1. The control panel shall provide, or be capable of expansion to 396 intelligent/addressable devices.
2. The control panel shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 3.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.
3. The system shall support up to 8 additional output modules (signal, speaker, telephone, or relay), each with 8 circuits for an additional 64 circuits. These circuits shall be either Class A (NFPA Style D) or Class B (NFPA Style Y) per the project drawings.
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 (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
5. The FACP shall provide the following features:
   a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
   b. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
   c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
   d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 1 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also include up to nine levels of prealarm, selected by detector, to indicate to maintenance personnel of impending alarms.
   e. The ability to display or print system reports.
   f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
   g. PAS presignal, meeting NFPA 72 3-8.3 requirements.
   h. Rapid manual station reporting (under 3 seconds).
   i. Non-alarm points for general (non-fire) control.
   j. Periodic detector test, conducted automatically by the software.
   k. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

l. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
m. Walk test, with a check for two detectors set to same address.
n. Control-by-time for non-fire operations, with holiday schedules.
o. Day/night automatic adjustment of detector sensitivity.
p. Device blink control for sleeping areas.
q. UL-1076 security monitor points.
r. Releasing options including: 10 independent hazards, a sophisticated cross-zone, delay and discharge timers, and an abort function. The system shall also include the ability to control low pressure CO2 valves with the ability to set time in/time out values in one second increments including a soak time of up to 9999 seconds.
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6. The FACP shall be capable of coding notification circuits in march time (120 PPM), temporal (NFPA 72 A-2-2.2.2), and California code. Main panel notification circuits (NAC 1,2,3 and 4) shall also support special two and three stage operations. The two stage feature allows 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. The three-stage option provides 20 PPM with one detector in alarm, 120 PPM with two detectors in alarm, and steady on with release.

D. Central Microprocessor:

1. The microprocessor shall be a state-of-the-art, high speed, 16 bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an 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.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

E. 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, internal panel circuits, and software zones.
3. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide 8 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING,

SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, and ALARM SILENCED.

4. The display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
6. The system shall support an optional battery ammeter/voltmeter display.

F. Signaling Line Circuits (SLC):

1. The system shall include two SLCs. Each 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 396 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The Loop Interface Board (LIB) shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, 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.

G. Serial Interfaces:

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.
2. One EIA-232 interface shall be used to connect an UL-Listed 40 or 80-column printer. Printers, which are not UL-Listed, are not considered acceptable substitutes.
3. One EIA-232 interface shall be used to connect an UL-Listed 40 or 80-column printer. Printers, which are not UL-Listed, are not considered acceptable substitutes.
4. The second EIA-232 interface shall be used to connect an UL-listed CRT terminal. This 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.
5. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
6. The EIA-485 interface may be used for network connection to a proprietary receiving unit.

H. Notification Appliance Circuit (NAC) Module:

1. The Notification Appliance Circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.
2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.
3. The module shall not affect other module circuits in any way during a short circuit condition.
4. The module shall provide eight green ON/OFF LEDs and eight yellow TROUBLE LEDs.

5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.
6. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or word processor.
7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.
8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.

I. Control Relay Module:

1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.
2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
3. The expansion module shall provide 8 green ON/OFF LEDs and 8 yellow LEDs (indicates disabled status of the relay).
4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.
5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or word processor.
6. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

J. Field Programming:

1. The system shall be programmable, configurable and expandable in the field.
2. It shall be possible to program through the standard FACP keyboard all system 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. Programmed control point activation shall include selective control of HVAC, door holder release, elevator recall, elevator power module shunt-trip, fire pump control, stairwell pressurization fans, etc.

K. Power Supply:

1. The main power supply for the fire alarm control panel shall provide 6.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an

integral battery charger for use with batteries up to 60 AH or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.

4. The main power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
   a. Ground Fault LED
   b. Battery Fail LED
   c. AC Power Fail LED
5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
7. The main power supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
8. The main power supply shall provide meters to indicate battery voltage and charging current.

L. Auxiliary Field Power Supply – Addressable:

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
10. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.

11. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
13. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

M. 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.

N. Document Storage Box

2.03 ANNUNCIATORS

A. Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located backlit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
7. The system shall allow a minimum of 32 terminal mode LCD annunciators. Up to 10 LCD annunciators shall be capable of the following system functions: Acknowledge, Signal Silence and Reset, which shall be protected from unauthorized use by a key switch or password.
8. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

2.04 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General:

1. Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel signaling line circuits. Detectors shall be supplied with dual auxiliary contacts for connection to air handlers, elevator controls, and other systems as required.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling 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 LED flash shall have the ability to be removed from the system 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. The panel on a time-of-day basis shall automatically adjust sensitivity.
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. Base shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications.
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).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Detectors shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LEDs shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
12. Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

B. 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 (44 mm) or larger.

C. 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. May be a combo Carbon Monoxide detector when required, and the devices is UL 2075 listed.

D. Intelligent Thermal Detectors: Thermal detectors shall be intelligent addressable devices rated at 135 deg. F (58 degrees C) and have a rate-of-rise element rated at 15 deg. F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Duct Smoke Sensor: The detector is to be Photoelectric type.

1. If possible the detector and housing will be a one-piece design. The housing and detector separate is allowed if a one-piece unit is not available.
   a. The duct detector housing shall be supplied with a clear cover so the presence of smoke can be monitored.
   b. Shall be supplied with either a magnetic test feature or an injection tube for device testing.
   c. Designed to operate with air velocity in the range of 300-4000fpm.
   d. Coordinate with mechanical plans for duct size and provide the appropriate length of sampling tubes.
   e. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
2. Detectors of either design will be provided with relays to connect to the fire alarm panel and DDC panel, as well as connect to a remote status LED.
3. Remote status LED will display the detector status exactly the same as the detector. The remote status LED is to indicate the detector is operational, in trouble mode, or in alarm.
   a. The remote status LED is required if the duct detector is over 10’ off the finished floor or is not visible because of a drop ceiling.
   b. Verify exact location to mount the remote status LED with the local AHJ prior to installation.

F. 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 SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) 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 (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

G. 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 (101.6 mm square), 2-1/8 inch (54 mm) 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.

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 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 circuit 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. Addressable Relay Module: Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. 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.

2.05 STAND-ALONE DETECTION

A. Residential grade smoke and carbon monoxide detectors shall be installed per OSSC 907.2.11 and 908.7.

2.06 ALARM INDICATING DEVICES

A. Horns shall be of sufficient number so that an alarm shall be clearly audible to all occupants of the building and/or fire area, as required by these specifications. Wall mounted devices shall be mounted in such a way that the lens is not less than 80” and not greater than 96” above the finished floor. Locations where ceilings prevent the installation at 96" centerline, the centerline of the unit shall be 6" below the ceiling.

B. Audible alarm signals shall produce a sound level at least 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level having a duration of a least 60 seconds (whichever is greater) measured 5 feet above the floor in each occupied area. The average ambient sound level is the root mean square, a weighted sound pressure measured over a 24-hour period. Low frequency alarms, 520Hz, to be installed in sleeping areas per OSSC. Low frequency alarms shall be used in bedrooms as directed by code.

C. Strobes shall be installed as shown on the drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Where multiple visual notification appliances can be seen from any location, circuitry shall be incorporated for the synchronization of flash rate.

1. Strobes shall produce a flash rate of one (1) flash per second minimum over the listed input voltage (20VDC - 31VDC) range.
2. Strobes shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid-state circuitry.

3. Strobe intensity shall be rated per UL 1971 for 15/75, 30/75, 60/75, 75 or 110 Candela. Dual listing strobes of 15/75 intensity for UL 1971/near-axis requirements shall be used where acceptable.
4. Strobes shall be available for semi-flush or surface mounting and in conjunction with audible appliances as required.

D. Provide manufacturer's standard wireguard where so indicated on the Drawings.

2.07 CONDUIT AND WIRE

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring 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, per NEC Article 760-29.
4. Wiring for 24 volt DC 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.
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).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. In certain applications, the system shall support up to 2 SLCs with up to 1,000 feet of untwisted, unshielded wire. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.

C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.

PART 3 EXECUTION

3.01 OPERATION

A. The fire alarm components (i.e. pull stations, smoke detectors, photoelectric smoke detectors, horns, magnetic door holders, fire alarm panel, batteries, chargers, fire alarm cable, etc.) will be supplied, installed and connected by Division 26 Contract Work. Duct smoke detectors are to be installed by Division 23, supplied and wired by Division 26.

B. The fire alarm system operation subsequent to the alarm activation of any pull station or automatic detection device shall be as follows:

1. Sound the building audible alarm devices.
2. Display on the control panel the English language description of the alarm and its location.
3. Print on the printer the alarm type, location, time and date.
4. Activate programmed output modules points.
5. Report the condition to the central station.
6. Log in the event buffer all system activity.
7. Recall the elevator if the alarm is activated from the lobby smoke detector(s).
8. Release magnetically held fire doors.
9. Deactivate the 120 volt smoke damper circuits.
10. Operate the elevator power module shunt trip switch to disconnect elevator power if the alarm is activated from the elevator heat detector(s).

C. Zoning: Provide each initiating device with its own address. This includes all detectors, pull stations, sprinkler flow switches, tamper switches, low air switches and any other monitored point.

3.02 INSTALLATION

A. Boxes, Enclosures and Wiring Devices:

1. Boxes shall be installed plumb and firmly in position.
2. Extension rings with blank covers shall be installed on junction boxes where required.
3. Junction boxes served by concealed conduit shall be flush mounted.
4. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
5. All junction box covers shall be painted fire department red and be affixed with a decal or silk-screened label “Fire Alarm System.”
6. Wet or damp locations shall require a NEMA rated enclosure suitable for the environment in which an addressable field device or module are to be installed. (i.e. monitoring of sprinkler water flow, tamper switches and OS&Y valves)
7. Termination junction boxes shall be of adequate size and room to facilitate ease of accessibility to work on wiring and to provide ample space for proper identification labeling. Enclosure design shall incorporate the use of a back plate within the enclosure to provide ease of installation. Terminal blocks shall be affixed to a secured mounting rail. Terminal enclosures shall be painted fire department red and stenciled “Interior Fire Alarm System.”
8. Electrical conduits shall enter only at the side or the bottom of control cabinets, unless designed and approved for entry on the top.
9. All conduits shall be grounded to a water main by approved ground clamps with a conductor equal in size to the largest conductor used in the system; but in no case shall the ground conductor be smaller than no. 10 AWG.

B. Conductors:

1. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
2. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer-wiring guides.
3. Wiring in accessible locations (i.e. above removable ceiling tiles) may be open fire alarm cable. The cabling is to be supported off the ceiling grid by means of D-rings, J-Hooks, or other products manufactured for the purpose. The cable is to be supported at least every 5’ and will not share a cable path with any other system. Cable shall not be attached to conduit, pipe, or ceiling stringers used by any other trade.

4. Wiring in inaccessible locations (i.e. walls, above gyp ceilings) shall be in a conduit raceway system. The contractor has the option to re-use the existing fire alarm raceway system if applicable and found to be in good condition. All conductors installed in existing raceway shall be THHN. Verify wiring with equipment supplier and increase conduit size where required.
5. Wiring for analog loop circuits, conventional detection circuits, speaker circuits and telephone circuits shall based on the fire alarm manufactures wiring guidelines, but shall not be smaller than #18 AWG.
6. Splices shall be made with UL listed wire nuts of the appropriate size for the cable gauge and count. Splices are only allowed at devices not mid run splices will be allowed.
7. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
8. A consistent color code for fire alarm system conductors throughout the installation shall be provided. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.
9. All nominal voltage branch circuit power feeds (120/220 VAC) shall be identified “labeled” at both ends of the circuit to indicate its source and purpose.
10. Wiring within system control panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance and to isolate nominal voltage wiring from system low voltage wiring.
11. Splices in electrical conductors in vertical risers are prohibited.
12. 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.
13. Communication circuits give off RF noise. Maintain at least an eighteen-inch distance from all other communication circuits.

3.03 FIELD QUALITY CONTROL

A. Certificate of Compliance: Complete and submit to the project engineer in accordance with NFPA 72, paragraph 1.7.2.

B. Field-Testing General:

1. Prior to any testing or programming verify numbering scheme, room names, and other means of identifying addressable devices prior to testing and labeling. The owner will be given a minimum of one week notice prior to the contractor requiring to have the numbering scheme requested by the owner.
2. Each addressable analog smoke detector shall be individually field tested prior to installing the device at its designated location to ensure reliability after shipment and storage conditions. A dated log indicating correct address, type of device, sensitivity and initials of the technician performing test - using test equipment specifically designed for that purpose - shall be prepared and kept for final acceptance documentation. After testing, the detection devices and base shall be labeled with the system address, date and initials of installing technician. Labeling shall not be visible after installation is complete.
3. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Tests shall check for stray voltage not to exceed 1 volt AC/DC unless otherwise specified by the manufacturer. Resistance, current and voltage readings shall be made as work progresses.
4. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor.
5. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

C. Final Acceptance Testing:

1. Testing shall be in accordance with NFPA72 and this specification.
2. A final As-built Function Matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm, trouble or supervisory condition on that input. In the case of outputs programmed using more complex logic functions involving "any," "or," "not," "count," "time," and "timer" statements; the complete output equation shall be referenced in the matrix.
3. The installing contractor prior to testing shall prepare a complete listing of all device labels for alphanumeric annunciator displays and logging printers.
4. The acceptance inspector shall use the system record drawings during the testing procedure to verify operation as programmed. In conducting the tests, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
    a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
        1) Open, shorted and grounded intelligent analog signaling line circuit.
        2) Open, shorted and grounded network signaling line circuit.
        3) Open, shorted and grounded conventional initiating device circuits.
        4) Intelligent device removal.
        5) Primary power or battery disconnected.
        6) Incorrect device address.
        7) Printer trouble, off line or out of paper.
        8) Loss of data communications between system control panels.
        9) Loss of data communications between system annunciators.
    b. System evacuation alarm indicating appliances shall be demonstrated as follows:
        1) All alarm notification appliances actuate as programmed.
        2) Audibility and visibility at required levels.
    c. System indications shall be demonstrated as follows:
        1) Correct message display for each alarm input, at the control panel, each remote alphanumeric LCD display.
        2) Correct annunciator light for each alarm input, at each annunciator and color graphic terminal.
        3) Correct printer logging for all system activity.
    d. System on-site and/or off-site reporting functions shall be demonstrated as follows:
        1) Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
        2) Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
        3) Trouble signals received for disconnect.
    e. Secondary power capabilities shall be demonstrated as follows:
        1) System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
        2) System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
        3) System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
5. In the event of system failure to perform as specified and programmed at the discretion of the acceptance inspector, the test shall be terminated.
    a. The installing contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.

b. In the event that software changes are required during the testing, the system manufacturer to compare the edited program with the original shall furnish a utility program. This utility shall yield a printed list of the changes and all system functions, inputs and outputs affected by the changes. The items listed by this program shall be the minimum acceptable to be retested before calling for resumption of the testing. The printed list and the printer log of the retesting shall be submitted before scheduling of the testing.

c. The acceptance inspector may elect to require the complete testing to be performed again if modifications to the system hardware or software warrant complete retesting.

D. Notify owner representative one week prior to all system testing days so they may witness tests.

E. Documentation:

1. System documentation shall be furnished to the owner and shall include but not be limited to the following:

a. Provide cut sheets for all equipment installed during construction. If multiple items are shown on one page indicate exactly which item was installed. Provide this information in hard copy and on CD with the record drawings.

b. System record drawings and wiring details including one set of reproducible hard copy, as well as, drawings on CD (compact disks) in a both CAD (or compatible program) and PDF.

c. System operation, installation and maintenance manuals.

d. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.

e. Documentation of system voltage, current and resistance readings taken during the installation and testing.

f. System program “hard copy” showing system functions, controls and labeling of equipment and devices. Also provide a CD with system file.

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

G. Warranty/Services: The contractor shall warrant the entire system against system hardware and electrical defects including programming software defects for a period described in the contract general conditions, but not less than one year. This period shall begin upon satisfactory completion and certification of final acceptance testing of the system. Contractor shall provide to owner a letter stating the start-date and end-date of warranty period. In addition, the contractor shall also provide an updated list of name(s) and phone number(s) for normal and off-hours contacts necessary to respond to warranty issues. Response to warranty notification shall require a reply within 24 hours of initial contact.

3.04 MAINTENANCE INSTRUCTIONS

A. Complete maintenance instructions for all devices including trouble-shooting procedures shall be provided to the owner. Owner’s personnel shall receive a minimum of six hours of hands on system training.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Provide manuals in accordance with Section 1. Manuals are to contain as-built drawings on disk utilizing AutoCAD, spare parts list, operating procedures, trouble shooting guide, operating system data file print out, operating system data file on disk, a one year service proposal on the system and a copy of the completed NFPA “Record of Completion.”

END OF SECTION