

PART 1 - GENERAL REQUIREMENTS

1-01 QUALIFICATIONS OF INSTALLER:

NOTE: EACH AND ALL ITEMS OF THE FIRE ALARM SYSTEM, INCLUDING WIRING, SHALL BE FURNISHED AND INSTALLED BY THE FIRE ALARM SYSTEM SUPPLIER (CONDUIT WITH PULL WIRES AND BOXES MAY BE INSTALLED BY THE ELECTRICAL CONTRACTOR). ANY WIRING OR FIRE ALARM EQUIPMENT FOUND TO BE INSTALLED BY THE ELECTRICAL CONTRACTOR SHALL BE REMOVED, DISCARDED, AND NEW FURNISHED & INSTALLED BY THE FIRE ALARM SYSTEM SUPPLIER AT NO COST TO THE OWNER OR THE ENGINEER.

1-02 GENERAL SYSTEM REQUIREMENTS:

Section 260500, "Basic Materials and Methods" applies to this section, with the additions and modifications specified herein. Refer to 260500 and to E001 for Duct Detector Allowance and Fire Alarm System Unit Pricing.

NFPA COMPLIANCE: The complete installation is to conform to Local Code Requirements and to the requirements of the AHJ enforced editions of the following publications including amendments:

- a) NFPA 13: Standard for the installation of sprinkler systems (applicable sections)
- b) NFPA 70: National Electrical Code (with particular attention to ARTICLE 760)
- c) NFPA 72: National Fire Alarm Code
- d) NFPA 101: Life Safety Code

UNDERWRITERS LABORATORIES: Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE Fire Alarm System manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994. Visual signaling appliances shall be listed under UL 1971.

INTERNATIONAL BUILDING CODE COMPLIANCE: The entire installed system and all integrated system operations shall be within the guidelines of the 2015 International Building Code (IBC) and the 2015 International Fire Code (IFC) unless superseded by architectural specifications

ADA COMPLIANCE: The fire alarm installation shall comply with the requirements of Appendix B, "ADA Accessibility Guidelines" of the American Disabilities Act for alarm systems.

NEMA STANDARD SB 4 COMPLIANCE: The complete installation is to comply with the applicable fire alarm installation sections of NEMA Standard SB 4.

The fire alarm cabinet for this project must be UL 864 Ninth Edition Listed.

Specific reference in the specifications to any article, device, product, material, fixture, form or type of construction, etc., by name, make or catalog number, with or without the words "or equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the Contractor in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction, which in the judgment of the Architect-Engineer, expressed in writing prior to bidding as specified below, is equivalent to that herein named.

The drawings and specifications shall be considered as complementary, one to the other, so that materials and labor indicated, called for, or implied by either shall be furnished and installed as if required by both. Where a disagreement exists between the plans and specifications, the item or

arrangements of better quality, greater quantity, or higher cost shall be included in the base bid. Any discrepancies between the drawings, specifications, and field conditions shall be resolved with the Engineer prior to commencing work. All agreements shall be verified in writing.

1-03 DESCRIPTION OF WORK:

The work includes the installation of a complete fire alarm system including associated equipment and appurtenances, complete and ready for operation. Equipment, materials, installation, workmanship, review, and testing shall be in strict accordance with the required and advisory provisions of "NFPA 72: National Fire Alarm Code". Devices and equipment for fire alarm service shall be listed by Underwriters Laboratories Inc. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

Existing fire alarm control panel and existing fire alarm initiating devices and associated wiring and conduit to be reused as indicated on the drawings.

Central Station monitoring of the fire alarm system to be provided by the Owner, coordinate in field.

Refer to drawings for phasing of work. Existing fire alarm system must remain operable while building is occupied.

WARRANTY: 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. The Contractor shall repair or replace any deficiencies reported in the guarantee period promptly after notification, without any additional compensation from the Owner.

As part of the above one-year warranty, the Contractor shall provide the following maintenance and testing, once at the 6-month point and a second time at the twelve-month point of the warranty period. The date of the two maintenance and testing sessions shall be scheduled as part of the fire alarm system closeout documents and shall be coordinated with the Owner and the Engineer prior to acceptance of the fire alarm system. The cost of this work shall be included in the Base Bid.

- a. Examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
- b. Each circuit in the fire alarm system shall be tested semiannually.
- c. Each smoke detector shall be tested in accordance with the requirements of NFPA 72.

The Contractor shall provide lightning protection for the fire alarm system and fire alarm circuits per the Manufacturer's recommendation. The Contractor shall provide lightning protection for the two (2) telephone lines serving the fire alarm system.

Furnish and install wiring materials under this section as specified in Section 260500, "Basic Materials and Methods," with the additions and modifications specified herein. Furnish materials and equipment that are current products of one manufacturer regularly engaged in the production of such equipment.

The existing system was manufactured by EST, and new equipment shall be compatible with and shall operate accurately and reliably with the existing system. Equipment and devices shall be compatible and operable in all respects with existing fire alarm system and shall not impair reliability or operational functions of existing fire alarm system.

1-04 **SYSTEM DESCRIPTION:**

A new addressable, intelligent reporting, microprocessor-controlled fire detection system shall be installed in accordance to the project specifications and drawings. Furnish and install all items hardware, software, programming, and factory setup required to provide a complete and operable fire alarm system. Addressable devices shall have the capability to be enabled or disabled individually without affecting other devices.

BASIC PERFORMANCE:

- a. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Class B Signaling Line Circuits (SLC).
- b. Initiation Device Circuits (IDC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
- c. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
- d. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- e. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke-zone whichever is greater.
- f. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
- g. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
- h. Two-way telephone communication circuits shall be supervised for open and short circuit conditions.
- i. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.
- j. All manual pull stations, building smoke detectors, building heat detectors, elevator smoke detectors, and extinguishing systems shall sound the building fire alarm upon activation unless specifically noted otherwise. The sprinkler tamper switch, duct smoke detectors, and door release smoke detectors shall sound a supervisory signal only upon activation, unless noted otherwise. The fire alarm control panel shall allow for on-site programming to change any device(s) signal.

BASIC SYSTEM FUNCTIONAL OPERATION: When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

- a. The system alarm LED on the system display shall flash.
- b. A local piezo electric signal in the control panel shall sound.
- c. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
- d. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
- e. 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 (notification appliances and/or relays) shall be activated.

TRANSIENT VOLTAGE SURGE SUPPRESSION(TVSS): In addition to the specific surge protection device locations named herein, surge protection shall be provided at each end of all signaling circuits, at all locations where signaling cable enters the building from outside, at all control panel terminations and areas recommended by the manufacturer.

1-05 **SUBMITTALS:** **Fire alarm equipment, devices and cabling shall not be ordered until manufacturer's data and shop drawings as described herein are submitted by the contractor and approved by the engineer.**

Submit Manufacturer's Data for:

- a. Control Panel and Cabinet(FAC)
- b. Digital Communicator (DACT) with Surge Protector
- c. Remote Annunciator Panels (FAA)
- d. 24VDC Power Extenders (FPE)
- e. Batteries and Battery Charger
- f. Audible/visual alarm notification devices
- g. Synchronization Control Modules (SCMs)
- h. Manual Stations
- i. Each type of Smoke, Heat, and Duct Detectors
- j. Magnetic Door Holders
- k. Monitoring Modules (MMs) and Control Modules (CMs)
- l. As-Built Cabinet
- m. Fire alarm cable
- n. Any other fire alarm equipment items required by the drawings or specifications
- o. Fire Stop Materials

Data submittals for each item shall provide evidence of listing by Underwriter's Laboratories as fire alarm equipment.

LIST OF SYSTEM ADDRESSES: Provide a list of system addresses for every addressable device.

INPUT OUTPUT MATRIX: Provide descriptions of all system operations.

SHOP DRAWINGS: Fire Alarm Shop Drawings shall comply with the requirements of 907.1.1 of the International Fire Code. Provide drawings that clearly and completely indicate the function of the control panel and devices connected thereto. Indicate termination points of devices and indicate the interconnection of modules required for proper operation of the system and connections to other systems including but not limited to HVAC systems, fire protection systems, fire pump controllers, and elevator controls. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

Equipment Supplier shall submit scaled shop drawings indicating exact routing of raceways, locations of junction boxes and number, size and type of conductors in each raceway for the fire alarm system. The Electrical Contractor shall use the reviewed drawing for rough-in of fire alarm system raceways and outlet boxes.

CALCULATIONS: Provide electrical load calculation for system power supplies, standby power supplies, each alarm notification circuit and standby batteries. Calculations shall verify that battery capacity exceeds supervisory and alarm power requirements. Provide battery calculations and voltage drop calculations with shop drawing submittal. Use NAC terminal voltage at FAC cut-off voltage as provided by manufacturer for voltage drop calculations starting voltage. Provide a table of the total length and cable used for each audible and visual notification circuit.

CERTIFICATION: 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.

OPERATION AND MAINTENANCE MANUAL: Provide two (2) copies, bound securely in durable, hard cover, water-resistant binders. Include instructions for operating and maintaining system components, assemblies, and accessories; include a detailed description of the control panel and system operation under both routine and emergency conditions. Include as-built circuit diagrams

complete with conductor color codes, a parts list by name, model number, and manufacturer, and a listing of smoke detector locations, with the serial number and firing voltage for each. General system descriptions included in manufacturer's catalogs or advertising media will not be acceptable in meeting the operation and maintenance manual requirement.

1-06 RECORD DRAWINGS AND CLOSEOUT DOCUMENTATION:

RECORD DRAWINGS: Redline construction drawings with all changes made during construction and submit to engineer. Provide up-dated shop drawings to reflect changes made during construction and provide hard copies and electronic files to the Owner.

TRAINING: Provide training for operating personnel in the system operation. Minimum instruction period shall be four (4) hours. Evidence of completion of training shall be included with closeout documents.

TESTING PRIOR TO STARTING WORK: See "EXISTING FIRE ALARM SYSTEM TESTING" on E001 for testing requirements prior to start of work.

TESTING UPON COMPLETION OF WORK: See 3-06 of this specification for testing requirements.

1-07 SPARE PARTS:

Spare parts shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, stamping, or tagging. Keys and locks for equipment shall be identical where possible. Furnish the following:

- a. Four keys or tools for resetting manual stations
- b. Four keys for locks of control panels or cabinets
- c. See "SPARE PARTS" list on E001 for additional items required

PART 2 - PRODUCTS

2-01 SYSTEM DESIGN AND OPERATION:

ACCEPTABLE MANUFACTURERS: EST. Equipment to be compatible with existing EST3 fire alarm control panel and equipment. Materials and equipment shall be the standard products of one manufacturer regularly engaged in the production of such equipment and shall be listed by Underwriter's Laboratories (UL). Performance criteria below reflect existing EST3 fire alarm control panel and are included for information purposes.

OPERATOR CONTROL:

- a. Acknowledge Switch:
 1. 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 LCD display to the next alarm or trouble condition.
 2. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
- b. 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 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.

- c. 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.
- d. 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.
- e. Lamp Test: The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

SYSTEM CAPACITY AND GENERAL OPERATION:

- a. The control panel or each network node shall provide, or be capable of, expansion to 636 intelligent/addressable devices.
- b. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
- c. It shall also include four Class B or Class A programmable Notification Appliance Circuits.
- d. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
- e. The system 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 with easy touch rubber keys for the field programming and control of the fire alarm system.
- f. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
- g. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
- h. The FACP or each network node shall provide the following features:
 - 1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
 - 2. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 14.
 - 3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
 - 4. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 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 support sensitive advanced detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
 - 5. The ability to display or print system reports.
 - 6. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
 - 7. PAS presignal, meeting NFPA 72, 23.8.1.2 and 23.8.1.3 requirements.
 - 8. Rapid manual station reporting (under 3 seconds) and shall meet NFPA 72 requirements for activation of notification circuits within 10 seconds of initiating device activation.
 - 9. Periodic detector test, conducted automatically by the software.

10. 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.
 11. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
 12. Walk test, with a check for two detectors set to same address.
 13. Control-by-time for non-fire operations, with holiday schedules.
 14. Day/night automatic adjustment of detector sensitivity.
 15. Device blink control for sleeping areas.
- i. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."
 - j. Network Communication: The FACP shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

CENTRAL MICROPROCESSOR:

- a. 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, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
- b. 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.
- c. 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. A special program check function shall be provided to detect common operator errors.
- e. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
- f. 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, and shall have the ability to upgrade the manufacturers (FLASH) system code changes. 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 compliance with the NFPA 72 requirements for testing after system modification.

SYSTEM DISPLAY:

- a. The system shall support the following display mode options: 80-character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.
- b. The display shall provide all the controls and indicators used by the system operator: The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and

LAMP TEST.

- c. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
- d. The display shall also provide Light-Emitting Diodes: The 80-character display shall provide 12 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, ALARM SILENCED, Controls Active, Pre-Discharge, Discharge and Abort.
- e. The display shall have QWERTY type keypad: The 80-character 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.
- f. The system shall support the display of battery charging current and voltage on the 80-character LCD display.

SIGNALING LINE CIRCUITS (SLC):

- a. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Class A or B wiring.
- b. CPU 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.

SERIAL INTERFACES:

- a. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
- b. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

ENCLOSURES:

- a. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
- b. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
- c. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

POWER SUPPLY:

- a. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
- b. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

- c. 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 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
- d. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
 - 1. Ground Fault LED
 - 2. AC Power Fail LED
 - 3. NAC on LED (4)
- e. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
- f. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
- g. All circuits shall be power-limited, per UL864 requirements.

BATTERIES: The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes-horn system and/or 15 minutes-voice evac system of alarm upon a normal AC power failure. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required. If necessary to meet standby requirements, external battery and charger systems may be used.

AUXILIARY FIELD POWER SUPPLY – ADDRESSABLE:

- a. 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.
- b. 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.
- c. 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.
- d. 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.
- e. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
- f. 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.
- g. 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.
- h. 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.

- i. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
- j. The addressable power supply mounts in either the FACP backbox or its own dedicated surface mounted backbox with cover.
- k. 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.
- l. 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 an 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.
- m. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
- n. 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.
- o. 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.
- p. 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.

FIELD CHARGING POWER SUPPLY (FCPS): The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

- a. 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.
- b. 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 shall be available for connection to the Notification devices.
- c. The FCPS shall include an attractive surface mount backbox.
- d. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.

SPECIFIC SYSTEM OPERATIONS

- a. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window.
- b. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. 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.
- c. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
- d. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - 1. Device status
 - 2. Device type
 - 3. Custom device label
 - 4. View analog detector values

5. Device zone assignments
 6. All program parameters
- e. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
 - f. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. 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. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
 - g. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below 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.
 - h. 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.
 - i. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
 - j. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
 1. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
 2. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
 3. All devices tested in walk test shall be recorded in the history buffer.
 - k. Waterflow Operation: An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
 - l. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
 - m. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.
 - n. Non-Alarm Input Operation: Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.
 - o. Combo Zone: A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

VOICE COMMAND CENTER (VCC):

- a. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. A Message generator shall be capable of automatically distributing up to four (4) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.
 1. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of at least 16 or 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.
 2. The audio portion of the system shall sound the proper audio signal (consisting of tone, voice, or tone and voice) to the appropriate zones.
 3. Notification Appliance Circuits (NAC) speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.
 4. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
 5. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
 6. Speaker circuits shall be either 25 VRMS or 70VRMS.
 7. The voice system shall utilize listed remote amplifiers as required for distribution to all system speakers. Each amplifier shall be sized as required to supply a minimum of 0.5 watts of power for each connected speaker plus 25% spare for future expansion or increased power output requirements. Where speaker tap schedule or drawings requires greater watts per speaker, amplifier shall be sized accordingly for greater output and shall still maintain 25% spare capacity. Amplifiers shall have standby battery backup and shall automatically transfer to standby battery when primary power fails. Provide a minimum of one backup amplifier at each amplifier location. The backup amplifier will automatically be utilized upon failure of a primary amplifier at that location to serve affected speaker paging zones.
- b. The emergency voice alarm communication system shall incorporate a Two-way emergency telephone communication system.
 1. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
 2. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
 3. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.

2-03 COMPONENT DESIGN:

MAIN FIRE ALARM CONTROL PANEL: Existing Main FACP to be reused - EST Model EST3, capable of having voice evacuation added as an option. Provide voice evacuation for EST3 as part of this project. Provide all voice control modules, amplifiers, tone generators, and other system modules necessary to provide an emergency voice/alarm communications system.

FURNISH & INSTALL SYSTEM SMOKE DETECTORS AT ALL FIRE ALARM CONTROL PANEL LOCATIONS, REMOTE FIRE ALARM ANNUNCIATOR LOCATIONS, AND ALL POWER SUPPLY LOCATIONS REGARDLESS OF WHETHER OR NOT THEY ARE SHOWN ON THE DRAWINGS.

The panel shall be UL listed as a test instrument for the measurement of the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors to comply with the testing requirements of NFPA 72.

ALARM SEQUENCE: The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within one minute the system is to resume normal operation. The Alarm Verification is to operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation is to be selectable by device.

ALPHANUMERIC LCD TYPE REMOTE FIRE ALARM ANNUNCIATOR (FAA): Mount with panel top 54 inches above finished floor elevation. Annunciator shall duplicate annunciation functions performed by the main control panel. Fire alarm device descriptions shall correspond to the fire alarm control panel device descriptions. Panel shall be flush mounted. Provide flush mount backbox as required. Field verify the remote annunciator location with the local building official prior to rough-in.

- a. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
- b. The LCD annunciator shall display all alarm and trouble conditions in the system.
- c. An audible indication of alarm shall be integral to the alphanumeric display.
- d. The display shall be UL listed for fire alarm application.
- e. 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.
- f. 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.
- g. 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 keyswitch or password.
- h. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

UNIVERSAL DIGITAL ALARM COMMUNICATOR TRANSMITTER (UDACT): The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station. Furnish and install a digital communicator for transmission of fire alarm signals to a remote monitoring facility via telephone lines. The digital communicator shall conform to UL 864 and NFPA 71 requirements, and shall be UL listed. The communicator shall be capable of transmitting the status of software zones (alarm & trouble), system trouble, panel off-normal, supervisory, bell trouble, low battery, and AC fail, and shall be compatible for use with the Fire Alarm Control Panel. The communicator shall have the capability of supervising two telephone lines, and of seizing the telephone lines and sending an alarm signal on one or both lines without the need for additional equipment. The communicator shall sound a local trouble alarm and transmit a signal to the fire alarm control panel if telephone service is interrupted on either line for more than 45 seconds and simultaneously transmit a signal to both the central monitoring station and the control panel when telephone service is restored. The communicator shall be capable of sending a test signal to the central monitor station every 24 hours at any specific time of day or

night by setting a program within the communicator. Alarm signals to the central monitor station shall indicate which of the communicator transmitter initiating device circuits are in trouble and which are in alarm. Restoration to normal shall also be transmitted to the central monitor station.

- a. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
- b. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
- c. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
- d. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
- e. Communication shall include vital system status such as:
 - Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - Independent Addressable Device Status
 - AC (Mains) Power Loss
 - Low Battery and Earth Fault
 - System Off Normal
 - 12 and 24 Hour Test Signal
 - Abnormal Test Signal (per UL requirements)
 - EIA-485 Communications Failure
 - Phone Line Failure
- f. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

Provide 2-line telephone surge protector for incoming DACT telephone lines. Surge protector shall be DiTek DTK-MRJ31XSCP-RUV, or approved equivalent of Innovative Technology, EPT, MCG Electronics, or APC. Unit shall be listed per UL 497A, rated for 130 volts, 9000 amps, 76 joules, with a 5 nanosecond response time. Unit shall be provided with RJ45 modular plugs.

2-04 NOTIFICATION APPLIANCES

SYNCHRONIZED STROBE VISUAL ALARMS (VOICE SYSTEMS): UL Listed to Standard 1971 and tested for 75 candela on-axis. Semi-flush mounted. Lamps shall be synchronized flashing Xenon type with field selectable 15/30/75/110 candela effective intensity and a flash rate of 1 Hz, and shall be protected by a clear plastic lens. The housing shall be finished in textured white plastic with no verbiage on the housing. Provide flush-mount backboxes as required. Strobe setting to be as indicated on the drawings.

SYNCHRONIZED SPEAKER-STROBE ALARMS (VOICE SYSTEMS): UL Listed to Standard 1971 and tested for 75 candela on-axis. Speaker notification appliances shall be listed to UL 1480. Semi-flush wall or ceiling mounted combination speaker-strobe assembly suitable for use on an electrically supervised circuit. Lamps shall be synchronized flashing Xenon type with field selectable 15/30/75/110 candela effective intensity and a flash rate of 1 Hz, and shall be protected by a clear plastic lens. The housing shall be finished in textured white plastic with no verbiage on the housing. Provide flush-mount backboxes as required. Strobe setting to be as indicated on the

drawings. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12 kHz for General Signaling. The speaker installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension. Provide remote amplifiers as required.

SPEAKER ALARMS (VOICE SYSTEMS): Speaker notification appliances shall be listed to UL 1480. Semi-flush wall or ceiling mounted speaker assembly suitable for use on an electrically supervised circuit. The housing shall be finished in textured white plastic with no verbiage on the housing. Provide flush-mount backboxes as required. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12 kHz for General Signaling. The speaker installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension. Provide remote amplifiers as required.

SYNCHRONIZATION CONTROL MODULES (SCM): Provide SCM's as required to synchronize all strobes and horns on each notification appliance circuit. Furnish, install, and wire the SCM's per the manufacturer's recommendations.

SPARE CAPACITY: All Notification Appliance Circuits shall be designed with a minimum of 25% spare capacity to allow for future devices.

Furnish & install wire guards for all fire alarm devices located in the gymnasium and where noted on the drawings.

2-05 INITIATING DEVICES

There shall be no limit to the number of detectors, stations, or modules that may be activated or "in alarm" simultaneously. Detectors shown connected to magnetic door holders or other similar devices shall be furnished with 120V auxiliary SPDT contacts for release of the devices when the detectors are actuated. Detectors shall be suitable for operation on 24V DC power.

INTELLIGENT MANUAL STATIONS: Provide noncoded type with mechanical reset features. Stations shall be semiflush mounted with the base at 48 inches above the finished floor to the top. The manual stations shall be addressable and identifiable by the master fire alarm control panel. Address assignments shall be set electronically and reside within the station in non-volatile memory. Addressable pull stations shall contain electronics that communicate the station's status (alarm or normal) to the control panel over two wires that also provide power to the pull station. The stations will be manufactured from high impact red Lexan. Lettering will be raised and painted white. The station will mechanically latch upon operation and remain so until manually reset by opening with a key. Pull stations shall be dual action. The front of the station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The addressable manual station shall be capable of field programming of its "address" location on an addressable signaling line circuit. Stations indicated as weatherproof shall be installed in cast metal, weatherproof housings with side-hinged access doors.

INTELLIGENT PHOTOELECTRIC TYPE SMOKE DETECTORS: UL 268A. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible particles or smoke densities that are below the factory

set point. No radioactive material shall be used. The 24VDC intelligent analog detector shall communicate actual smoke chamber values to the system control.

INTELLIGENT PHOTOELECTRIC TYPE DUCT SMOKE DETECTORS: UL 268A. Detectors in ducts shall comply with UL requirements for sensing of products of combustion in air handling/duct systems for each air handler. Provide power on LED and relay for AHU shut down. The relay must be capable of being logically controlled independent of the detector head. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible particles or smoke densities that are below the factory set point. No radioactive material shall be used. The 24VDC intelligent analog duct detector shall communicate actual smoke chamber values to the system control. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover. Provide a remote indicator with integrated key-activated remote test station for each duct smoke detector.

Duct Detectors shall be furnished by the Fire Alarm System Contractor, installed by the HVAC Contractor. Wiring for the Fire Alarm System shall be furnished and installed by the Fire Alarm System Contractor. Keyed Test Station and Alarm Light to be furnished and installed by the Fire Alarm System Contractor. Wiring for HVAC control/shutdown shall be furnished and installed by the Mechanical Contractor. Coordinate in field prior to rough-in as required. Refer to manufacturer's installation instructions prior to installing duct smoke detectors and coordinate the location of each duct detector with the Mechanical Contractor prior to rough-in to ensure compliance with the manufacturer's requirements. See fire alarm notes for location and testing of duct mounted smoke detectors.

INTELLIGENT HEAT DETECTORS: UL 521.

- a. Combination Rate of Rise Type: Detector shall be semi-flush mounted intelligent addressable device 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. No detector shall be located closer than 12" to any part of any light fixture. Detector shall be automatically restorable and shall have tamper resistant design. Provide a separate mounting base with terminal screws for all wiring connections. Base shall be capable of mounting on standard 4" square back box for flush mounting or special box for surface mounting. Detector shall be polled and shall report "Normal", "Alarm", or "Trouble" condition to the control panel. A detector disconnected from the based shall indicate a "Trouble" condition. Detector shall utilize an LED that blinks when device is polled and glows steady when device is in alarm.
- b. Fixed Temperature Type: Detector shall be semi-flush mounted intelligent addressable device rated at 135 degrees Fahrenheit (58 degrees Celsius) for standard and 190 degrees Fahrenheit (88 degrees Celsius) for high temperature. No detector shall be located closer than 12" to any part of any light fixture. Detector shall be automatically restorable and shall have tamper resistant design. Provide a separate mounting base with terminal screws for all wiring connections. Base shall be capable of mounting on standard 4" square back box for flush mounting or special box for surface mounting. Detector shall be polled and shall report "Normal", "Alarm", or "Trouble" condition to the control panel. A detector disconnected from the based shall indicate a "Trouble" condition. Detector shall utilize an LED that blinks when device is polled and glows steady when device is in alarm.

MAGNETIC DOOR HOLDERS: Low profile, concealed wiring type, 24VDC/120VAC. Tie in to smoke detectors as indicated on the drawings. Provide one addressable output module per door holder. Provide extension arms where required for proper door holder function.

INTELLIGENT MONITORING MODULES: Monitoring Modules (MMs) shall be used for monitoring systems including but not limited to: waterflow, valve tamper, Halon/Clean Agent Control Panels, fire pump controllers, kitchen hood fire suppression systems, and non-addressable detectors. . Modules shall be capable of mounting in a standard electric outlet box and shall include cover plates to allow surface or flush mounting. Each Module shall be supervised and uniquely identified

by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions. Should a Module become non-operational, tampered with, or removed, a discrete trouble signal, unique to the device, shall be transmitted to, and annunciated at, the control panel. Modules shall be capable of being programmed for "address" location on the addressable device signaling line circuit, and shall be compatible with addressable manual stations and addressable detectors on the same addressable circuits. Modules shall be cable of field assignable personality codes based upon monitoring point type.

INTELLIGENT CONTROL MODULES: Control Modules (CMs) shall be used for controlling systems including but not limited to AHU systems, elevator controllers, smoke damper controls and electrically operated door controls. Modules shall be capable of mounting in a standard electric outlet box and shall include cover plates to allow surface or flush mounting. CMs shall receive their 24VDC power from a separate two wire pair running from an appropriate power supply. Each Module shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions. Should a Module become non-operational, tampered with, or removed, a discrete trouble signal, unique to the device, shall be transmitted to, and annunciated at, the control panel. Modules shall be capable of being programmed for "address" location on the addressable device signaling line circuit, and shall be compatible with addressable manual stations and addressable detectors on the same addressable circuits. Control modules shall contain form "C" contacts rated at 2A, 24VDC and 0.5A, 120VAC. Where the device being controlled requires higher contact current ratings, provide heavy duty relays with proper contact ratings slaved from an output module on a supervised control circuit. Coordinate with controlled device for contact voltage and current ratings.

2-06 WIRE

WIRING: Furnish and install in accordance with NFPA 70 and NFPA 72. 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. Conductors for 120-volt circuits shall be No. 12 AWG minimum. 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. Identify conductors within each enclosure where a tap, splice, or termination is made. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Wire the alarm initiating and notification signal devices so that removal will cause the system trouble device to sound. Pigtail or "T" tap connections to evacuation alarm bells, horns, and fire warning lights are not acceptable. Each conductor used for the same specific function shall be distinctively color coded. Each circuit color code wire shall remain uniform throughout circuit.

- a. All fire alarm system wiring shall be new (verify all fire alarm system wiring requirements with the equipment manufacturer prior to starting work). Conductors shall be copper.
- b. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
- c. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
- d. All field wiring shall be electrically supervised for open circuit and ground fault.
- e. The fire alarm control panel shall be capable of t-tapping Class B Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

Wiring types will be approved by the equipment manufacturer. The system must allow up to 2,500 feet wire length to the furthest addressable device. Class A communications will be provided where shown on the drawings. Wire and conduit will be routed to maintain sufficient distance between the

forward and return loop as called for by the authority having jurisdiction. Class B communications will be provided where shown on the drawings.

Where NFPA 72 requires a pathway survivability of 2 or greater for fire alarm, the use of fire resistive cables listed for the application is acceptable. Other listed systems for pathway survivability may be used only after approval from the AHJ and engineer.

Use solid conductors with 600V Type THHN-THWN-MTW insulation for systems operating at 120V, and 300V Type TF insulation for systems operating at low voltage (24V or less). Stranded wire may be used if Sta-Con connectors are used at all screw terminals.

2-07 RACEWAYS

Galvanized rigid conduit (GRC) or Intermediate grade metallic conduit (IMC) with screwed fittings, or Electrical metallic tubing (EMT) with compression type fittings or all-steel set screw fittings. See Section 260500, Basic Materials and Methods.

All circuits shall be in metal conduit, unless noted otherwise. All raceways shall be run concealed in walls or ceilings in EMT, GRC, or IMC, unless noted otherwise. Where surface raceway is required and is approved in writing by the Architect and the Owner, use Wiremold ivory surface metal raceway with red surface metal boxes compatible with fire alarm devices, except that EMT with steel boxes may be used in storage rooms, etc. requiring surface raceway. No high voltage wiring will be permitted in the same raceway or electrical box with any wiring of the fire alarm system except where there is a direct interface such as programmable relay controlling an external device. Where this occurs, the box must be clearly marked to indicate the presence of high voltage.

2-08 PATHWAY SURVIVABILITY

Refer to NFPA 72 for pathway survivability requirements of each alarm and communication circuit for the fire alarm system and area of refuge system. Provide rated cable or other system approved by the AHJ and the engineer to achieve pathway survivability ratings.

PART 3 - INSTALLATION

3-01 WORKMANSHIP

All work shall be installed in a neat and orderly manner. Devices, cabinets, covers, fixtures, exposed raceways, etc., shall be aligned parallel or perpendicular to the building walls, ceiling and floor. Wiring in panelboards and cabinets shall be neatly looped and laced, and not wadded. The Owner reserves the right to require repair or replacement of defective workmanship and material without additional compensation to the Contractor.

3-02 SUPPORTS

Conduits, boxes, cabinets, enclosures, etc., shall be securely supported by structural members or structural walls at intervals required by the NEC or as recommended by the manufacturer. Plaster, gypsum board, acoustical tile, and other ceiling and wall finish material shall not be used for support.

3-03 MANUFACTURER'S REPRESENTATIVE

The services of a qualified manufacturer's representative or technician, experienced in the installation, operation, testing, and servicing of the type of system being installed, shall supervise the installation, connecting, software documentation, testing, and adjusting of the system, and train

the Owner's personnel in operation of the system. Certified test reports of the final satisfactory test shall be submitted to the Architect-Engineer.

3-04 CONDUIT AND WIRING

See Section 260500, Basic Materials and Methods. All wiring shall be run in EMT, GRC, or IMC conduit. All junction box covers shall be spray painted red and labeled "Fire Alarm". Conduit used for Fire Alarm System wiring shall be red, similar to Allied Fire Alarm EMT. Conductors shall be color coded as follows:

Red/Black	Indicating Circuits (Horns/lights)
Blue/Yellow	Manual Initiating Circuits (Different zones shall be numbered)
Brown/Orange	Automatic Initiating Circuits (Different zones shall be numbered)
White/Green	Do Not Use

Splice/extend/reroute existing conduit and wiring for existing initiating devices being reused as required to maintain proper operation of these devices and the initiating circuit they are wired to.

3-05 INITIATING AND INDICATING DEVICES

Initiating and indicating devices shall be SECURELY installed as indicated on the drawings and connected in accordance with the applicable wiring diagrams. The contractor shall clean all dirt and debris from the inside and outside of the fire alarm equipment after completion of the installation. The smoke detection devices shall be covered with plastic bags or hard covers in accordance with the manufacturer's recommendations after installation to maintain cleanliness. The bags/covers shall be red for quick visual identification for removal at time of occupancy.

PIV MONITORING: Furnish & install all conduit, wiring, monitoring modules, programming, etc. necessary to monitor Post Indicator Valves (PIVs), coordinate location with civil drawings, reviewed sprinkler shop drawings, and sprinkler contractor. For existing projects where there is no sprinkler contractor, provide necessary tamper switch(es) for existing PIVs.

3-06 TESTS

Upon completion of work, the entire system shall be completely operational and tested for conformance with these specifications and drawings, and reviewed by the Architect-Engineer. Test shall be performed in accordance with the fire alarm system manufacturer's instructions and per NFPA 72 requirements. All defects in workmanship and material shall be immediately corrected without additional compensation to the Contractor.

SMOKE DETECTOR TESTS: Prior to formal review and tests, clean and perform operational test on each smoke detector. Clean the smoke detectors in accordance with the manufacturers recommended procedures.

DUCT MOUNTED SMOKE DETECTOR TESTS: Prior to formal review and tests, clean and perform operational test on each smoke detector. Clean the smoke detectors in accordance with the manufacturers recommended procedures. Provide documentation of duct detector testing per NFPA 72 Table 14.4.2.2-14(g)(6). Air duct detectors shall be tested or inspected to ensure that the device will sample the airstream. The test shall be made in accordance with the manufacturer's published instructions.

FIELD REVIEW AND TEST: Before final acceptance of the work, test each system to demonstrate compliance with the contract requirement. Each system shall be subjected to complete functional and operational tests including tests in place of each heat and smoke detector (smoke testing

aerosols containing oil are NOT acceptable). When tests have been completed and corrections made, submit a signed and dated certificate with a request for formal review and tests.

FORMAL REVIEW AND TEST: The Engineer will witness formal tests after receipt of written certification that preliminary tests have been completed and that the system is ready for final review. The system manufacturer's technical representative shall be present for the final review and test. Preliminary tests shall be repeated and functional and operational tests conducted, as requested by the Engineer. Correct defects and conduct additional tests to demonstrate that the system conforms to contract specifications.

RECORD OF COMPLETION: Complete and submit the NFPA-72 Record of Completion form.

3-07 INSTRUCTION

Instruction shall be provided 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.

The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3-08 RECORD OF SYSTEM PROGRAMMING

Provide to the owner a printout of the system programming and DVD disk containing a copy of the program. DVD shall contain all manufacturer software necessary for system maintenance and/or adds and deletes of devices/equipment.

3-09 CLEAN-UP

Upon completion of all installations and prior to final acceptance by the Owner, all debris shall be removed from the site. Cabinets, enclosures, cover plates, etc., shall be cleaned and paint touched up.

END OF SECTION 283100