

**SECTION 28 31 02****SMOKE DETECTION SYSTEM****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of contract, including General and Supplementary conditions, apply to work of this section.
- B. Division 26, Basic Electrical Materials & Methods apply to work specified in this section.
- C. Division 26 "Electrical Identification" apply to work in this section for labeling of conduit and equipment.
- D. Related work specified in other divisions of these specifications.
  - 1. Installation of duct type smoke detectors.
  - 2. Control wiring from Fire Sprinkler and Smoke Control equipment to mechanical fans, dampers, control equipment both low voltage and line voltage and all other control wiring associated with mechanical equipment.
- E. Secure permits and approvals prior to installation.
- F. Prior to commencement and after completion of work notify Authorities Having Jurisdiction.
- G. Submit letter of approval for installation before requesting acceptance of system.

**1.2 SUMMARY**

- A. Provide a complete and coordinated Class A wiring, fire management system in accordance with the contract documents.
- B. Any fire alarm devices, wiring etc., not indicated on the drawings, but required by the Authority Having Jurisdiction and Fire Department, shall be provided as part of this specification. As minimum, an additional 5 smoke detectors, and 5 addressable interface devices shall be included in price including labor.

**1.3 RELATED WORK**

- A. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the alarm system shall include, but not be limited to:
  - 1. Duct smoke detectors shall be furnished, wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors.
  - 2. Conduit: Section 26 05 33.
  - 3. Wire and Cables: Section 26 05 19.

4. Installing dedicated outgoing RJ-31X telephone lines (2) shall be the responsibility of the Installing Electrical Contractor. Establishment of central station monitoring account shall be the responsibility of the fire alarm equipment vendor. Central station subscription information shall be provided by the customer.

#### 1.4 SUBMITTALS

- A. Procedure - prepare and make submittals listed in accordance with General Conditions, "Submittals" as required by Local Department of Fire.
- B. Provide list of all types of equipment and components provided. This shall be incorporated as part of a Table of Contents, which will also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product datasheet on which the information can be found.
- C. Provide description of operation of the system (Sequence of Operation), similar to that provided in Part 2 of this Section of the Specifications, to include any and all exceptions, variances or substitutions listed at the time of bid. Any such exceptions, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. The sequence of operation shall be project specific, and shall provide individual sequences for every type of alarm, supervisory, or trouble condition that may occur as part of normal or off-normal system use.
- D. Product Data - submit manufacturer's specifications, recommendations, and installation instruction for use intended. The data shall include but is not limited to the following:
  1. Control panel
  2. Cabinets
  3. Fuse cut out panels
  4. Manual Stations
  5. Batteries
  6. Battery charger
  7. Smoke sensors
  8. Installer's training history
  9. Audio alarms
  10. Addressable interface devices
  11. Central processing unit
  12. Wiring conductors
  13. Wire connectors
  14. Thermal sensors
  15. Electromagnetic door hold-open devices
  16. Remote alpha numeric LCD annunciators with control capabilities.
  17. Manufacturer's recommended calibrated test method for smoke sensors and smoke detectors.
  18. Include Underwriters Laboratories or Factory Mutual listing cards for equipment provided.
- E. Provide manufacturer's printed product data, catalog cuts and description of any special installation procedures. Poorly photocopied and/or illegible product data sheets shall not be acceptable and shall be rejected. All product datasheets shall be highlighted or stamped with arrows to indicate the specific components being submitted for approval.

- F. Provide manufacturer's operator's instruction manual for specified system.
- G. Provide samples of various items when requested.
- H. Provide copy of New York State License to perform such work.
- I. Provide copies of NICET Level II Fire Alarm certifications for the two (2) technicians assigned to this project.
- J. Drawings
  - 1. Detailed drawings for the sprinkler and fire detection system shall consist of illustrations, schedules, performance charts, battery calculations, point lists, instructions, diagrams, sequence of operation, and complete detailed drawings of the fire alarm system.
  - 2. A descriptive index of drawings in the submittal with drawings listed in sequence by drawing number.
  - 3. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.
  - 4. Floor plans drawn to a scale not less than 1/8-inch equals 1 foot which clearly show locations of devices, equipment, risers, panels, electrical power connections, approximate location of conduit runs, and other details required to clearly describe the proposed system.
  - 5. Location of control panels, detectors, supervisory switches, manual pull stations, audible alarms and electrical devices. Clearly and completely indicate the function of the control panel and devices. Indicate conduit routing and sizes, and the number of conductors contained in each. Indicate points of connection and terminals used for electrical field connections in the system, with a wiring color code. Indicate termination points of devices and indicate the interconnection of modules required for proper operation of the system. Indicate interconnection between modules and devices. Control diagrams shall be supplemented with a narrative description of the system. Point-to-point wiring diagrams shall indicate control panel wiring and make and model of devices and equipment. Signal circuit diagrams shall show current draw and load by device and by circuit.
  - 6. Device riser diagram shall individually depict all control panels, annunciators, addressable devices, and notification appliances. Riser diagrams shall include a specific, proposed point descriptor above each addressable device. Riser diagrams shall include a specific, discrete point address that shall correspond to addresses depicted on the device layout floor plans. Drawing shall provide wire specifications, and wire tags shown on all conductors depicted on the riser diagram. All circuits shall have designations that shall correspond with those require on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
  - 7. Device typical wiring diagram drawing(s) shall be provided which depict all system components, and their respective field wiring termination points. Wire type, gauge, and jacket shall also be indicated. When an addressable module is used in multiple configurations for monitoring or controlling various types of equipment, different device typical diagrams shall be provided. End-of-line resistors (and values) shall be depicted.
- K. Design Data
  - 1. Battery standby power requirements calculations.

2. Battery calculations shall be provided on a per power supply/charger basis. These calculations shall clearly indicate the quantity of devices, the device part numbers, the supervisory current draw, the alarm current draw, totals for all categories, and the calculated battery requirements. Battery calculations shall also reflect all control panel component, remote annunciator, and auxiliary relay current draws. Failure to provide these calculations shall be grounds for the complete rejection of the submittal package.

**L. Field Test Reports**

1. Preliminary and acceptance tests.
2. Include the control panel and initiating and indicating devices, a unique identifier for each device with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information.

**M. Records Drawings**

1. Upon completion, and before final acceptance of the work, submit a complete set of CAD generated as-built drawings for the fire alarm system, including components and any other associated appurtenances. Include as-built circuit diagrams complete with conductor color codes and a listing of initiating device locations and fixing voltage for each. Submit a minimum ten of 11 x 17 inch reproducible as-built drawings with title block similar to contractor drawings, and provide CAD diskettes of entire project. Submit as-built drawings in addition to the record drawings required by General Conditions, "Operation and Maintenance Data".
2. List of SACP alphanumeric address names
3. Request for formal inspection and tests
4. When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests.

**N. Operation and Maintenance Manuals**

1. Smoke alarm control panel
2. Smoke and thermal sensors
3. Interface and control modules
4. Submit in accordance with General Conditions, "Operation and Maintenance Data". Include current unit prices and source of supply for parts list, and a list of parts recommended by the manufacturer to be replaced after one year and three years of service. Include in the fire alarm control panel, full and comprehensive manufacturer's repair and service manuals.

- O.** See section 3.3 F. Documentation and Training for other documents related to this section.

**1.5 QUALITY ASSURANCE**

- A.** Qualifications the manufacturer's authorized distributor must substantiate that within a 50 mile radius of the job site, there is an established agency which stocks a full complement of parts and offers full service during normal working hours on all equipment to be furnished and that the agency will supply parts without delay and at a reasonable cost.

1. Verify operation of all manual pull stations and detectors.
  2. Verify line supervision of each initiating and indicating circuit.
  3. Verify the Class A operation of each initiating circuit.
  4. Verify operation of all indicating devices.
  5. Verify operation of all alarm initiated function.
  6. Perform smoke test(s) as directed by the Local Fire Department. Provide electricians, and factory representatives to perform as many tests as required to approve system. The Engineer, City of New York and Architect shall be advised a minimum of five working days before each test.
- G. All equipment provided as part of this section shall be the product of a single fire alarm equipment manufacturer.
- H. Equipment and devices shall be from a manufacturer who has been manufacturing similar products for a minimum of 3 years. Furnish materials and equipment that are current products of one manufacturer regularly engaged in the production of such equipment.
- I. Regulatory Requirements
1. Devices and equipment for fire alarm service shall be listed by Underwriters Laboratories, Inc. and listed in UL FPKD or approved by Factory Mutual and listed in FM P7825. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement.
- J. Requirements for Fire Protection Service
1. Equipment and material shall have been tested by Underwriters Laboratories, Inc. and listed in UL FPKD or approved by Factory Mutual and listed in FM P7825. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement.
- K. Standard Products
1. Materials and equipment shall be standard new products of a manufacturer regularly engaged in the manufacturer of such products. Select material from one manufacturer, and not a combination of manufacturers, for any particular classification of materials.
- L. Modification of References
1. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction".
- 1.6 DELIVERY, STORAGE AND HANDLING**
- A. Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt and dust, and other contaminants.
- 1.7 SPARE PARTS**
- A. Spare parts shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate,

- B. Qualifications of Installer: Prior to installation, submit data for approval showing that the Contractor has successfully installed addressable, analog intelligent interior fire alarm systems of the same type as specified herein, or that the Contractor has a firm contractual agreement with a subcontractor having such required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months. Submit names and phone numbers of points of contact at each site.
- C. Codes and Standards: Except as modified by governing codes and where more stringent standards are specified by the contract documents, comply with the latest applicable provisions and the latest recommendations of the following:
1. All equipment shall be UL listed for its intended use.
  2. National Electric Code, Article 760.
  3. National Fire Protection Association Standards: NFPA72 and NFPA 101.
  4. Local and State Building Codes and the Local Authorities Having Jurisdiction.
  5. MEA / BSA
  6. Underwriters Laboratories Inc.: The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
    - UL 864/UOJZ, APOU Control Units for Fire Protective Signaling Systems.
    - UL 268 Smoke Detectors for Fire Protective Signaling Systems.
    - UL 268A Smoke Detectors for Duct Applications.
    - UL 217 Smoke Detectors Single Station.
    - UL 521 Heat Detectors for Fire Protective Signaling Systems.
    - UL 228 Door Holders for Fire Protective Signaling Systems.
    - UL 464 Audible Signaling Appliances.
    - UL 38 Manually Activated Signaling Boxes.
    - UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
    - UL 1971 Standard for Signaling Devices for the Hearing Impaired
    - UL 1481 Power Supplies for Fire Protective Signaling Systems.
    - UL 1711 Amplifiers for Fire Protective Signaling Systems.
  7. Americans with Disabilities Act (ADA)
  8. International Standards Organization (ISO): ISO-9001
  9. The latest provisions of and amendments to Local Law No. 5, Local Law No. 16 Local Law No. 58, and Fire Alarm Code of the City of New York.
  10. The requirements of the City of New York Building Department and the City of New York Fire Department.
  11. New York City Electrical Code, latest edition.
- D. Federal Specifications Compliance: Comply with FED-STD-595, "Colors used in Government Procurement".
- E. Warranty - all components, parts and assemblies supplied by the manufacturer shall be warranted against defects in materials and workmanship for a period of 12 months upon acceptance. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully-staffed branch office located within 50 miles from the job site.
- F. Testing - conduct a total system test for Commissioner and Local Fire Department. Tests shall include as a minimum.

stamping or tagging. Furnish the following:

1. Four keys or tools for resetting manual systems.
2. Four keys for locks of control panels or cabinets.
3. Three (bases and heads) of each type smoke (area and duct) and thermal sensors.
4. Three of each type monitor module.
5. Three of each type control module.
6. Three fuses of each type provided. Spare fuses shall be mounted in the fuse holder located inside each control panel.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESIGN**

#### **A. Acceptable Manufacturers:**

1. All products used shall be of a single manufacturer. Submission of notification appliances, auxiliary relays, or documentation from other than a single manufacturer shall not be acceptable and will be grounds for immediate disapproval without comment.
2. The Smoke Detection System supplied under this specification shall be a microprocessor-based. All Control Panel Assemblies and connected Field Appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as compatible to ensure that a fully functioning Life Safety System is designed and installed.

#### **B. Scope:**

1. The work covered by this Section of the Specification shall include all labor, equipment, materials and services to furnish and install a complete addressable sprinkler and smoke detection system. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer.
2. The system shall consist of, but not be limited to, the following:
  - a. Smoke Detection System.
  - b. Remote Annunciators if the control panel is not located in the building lobby. See project plans.
  - c. Addressable analog area smoke detectors.
  - d. Provide MEA approved 24 Vdc CO detector that is powered (24 Vdc) and monitored (addressable monitor module) by the smoke detection system. CO detectors shall include a relay output for monitoring and the smoke detection system shall send a CO (supervisory) signal to the central station monitoring system.
  - e. Addressable analog Photo-electric duct smoke detectors for supply and return fans over 2,000 cfm.
  - f. Addressable analog heat detectors.
  - g. Central station alarm connection control.
  - h. Air handling systems shutdown control.
  - i. Magnetic door holder release.
  - j. Battery standby.
3. Each item of the Smoke Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by the Underwriters'

- Laboratories, Inc. (UL), and shall bear the "U.L." label. The Control Equipment for all Systems shall be listed under UL category UOJZ as a Single Control Unit.
4. The complete installation shall conform to the applicable sections of NFPA-72, NEC 76, Life Safety Code 101, and Local authorities having jurisdiction.
  5. Nodes as defined for this specification shall be intelligent, microprocessor based devices that connect to, and handle network communications.
  6. By programmable selection at each node:
    - a. The specific detail information of any point connected to any node in the network may be made accessible (declared public) to the network.
    - b. Points within each node shall be able to be grouped by area, type of device, type of function, or any other user selectable category, and custom labeled as a point list. A point list shall be acted upon as though it was a point for purposes of interaction with the node custom control program. Detail information shall not burden the point list messages, only the quantity and type of status shall be broadcast into the network.
  7. The smoke alarm system shall be provided with the primary monitoring host computer system for alarms, trouble, and supervisory indication located as shown on the construction documents. This host shall be U.L. listed for use with the fire alarm system. The host system shall be connected to the fire alarm control panels utilizing an RS-485, BacNet Level II, or equivalent network protocol on a twisted pair communication bus network.
  8. Survivability: When wiring connecting the FSCS to any remote mounted controlling device exceeds 100 feet; the wire shall be 2-hour rated in addition to being in conduit.
  9. ALL NYC required Smoke Detection system peripherals, placards, riser diagram, etc. shall be included in the system price.

#### C. Alarm System

1. Furnish and install a fully field programmable/addressable analog fire detection system. The System shall determine the number and types of modules installed, the number of analog addressable loops, and all installed devices. It shall determine the type of device and the device number. The System shall use Style 4 (Class A) signaling line circuits and Style Z (Class A) indicating appliance circuits with individual device supervision and annunciation, primary and secondary supervision, and interfaces to the public address system (furnished by others). Include control panels, central processing unit, microphone, signal zone selectors, smoke sensors, thermal sensors, addressable input interface devices, control and isolation devices, analog/addressable loop modules, audio devices, devices, wiring, connections to devices, outlet boxes, junction boxes, and other necessary material for a complete operating system. System shall allow for loading or editing special instructions and operation sequences as required. System shall be site programmable to accommodate and facilitate expansion or changes. System shall be capable of generating the programming necessary to establish a fully functional general alarm system upon initialization. Software operations are to be stored in a non-volatile programmable memory. Loss of primary and secondary power shall not erase the instructions stored in memory. Selective input/output control functions based on ANDing, Oring, NOTing, timing and special coded operations shall be incorporated in the resident software programming of the system.



## D. Job Site Changes

1. To accommodate and facilitate job site changes, initiating and indicating circuits shall be individually configurable on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or an alarm verification circuit.

## E. Operations

1. Display
  - a. Under normal condition, front panel shall display a "SYSTEM NORMAL" or equivalent message and the current time and date.
2. Sequence of Operation
  - a. The system shall identify any off normal condition and log each condition into the system database as an event.
    - (1) The system shall automatically display on the control panel Liquid Crystal Display the first event of the highest priority by type. The priorities and types shall be alarm, supervisory, trouble, and monitor.
    - (2) The system shall have a Queue operation, and shall not require event acknowledgment by the system operator. The system shall have a labeled color coded indicator for each type of event; alarm - red, supervisory - yellow, trouble - yellow, monitor - yellow. When an unseen event exists for a given type, the indicator shall be lit.
    - (3) For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred and up to a 40 character custom user description.
    - (4) The user shall be able to review each event by simply selecting scrolling keys (up-down) for each event type.
  - b. Alarm activation of any area smoke detect/sensor, duct smoke detect/sensor, shall automatically
    - (1) Update the control/display as described above (a.(1))
    - (2) Sound a pulsing audible signal and flash the general alarm LED indicator at the control panel. Pressing the alarm acknowledge key on the SACP shall silence the audible signal and continuously light the LED, during the alarm condition. Subsequent alarm conditions shall resound the audible signal and again flash the LED. Each alarm condition must be individually acknowledged.
    - (3) Display a general alarm indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the SACP alphanumeric, liquid crystal display (LCD). The LCD Display shall automatically display the device/circuit type and the custom 40-character message without any operator intervention.
    - (4) Enter the custom label for the device or circuit reporting the alarm condition with the time and date of alarm activation into the SACP historical alarm log for future recall/review.
    - (5) Sound an audible signal at the remote annunciator panel. The audible signal may be silenced during the alarm condition. Subsequent alarm conditions shall resound the audible signal.
    - (6) Visually annunciate the alarm initiating device via an individual or "group" alarm indicator.
    - (7) Display a general alarm indication and system status summary (numbers of alarm, supervisory and /or trouble conditions) on the remote annunciator panels(s) alphanumeric, liquid crystal display

- (LED). The LCD shall automatically display the device type and custom 40-character display without operator intervention.
- (8) Operate control relay contacts to shutdown all air handling systems that serve the building and close any smoke dampers related to those systems. Air handling systems shall not be permitted to restart to normal operation from the simple operation of the system reset switch. A separate air handling systems restart switch shall be provided on the SACP to permit air handling systems to be restarted after the alarm system has been reset to normal.
  - (9) Operate control relay contact to initiate the transmission of an alarm indication by type of alarm condition (smoke/heat alarm) to a central station agency via telephone lines. Selection of a central station agency, its equipment, its fees and fees for telephone line usage are the responsibility of the City of New York or his representative.
  - c. The entire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens, grounds or disarrangement of wiring and shorts across alarm signaling wiring shall automatically:
    - (1) Update the control/display as described above (a.(1))
    - (2) Transmit a trouble condition, via the integral central station communicator, to central station/Local Fire Department.
    - (3) Visually and audibly annunciate a general trouble condition, on the remote annunciator panels. The visual indication shall remain on until the trouble condition is repaired.

F. Primary Power

- 1. Provide normal power as per fire alarm detail on drawings.

G. Auxiliary Power (Secondary Power)

- 1. Provide for system operation in the event of normal power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.
  - a. Batteries
 

Provide rechargeable lead acid type with sufficient ampere-hour rating to operate the system under supervisory and trouble conditions, including audible trouble signal devices for 24 hours and audible and visual signal devices under alarm conditions for an additional 5 minutes. House batteries either within the control panel or in a separate substantial steel cabinet, and finish on inside and outside with enamel paint; equip with a non corrosive base and cylinder lock keyed to match SACP. Separate cells to prevent contact between terminals of adjacent cells and between terminals and other metal parts. Locate cabinet to allow convenient viewing and servicing of the batteries. A separate cabinet shall have twice the volume of batteries it will contain. The battery cabinet, if provided, shall be identified SMOKE ALARM SYSTEM BATTERY CABINET with a red and white engraved plastic sign permanently affixed to the face of the panel.
  - b. Battery Charger
 

Provide solid state automatic float type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less. Locate

charger within the control panel or within the battery cabinet. Provide voltmeter and ammeter to indicate battery voltage and charging current.

#### H. Wiring

1. Each addressable analog loop shall be circuited so device loading is not to exceed 80% of loop capacity in order to leave for space for future devices. The loop shall have Class B operation.
2. Where it is necessary to interface conventional initiating devices provide intelligent input modules to supervise Class A.
3. Each of the following types of alarm notification appliances shall be circuited as shown on the drawings but shall be typically as follows:
  - a. Smoke alarm bell (at control panel): Provide one (1) alarm bell circuit
  - b. System trouble bell (at control panel): Provide one (1) trouble bell circuit
4. Each of the following types of remote equipment associated with the alarm system shall be provided with a form 'C' control relay contact as shown on the drawings, but shall be typically as follows:
  - a. HVAC Fan Systems: Provide one (1) shutdown control relay contact for each HVAC fan system.
  - b. HVAC Supply Fans: Provide one (1) shutdown control relay contact for each HVAC supply fan.
  - c. HVAC Return Fans: Provide one (1) shutdown control relay contact for each HVAC return fan.
5. Provide a dedicated 24VDC circuit to feed all auxiliary relays required for inductive loads. Circuits shall be supervised via an end-of-line relay and addressable input module. Auxiliary relays shall not derive their power from the starter or load being controlled.
6. Each control or data gathering panel shall have a dedicated 20Amp-120VAC feed. An appropriate disconnect switch shall be included, wired as indicated in the Building Code for the City of NY.

## 2.2 UL LISTED AND APPROVED EQUIPMENT

#### A. Control Panel Requirements:

1. The control panel or panels and all system devices (pull stations, smoke and heat detectors, etc. shall be by one manufacture and all under one label "**UL listed and approved**" for the use of fire alarm systems in this area of the United States of America. The operating controls shall be located behind locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified.

#### B. System Controllers:

1. The main controller shall be supervised, site programmable, and of modular design supporting up to 96 detectors and 94 remote modules, and two Notification Appliance Circuits (NACs). Additional support for expansion modules will add up 96 detectors and 94 modules including two additional NAC circuits. NAC's shall be convertible to power risers to serve remote multiple NAC modules for zoned signal applications. The system shall support up to five controllers connected together in a peer-to-peer topology. The cabinet shall be steel with a red finish.

- C. The system shall store all basic system functionality and job specific data in non-volatile memory. All site specific and operating data shall survive a complete power failure intact. Passwords shall protect any changes to system operations.
- D. The Main Controller Module shall control and monitor all local or remote peripherals. It shall support a large 80 character LCD, power supply, remote LCD and zone display annunciators, printers, and support communication interface standard protocol (CSI) devices such as color computer annunciators and color graphic displays. Remote LCD annunciators shall also display each and every point in the system and be sized with the same number of characters as in the main SACP display.
- E. The panel shall have an interface module for remote site monitoring. The module shall have a dialer (alarm communicator transmitter (DACT)) module to transmit alarm, supervisory and trouble signals to a Central Monitoring Station (CMS). The DACT shall support dual telephone lines, 20 PPS 4/2 communications, and configured for dual tone multi-frequency (DTMF) or pulse modes. It shall be possible to delay AC power failure reports, auto test call, and site program using a touch tone phone and password. The dialer shall be capable of transmitting up to 40 individual alarm conditions to central station.
- F. The system shall have built-in automatic system programming to automatically address and map all system devices attached to the main controller. A minimum default single stage alarm system operation shall be supported with alarm silence, event silence, drill, lamp test, and reset common controls.
- G. Advanced Windows-based System Definition Utility with Program Version Reporting to document any and all changes made during system start-up or system commissioning shall be used to maintain site specific programming. Time and Date Stamps of all modifications made to the program must be included to allow full retention of all previous program version data. It shall support programming of any input point to any output point. The system shall support the use of Bar Code readers to assist custom programming functions. It shall allow authorized customization of fundamental system operations using initiating events to start actions, timers, sequences and logical algorithms. The system program shall meet the requirements of this project, current codes and standards, and satisfy the local Authority Having Jurisdiction.
- H. The system shall support distributed processor intelligent detectors with the following operational attributes; integral multiple differential sensors, automatic device mapping, electronic addressing, environmental compensation, pre-alarm, dirty detector identification, automatic day/night sensitivity adjustment, normal/alarm LEDs, relay bases, sounder bases and isolator bases.
- I. The system shall use full digital communications to supervise all addressable loop devices for placement, *correct location*, and operation. It shall allow swapping of "same type" devices without the need of addressing and impose the "location" parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.
- J. Each controller shall contain a RS232 printer/programming port for programming locally via a windows based PC or down loading through modems from a remote PC. When operational, each controller shall support a printer through the RS232 port and be capable of message routing.
- K. System circuits shall be configured as follows: Addressable analog SLC loops Class A (Style 4); Initiating Device Circuits Class A; Notification Appliance Circuits Class A; Network Communications Class A; Annunciator Communications Class A.
- L. Single stage operation shall be provided.

- M. The system shall have a UL Listed Detector Sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4 hours.
- N. The system shall support 100% of all remote devices in alarm and provide support for a 100% compliment of detector isolator bases.
- O. All panel modules shall be supervised for placement and return trouble if damaged or removed.
- P. The system shall have a CPU watchdog circuit to initiate trouble should the CPU fail.
- Q. The Smoke Alarm System shall incorporate the ability to code Notification Appliance circuits per the NYC building code.
- R. Audible notification appliances shall be affected by signal silence features. Visual signal appliance shall not be affected by signal silence features.

S. User Interface

The display module shall be of membrane style construction with a 4 line by 20 character Liquid Crystal Display. The LCD shall use super-twist technology and backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disable points. In the alarm mode display the total number of events and the type of event on display. Reserve 40 characters of display space for user custom messages. The module shall have visual indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be common control keys and visual indicators for; reset, alarm silence, trouble silence, drill, and one custom programmable key/indicator. Provide four pairs of display control keys for selection of event display by type (alarm, supervisory, monitor and trouble) and forward / backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicator that lights when an event of its type is active. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program, and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.

T. Power Supplies

The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc at 4.5A continuous for notification appliance circuits.

- U. Auxiliary power supplies shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc at 7A continuous for notification appliance circuits. The power supply shall be capable of providing 8A to output circuits for a maximum period of 100 ms. All outputs shall be power limited. . All outputs shall be power limited. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 5 minutes.
- V. Each annunciator must be capable of supporting custom messages as well as system event annunciation. It must be possible to filter unwanted annunciation of trouble, alarm or supervisory functions on a by point or by geographic area. The annunciators shall be mounted in stand-alone enclosures or integrated into the network panels as indicated on the plans.

## 2.3 COMPONENT DESIGN

### A. Colors

1. Provide finish colors under this section in accordance with FED-STD-595.

### B. Intelligent Devices—General

1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and *supervision by location*. Setting a device's address by physical means shall not be necessary.

### C. Intelligent Detectors—General

1. The System Intelligent Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.
2. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors changing state shall be 0.5 seconds.
3. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status.
4. The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.
5. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings.
6. Each detector microprocessor shall contain an environmental compensation algorithm which identifies and sets ambient "Environmental Thresholds"

approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminants as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24 hour long term and 4 hour short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned" base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

7. The intelligent analog detectors shall be suitable for mounting on any detector mounting base.

D. Fixed Temperature/Rate of Rise Heat Detector

Provide intelligent combination fixed temperature/rate-of-rise heat detectors. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F(9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70ft (21.3m) centers and be suitable for wall mount applications.

E. Photoelectric Smoke Detector

Provide intelligent photoelectric smoke detectors. The analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC. The photo detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes.

The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:

- Temperature: 32°F to 120°F (0°C to 49°C)
- Humidity: 0-93% RH, non-condensing
- Elevation: no limit

F. Standard Detector Mounting Bases

Provide standard detector mounting bases suitable for mounting on North American 1-gang, 3½" or 4" octagon box and 4" square box. The base shall, contain no

electronics, support all Signature Series detector types and have the following minimum requirements:

1. Removal of the respective detector shall not affect communications with other detectors.
2. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
3. The base shall be capable of supporting one (1) Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

G. Carbon Monoxide (CO) Alarm

1. Provide 24 Vdc Carbon Monoxide Alarms. Units shall be powered and battery backed by an UL-Listed/MEA approved fire alarm power supply. These devices shall be installed per the manufacturer's recommendations and the rules set forth by NYC Code. CO Alarms shall include a relay contact that can be monitored by the Smoke Detection systems as a non-alarm or supervisory function. CO Alarms shall be MEA approved and installed in accordance with the latest requirements of NYC code.

H. Duct Detector

Provide low profile intelligent addressable DUCT smoke detector as indicated on the project plans. Provide for variations in duct air velocity between 100 and 4,000 feet per minute and include a wide sensitivity range of .79 to 2.46%/ft. Obscuration. Include one Form-C shut down relay rated 2.0 amps @ 30 Vdc and also include slave high contact relays if required. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. The addressable DUCT housing shall be suitable for extreme environments, including a temperature range of -20 to 158 degrees F (-29 to 70 degrees Celsius) and offer a harsh environment gasket option. Provide Remote Alarm LED Indicators and/or remote test station as indicated on the project plans.

I. Intelligent Modules—General

It shall be possible to address each Intelligent Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

- Temperature: 32°F to 120°F (0°C to 49°C)
- Humidity: 0-93% RH, non-condensing



**J. Single Input Module**

Provide intelligent single input modules. The Single Input Module shall provide one (1) supervised Class A input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:

- Normally-Open Alarm Latching (Heat Detectors, etc.)
- Normally-Open Active Non-Latching (Monitor, Fans, Doors, etc.)
- Normally-Open Active Latching (Supervisory)

**K. Dual Input Module**

Provide intelligent dual input modules. The Dual Input Module shall provide two (2) supervised Class A input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The dual input module shall support the following circuit types:

- Normally-Open Alarm Latching (Heat Detectors, etc.)
- Normally-Open Active Non-Latching (Monitor, Fans, Doors, etc.)
- Normally-Open Active Latching (Supervisory)

**L. Monitor Module**

Provide intelligent monitor modules. The Monitor Module shall be factory set to support one (1) supervised Class A Normally-Open Active Non-Latching Monitor circuit. The monitor module shall be suitable for mounting on North American 2 ½" deep 1-gang boxes and 1 ½" deep 4" square boxes with 1-gang covers.

**M. Waterflow/Tamper Module,**

Provide intelligent waterflow/tamper modules. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class A input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch. The waterflow/tamper module shall be suitable for mounting on North American 2 ½" deep 1-gang boxes and 1 ½" deep 4" square boxes with 1-gang covers.

**N. Single Input Signal Module**

Provide intelligent single input signal modules. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class A output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 ½" deep 2-gang boxes and 1 ½" deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The single input signal module shall support the following operations:

- Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)

## O. Control Relay Module

Provide intelligent control relay modules. The Control Relay Module shall provide one form "R" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

## P. Multi-Voltage Control Relays

Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 24 Vdc, 24 Vac, 115 Vac, or 230 Vac. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

## Q. Manual Stations

1. Provide an addressable noncoded double action type with mechanical reset features. Locate stations as indicated. Stations shall be die cast aluminum semi-flush or surface-mounted. Surface-mounted boxes shall be painted the same color as alarm station. Mount stations with the base at 4 feet above finished floor and no more than 5 feet from any door, measured horizontally, as shown. Provide each station with screw-type terminals of proper number and type to perform functions required. Break-glass-front stations will not be permitted; however, a pull-lever, break-glass-rod type is acceptable. The manual alarm station shall require a key to reset or test.

## R. Notification Appliances – General

1. All appliances shall be UL Listed for Fire Protective Service.
2. All appliances shall be of the same manufacturer as the Smoke Alarm Control Panel (NO EXCEPTIONS) specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions.
3. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from THE CONTROL PANEL MANUFACTURER clearly stating that the control equipment (as submitted) is 100% compatible with the submitted Notification Appliances.

## S. Horns

Provide low profile wall mount horn at the locations shown on the drawings. The horn shall provide an audible output of 84.4 dBA at 10 ft at the high setting and for smaller room size locations (as indicated on the plans) a low dB setting (field selectable) of 79.4 dB at 10 ft. when measured in reverberation room per UL-464. Strobes shall provide synchronized flash outputs. The strobe output shall be as indicated on the drawings in one of the following field selectable intensity levels; 75cd & 110cd devices per UL 1971. The horn shall have a selectable steady or synchronized temporal output. Low profile horn/strobes shall mount in a North American 1-gang box or surface mounted on a matching back box provided by the manufacturer, as directed in the field.

T. Electromagnetic Doorholders – General

Electromagnetic doorholders submitted for use must have written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

U. Electromagnetic Doorholders Wall Mounted

Provide flush, semi-flush or surface wall mounted electromagnetic doorholder/releases rated at 24 Vac/dc as directed by the Consulting Engineer. Finish shall be brushed zinc.

V. Operating Instruction/Riser Diagram Holders

Shall be red painted steel, frame holder with clear, Acrylic window with nine inch by twelve inch (9" x 12") dimensions. One (1) holder shall be provided for the smoke alarm control panel (SACP)/system operating instructions and one (1) holder shall be provided for a reduced copy (8-1/2" X 11") of the smoke alarm system riser diagram. The operating instruction and riser diagram holders shall be mounted adjacent to the smoke alarm control panel (SACP).

W. Alarm System Disconnect Switch

The Contractor shall provide a 3 phase fusible disconnect switch:

1. Disconnect switch shall be provided with silver sand fuses, current limiting type with an interrupting capacity rating of 200,000 amps (r.m.s. symmetrical). The size of the fuses shall be thirty (30) amperes.
2. The disconnect switch shall bear an engraved white-core phenolic or bakelite identification nameplate stating in minimum one-quarter inch (1/4") high white letters on a red background "FIRE ALARM DISCONNECT".
3. A four (4) wire feeder shall bring three phase 120/208 volt service to the disconnect switch. The feeder shall be tapped off the main building service ahead of the main service switch but after the Current Transformers (Metering Transformers).

## 2.4 SUPPORT FOR INSTALLER AND CITY OF NEW YORK MAINTENANCE

- A. Provide a coded one-man walk test feature. Allow audible or silent testing. Signal alarms and troubles during test. Allow receipt of alarms and programmed operations for alarms from areas not under test.
- B. Provide internal system diagnostics and maintenance user interface controls to display/report the power, communication, and general status of specific panel components, detectors, and modules.
- C. Provide loop controller diagnostics to identify common alarm, trouble, ground fault, Class A fault, and map faults. Map faults include wire changes, device type changes by location, device additions/deletions and conventional open, short, and ground conditions. Ground faults on the circuit wiring of remote module shall be identified by device address.

- D. Allow the user to display/report the condition of addressable analog detectors. Include device address, device type, percent obscuration, and maintenance indicator. The maintenance indicator shall provide the user with a measure of contamination of a device upon which cleaning decisions can confidently be made.
- E. Allow the user to report history for alarm, supervisory, monitor, trouble, smoke verification, watchdog, and restore activity. Include Facility Name, Licensee, Project Program Compilation date, Compiler Version, Project Revision Number, and the time and date of the History Report.
- F. Allow the user to disable/enable devices, zones, actions, timers and sequences. Protect the disable function with a password.
- G. Allow the user to activate/restore outputs, actions, sequences, and simulate detector smoke levels.
- H. Allow the service user to enter time and date, reconfigure an external port for download programming, initiate auto programming and change passwords. Protect these functions with a password.
- I. THE END-USER SHALL RETAIN COMPLETE RIGHTS AND OWNERSHIP TO ALL SOFTWARE RUNNING IN THE SYSTEM. The alarm equipment vendor shall provide useable hard and soft copies of the software database to the End-User at the end of the warranty period. The database provided shall be useable by any authorized and certified distributor of the product line, and shall include all applicable passwords necessary for total and unrestricted use and modification of the database. The Consulting Engineer shall define the extent of hardcopy database documentation to be provided.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the manufacturer, approved by the local Fire Department and specified within. All penetration of floor slabs and firewalls shall be sleeved (1" conduit minimum) fire stopped in accordance with all local fire codes.
- B. All penetration of floor slabs and firewalls shall be sleeved (1" conduit minimum) fire stopped in accordance with all local fire codes.
- C. End of Line Resistors shall be furnished as required for mounting as directed by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled so removal of the device is not required to identify the EOL device.
- D. No area smoke detectors shall be mounted within 36 inches of any HVAC supply, return air register or lighting fixture.
- E. No area smoke or heat detector shall be mounted within 12 inches of any wall. All detectors shall be installed in strict accordance with NFPA 72.

- F. All visual devices shall be mounted 80 inches above the finished floor, as measured on center. Devices shall be mounted no less than 6 inches from the ceiling.
- G. All mechanical rooms, boiler rooms, wiring closets, etc. or areas with no hung ceilings shall be piped with 3/4" conduit. All device plenum rated wiring shall be mechanically protected with conduit.
- H. All areas in public view shall be in metal conduit. All boxes must be painted red and labeled.
- I. All addressable modules shall be mounted within 36 inches of the monitored or controlled point of termination. This shall include, but is not necessarily limited to, fan shutdown, or door release. Label all addressable modules as to their function.
- J. New door holders shall derive their 24VAC/VDC power from a separate power supply housed in a dedicated, metal enclosure. The power supply shall have a 120VAC feed, and is to be centrally located to serve door holders on a per floor or area basis. All existing door holders shall be connected to new SACP. E.C. shall extend all existing wiring in order to make this work. Locations and quantities of door holder power supplies shall be referenced and submitted in the submission package for approval by the Consulting Engineer.
- K. All low voltage wiring terminated to the fire alarm system shall be PLENUM RATED with no exceptions and no less than No. 12 AWG in size for NAC circuits and 16 AWG for Initiating Circuits, and solid copper.
- L. All line voltage (120VAC) wiring shall be no less than No. 10 AWG in size, and solid copper. System grounding shall be minimum No. 8 AWG.
- M. SACP must have a DEDICATED system disconnect switch arranged per NYC code.
- N. All wiring shall be color-coded throughout, to National Electrical Code standards.
- O. Power-limited/Non-power-limited NEC wiring standards SHALL BE OBSERVED.
- P. All junction box covers shall be painted red and labeled INTERIOR FIRE ALARM SYSTEM.
- Q. Alarm system wiring shall not co-mingle with any other system wiring in the facility. Conduits shall not be shared under any circumstance. Only when fire alarm wiring enters the enclosure of a monitored or controlled system will co-habitation be permitted (i.e. at fan starters or elevator controllers). THIS WILL BE FIELD INSPECTED BY THE PROJECT ENGINEER.
- R. Auxiliary relays shall be appropriately labeled to indicate "FIRE ALARM SYSTEM" and their specific function (i.e. FAN S-1 SHUTDOWN).
- S. All fire alarm wiring shall be continuous and unspliced. Terminations shall only occur at fire alarm devices or control panel enclosures under terminal screws. All other splicing methods are specifically disallowed (i.e. plastic wirenuts).
- T. All alarm wiring shall be installed using a dedicated system of supports (i.e. bridle rings). Fire alarm wiring shall not be bundled or strapped to existing conduit, pipe or wire in the facility. THIS WILL BE FIELD INSPECTED BY THE PROJECT ENGINEER.
- U. All alarm wiring shall be sleeved when passing through any wall, using conduit sleeves (1" min.) with bushings, and fire stopped in accordance with Code.
- V. The system shall be arranged to receive power from one three wire 120 Vac, 20 A supply. All low voltage operation shall be provided from the fire alarm control panel.

- W. All alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the Contract Drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Project Engineer. Failure to bring such issues to the attention of the Project Engineer shall be the exclusive liability of the installing Electrical Contractor.
- X. The installing Electrical Contractor shall be responsible for the removal of ENTIRE existing alarm system components and controls on the demolition drawing shown or not, upon approval of the AHJ and the Consulting Engineer. The End-User reserves the right to retain any existing alarm system components, upon their request. All existing alarm system components requiring special handling for disposal (due to radioactivity) shall be the responsibility of the installing contractor. Written proof of proper disposal by the installing contractor shall be required prior to release of outstanding retainage.

### 3.2 PAINTING

- A. Paint exposed electrical, fire alarm conduit and surface metal raceway to match adjacent finishes in exposed areas. Paint conduit and surface metal raceways red in unfinished areas and above finished ceilings.

### 3.3 FIELD QUALITY CONTROL

- A. The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all of the function as specified.
- B. The installing contractor or fire alarm equipment vendor shall have no less than two (2) NICET Level II fire alarm technicians dedicated to this project.
- C. The Installing Contract and the Alarm System Vendor shall, upon the request of the Consulting Engineer or End-User, attend any and all project meetings for the purpose of accurately determining progress.
- D. It shall be the responsibility of the installing contractor to assure that construction debris does not adversely affect any sensing devices installed as part of this project. Should it be deemed necessary by the Consulting Engineer, End-User or AHJ, the installing contractor shall be responsible for the cleaning of all smoke detectors prior to final acceptance.
- E. Preliminary Tests
  - 1. Conduct the following tests during installation of wiring and system components. Correct any deficiencies pertaining to these requirements prior to formal functional and operational tests of the system.
  - 2. Ground Resistance
    - a. Measure the resistance of each connection to ground. Ground resistance shall not exceed 10 ohms.
  - 3. Dielectric Strength and Insulation Resistance
    - a. Test dielectric strength and the insulation resistance of system interconnecting wiring by means of an instrument capable of generating 500 volts dc and equipped to indicate leakage current in 1000 mega-ohms. For the purpose of this test, instrument shall be connected between each conductor on the line and between each conductor and ground at control panel and of line, with the other extremity open circuited and series-connected devices shunted or in place. System shall withstand test without breakdown and indicate a resistance of not less than 500,000 ohms, the measurement being taken after an electrification of not more

than 1.0 minute with a dc potential of not less than 100 volts nor more than 550 volts. Dielectric tests shall be witnessed by Engineer or his designee.

4. Smoke and Thermal Sensor Tests
  - a. Prior to formal inspection and tests, clean and perform sensitivity tests on each smoke and thermal sensor. Clean the smoke and thermal sensors in accordance with the manufacturer's recommended procedures. Perform voltage activation sensitivity test on each sensor and record the results. Remove sensors with a sensitivity level above or below the UL accepted sensitivity range for that sensor and replace with new sensors. Present recorded data at the formal inspection for verification. Approved copies shall become part of the operations and maintenance manual for the fire alarm system.
5. Field Inspection and Test
  - a. Before final acceptance of the work, test each system to demonstrate compliance with the contract requirement. Each system shall be subjected, at minimum, to complete functional and operational tests including tests in place of each smoke sensor and detector, each thermal sensor, audio device, tests of wiring supervision and tests of control panel functions. Preliminary tests shall be performed in accordance with manufacturer's published testing instructions and in accordance with NFPA 72. Furnish one extra Operations and Maintenance Manual with the formal request for final acceptance testing. The system shall be operational, with no trouble or alarm conditions, a minimum of 14 consecutive days prior to formal tests. Printer shall be operational during the preliminary tests and break-in period. Provide printer records with the request for formal inspection as evidence of completion of required preliminary test.
6. Formal Inspection and Test
  - a. The Authority having Jurisdiction will witness formal tests after receipt of written certification that preliminary tests have been completed and that the system is ready for final inspection. The system manufacturer's technical representative shall be present for the inspection and test. At minimum, preliminary tests shall be repeated and functional and operation tests conducted, as requested by the Commissioner. Correct defects and conduct additional tests to demonstrate that the system conforms to contract specifications. Contractor shall provide two-way radios, personnel and test equipment required for conducting tests. Smoke detectors shall be tested using the manufacturer's calibrated test method. In addition, formal testing will require real smoke to be used to test smoke detectors. Canned smoke will not be permitted. Test equipment shall be turned over to the Authority having Jurisdiction following test completion.
7. Manufacturer's Field Service
  - a. Manufacturer's Representative
 

Furnish the services of a factory-trained fire alarm system manufacturer's representative or technician, experienced in the installation and operation of the type of system being provided, to supervise the installation, testing, including formal testing, adjustment of the system, and instruction to the facility personnel. Furnish names and phone numbers of the factory-trained fire alarm system representatives or technicians.

F. Documentation And Training

1. The contractor shall compile and provide to the City of New York three (3) complete manual on the completed system to include SITE SPECIFIC operating

and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams and a manufacturer's suggested spare parts list.

2. In addition to the above manuals, the Electrical Contractor shall provide the services of the manufacturer's trained representative for **two (2)** separate calendar days for a period of four **(4) hours** per day to instruct the City of New York's designated personnel on the operation and maintenance of the entire system.
3. As-built drawings shall consist of the following:
  - a. Complete revision of all previously submitted drawings
  - b. Point-to-point depiction of all device wiring on the device layout floor plans.
  - c. One (1) set of B-size, laminated as-built drawings.
  - d. Two (2) sets of 30"x42"inch 1/16"=1' scale drawing showing all points of alarm. One set shall be submitted with the close-out documents. Second set shall be mounted in frame with a lexan cover. These drawing must be submitted to project Engineer or approval.
4. Turnover of all software database hard/soft copies shall be required. This shall include all possible programming software logs, diskettes or CDs containing exported project files, hard copies of all device maps, the revision number of the version of programming utility used, and all required passwords. The turnover of all database information shall occur prior to the end of the One (1) warranty period (or period as amended earlier in this specification).

G. Adjustments

1. Equipment manufacturer shall provide necessary subsequent custom reprogramming to modify and adjust operations and individual identification nomenclature to the Commissioner's satisfaction four months after final system acceptance and twelve months after system acceptance. Reprogramming is to be done at the job site and witnessed by the Authority having Jurisdiction representative. Revision of as-built and record drawings shall be by the installing Contractor.

**END OF SECTION**