

SECTION 16732
FIRE ALARM, DETECTION AND NOTIFICATION SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

- A. The work covered by this Section of the Specification shall include all labor, equipment, materials and services to furnish and install a complete fire alarm system.
1. Fire Alarm Control Panel.
 2. Remote Annunciator.
 3. Manual pull stations.
 4. Smoke detectors.
 5. Heat detectors.
 6. Fire Alarm System Interface Controls- Proprietary supervising station, magnetic door/card access release override, and air handling system.
 7. Notification appliances.
 8. Air handling systems shutdown control.
 9. Magnetic door holder release.
 10. Fire Suppression Supervision- Wet pipe, dry pipe, deluge valve, pre-action System, kitchen hood, clean agent and Halon system monitoring.
- B. Related Sections:
1. Section 08331 – Overhead Coiling Doors.
 2. Section 08710 – Finish Hardware.
 3. Section 13905 – Fire Protection, Suppression and Alarm.
 4. Section 14200 – Hydraulic Elevators.
 5. Section 14240 – Traction Elevators.
 6. Section 14300 – Heavy-Duty Escalator.
 7. Section 16120 – Wire, Cable and Busways.
 8. Section 16130 – Raceways, Boxes and Cabinets.
 9. Section 16705 – Communications Standard Specifications – Equipment & Material.
 10. Section 16706 – Communications Systems Submittals & Services.
 11. Section 16707 – Communications Systems Quality Assurance & Testing.
 12. Section 16710 – Communications Grounding. Section 16715 – Communications Electrical Power Distribution.
 13. Section 16733 – Communications – Kiosk Systems.

14. Section 16925 – ATC – Data Transmission System.

1.02 REFERENCES

- A. The system and all components shall be approved by insurance provider for use in fire protection systems and compliant with all insurance provider guidelines. If insurance provider approval is not available, insurance representatives must be consulted to ensure system is acceptable and components must at least be listed by Underwriters Laboratories, Inc. for use in fire protective signaling systems.
- B. The installation shall comply with:
 - 1. State and Local Building and Fire Codes.
 - 2. Americans with Disabilities Act (ADA).
 - 3. NFPA 70 – National Electrical Code.
 - 4. NFPA 72 – National Fire Alarm and Signaling Code.
 - 5. Local and State Authorities Having Jurisdiction.
 - 6. NFPA 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems
 - 7. NFPA 70 - National Electrical Code
 - 8. NFPA 101 - Life Safety Code

1.03 SUBMITTALS

- A. Provide a list of all types of equipment and components provided. This shall be incorporated as part of a Table of Contents, which shall also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product data sheet on which the information can be found. See Division 1 for specific details about submissions.
- B. Provide a Sequence of Operation matrix. The sequence of operation shall be building specific, and shall provide individual sequences for every type of alarm, supervisory or trouble condition which may occur as part of normal or off-normal system use.
- C. Provide manufacturer's original printed product data, catalog cuts and description of any special installation procedures. Photocopied and/or illegible product data sheets shall not be acceptable. All product datasheets shall be highlighted or stamped with arrows to indicate the specific components being submitted for approval.
- D. Provide manufacturer's installation instruction manual for specified system.
- E. Provide samples of various items when requested.
- F. Provide copy of state License to perform such work.
- G. Provide copies of NICET Level IV Fire Alarm certifications for a minimum of two (2) technicians assigned to this project also responsible for Fire Alarm Control Panel (FACP) programming.
- H. Provide shop drawings as follows:
 - 1. Coversheet with project name, address and drawing index.
 - 2. General notes drawing with peripheral device back-box size information, part numbers, device mounting height information, and the names, addresses, point of contact, and telephone numbers of all contact project team members.

3. Building specific device riser diagram, which individually depicts all control panels, annunciators, addressable devices, and notification appliances. Include a specific, proposed point descriptor above each addressable device. Include a specific discrete point address that shall correspond to address 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 required on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
 4. Control panel termination drawing(s). Include internal component placement and all internal and field termination points. Drawing shall provide a detail indicating where conduit penetrations shall be made, so as to avoid conflicts with internally mounted batteries. For each additional data gathering panel, a separate control panel drawing shall be provided, which clearly indicates the designation, service and location of the control enclosure. End-of-line resistors (and values) shall be depicted.
 5. Building specific device 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.
 6. See section 3.05 CLOSEOUT ACTIVITIES for other documents relating to this section.
- I. Battery calculations shall be provided on a per power supply/charger basis. These calculations shall clearly indicate
 1. The quantity of devices
 2. The device part numbers
 3. The supervisory current draw
 4. The alarm current draw
 5. Totals for all categories, and the calculated battery requirements (which reflect a 20% DEGRADE, for 24 hour supervisory, 5 minute alarm operation).
 6. Battery calculations shall also reflect all control panel components, remote annunciator, and auxiliary relay current draws.
 - J. Scale drawing sets shall be submitted along with the submittal book. These drawings shall be 22" x 34" and of a sufficient resolution to be completely legible when reduced to 11" x 17" size.
 - K. Written proof of proper disposal by the installing contractor shall be required prior to release of outstanding retainage.
 - L. Turnover of all software database hard/soft copies to WMATA prior to the end of the one (1) year warranty period (or period as amended earlier in this specification). This shall include all possible programming software logs, exported project files, hard copies of all device maps, the revision number of the version of programming utility used, and all required passwords. This information shall be provided to WMATA on a flash drive.

1.04 QUALITY ASSURANCE

- A. Qualifications: Company specializing in installation of work in this Section with minimum of three years documented experience, approved by manufacturer.
- B. System Standards:
 1. NFPA 72.

2. CEC, Article 760.

C. Design criteria:

1. Comply with all system standards.
2. Meet all requirements of fire authorities having jurisdictions.
3. The Building Electronics contractor shall provide complete fire detection and alarm system design, wiring diagrams, interphase wiring diagrams, and operational details.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt, dust and any other contaminants.
- B. Project staging may be provided at stakeholders' convenience. A staging area is not guaranteed.

1.06 RELATED WORK

- A. The fire alarm and detection system provides controls to and/or interfaces with the following systems and equipment:
 1. Ventilation fans.
 2. Fire suppression systems.
 3. Elevators and escalators.
 4. Data Transmission Systems (DTS).
 5. Automatic Fare Collection (AFC).
 6. Automatic public address.
 7. Fire standpipe systems.
 8. Clean agent systems.
 9. Combustible gas detection.
 10. Carbon monoxide detection.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers capable of meeting the system requirements of Part 2 of this specification.
- B. New fire alarm equipment shall be compatible with the existing WMATA fire alarm equipment. New equipment shall be able to provide two-way command and control communication between an EST Fireworks® head end and all protected premise fire alarm control panels and field devices.

2.02 EQUIPMENT

- A. Fire Alarm Control Panel (FACP)
 1. The fire alarm control panel(s) shall be an Edwards EST-3 or equivalent. System devices (notification appliances, pull stations, smoke and heat detectors, etc.) shall be compatible with one another. All components will be labeled "FM approved" for the use of fire alarm systems in this area of the United States of America.

2. Fire alarm control panel cabinet shall be 3-CAB series or equivalent. Cabinet shall be manufactured from #14 AWG cold rolled steel with a gray baked enamel finish. Operating controls shall be located behind a locked door with a viewing window.
3. Fire alarm control panel enclosures shall have engraved labels indicating, "FIRE ALARM SYSTEM", and the areas of the building served by that panel.
4. All control modules shall be labeled, and all zone locations shall be identified.
5. Conventional fire alarm panel supporting 1/3/5/10 initiating device circuits and 1 through 4 notification appliance, Class B circuits as required in the space. If the panel is not a slave provide Digital Alarm Communicator Transmitter (DACT) for off premises communication.
6. 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.
7. 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.
8. 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.
9. 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.
10. The fire alarm panel shall provide integral security system interfaces.

B. User Interface

1. The display module shall be of membrane style construction with a 24 line by 40-character (960 total characters) Liquid Crystal Display (LCD). The LCD shall use super-twist technology and backlighting for high contrast visual clarity and a colored grey/black and white display.
 - 1.1 In the normal mode the LCD shall display the time, a customer facility name, and the number of history events.
 - 1.2 In the alarm mode the LCD shall display the total number of events and the type of event. The LCD shall display the first event of the highest priority as well as the previous seven (7) alarm events "hands free" in chronological order so that the arriving firefighter may track the fire progression. The LCD shall reserve 42 characters of display space for each user custom message by addressable device.
2. There shall be common control keys and visual indicators for reset, alarm silence, panel silence and drill.
 - 2.1 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.

2.2 The operation of these keys shall be integrated with the related common control indicators to flash the indicators when un-displayed events are available for display and turn on steady when all events have been displayed.

3. Provide system function keys for status, reports, enable, disable, activate, restore, program and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.
4. Provide field programmable 12 switch 12 LEDs control display module.

As an alternate if the above cannot be provided, provide UL 864, 9th edition PC graphics display.

C. Software

1. Windows-based System 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. Software will be Edwards EST-3 or equivalent and capable of coordination with EST fireworks head end. 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.

D. Digital Alarm Communicator Transmitter (DACT)

1. The FACP shall have a DACT module to transmit alarm, supervisory and trouble signals to a central monitoring or proprietary supervising station.
2. The DACT shall support dual telephone lines, Contact I.D. communications, and configured for dual tone multi-frequency (DTMF) or pulse modes.
3. It shall be possible to delay AC power failure reports, auto test call, and be site programmable.
4. The dialer shall be capable of transmitting every individual alarm condition to the central station or proprietary supervising station.

E. Network Communications Card

1. A network communication card shall be provided for each building to allow building to building, peer to peer networking.

F. Fiber Optics Communications Interface

1. Fiber optics communications interface shall be provided for buildings, where available, to allow building to building networking in a Class A configuration.

G. System Controllers

1. The main controller shall be supervised, site programmable, and of modular design supporting at least 125 detectors and 125 remote modules per addressable Signaling Line Circuit (SLC).
2. The controllers shall support up to 10 SLC's per panel for a total system capacity of 2,500 intelligent addressable points.
3. The system shall be designed with peer-to-peer networking capability for enhanced survivability, with support for up to 64 nodes, each with up to 2,500 points and an overall capacity of 160,000 points.

4. The cabinets shall be steel, with a red finish.
5. The main controller module shall control and monitor all local or remote peripherals. It shall support at least a large 960 character LCD, power supply, remote LCD and zone display annunciators, printers, and support standard communication interface protocol devices such as color computer annunciators and color graphic displays. If configured as a network, each system shall display every point in the system and shall support up to 64 remote LCD display annunciators. Remote LCD annunciators shall also display every point in the system and be sized with the same number of characters as in the main FACP display.
6. Each controller shall contain a communication card which contains two RS232 ports. A computer for programming locally and a printer shall be provided and connected to the RS232 ports, a RS232 printer/programming port for programming locally via PC. When operational, each controller shall support a printer through the RS232 port and be capable of message routing.
7. Single stage operations shall be provided.
8. The system shall have a listed Detector Sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4 hours.
9. The system shall support 100% of all remote devices in alarm and provide support for a 100% compliment of detector isolator bases.

H. Power Supplies

1. Provide a power supply with power input of 120 VAC, 3.0A, 50/60 Hz and power output of Internal DC 24 Vdc @ 7.0A Max, Auxiliary DC Two 24 Vdc @ 3.5A Max. The battery charger shall be included in the power supply.
2. 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.
3. The power supply shall provide internal power and 24VDC at 7.0A continuous for notification appliance circuits.
4. The power supply shall be capable of providing 7.0A to output circuits for a maximum period of 100 milliseconds. All outputs shall be power limited.
5. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 5 minutes.

I. Auxiliary Power Supplies

1. 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.
2. The power supply shall provide internal power and 24VDC at 7.0A continuous for notification appliance circuits.
3. The power supply shall be capable of providing 7.0A to output circuits for a maximum period of 100 milliseconds. All outputs shall be power limited.
4. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 5 minutes.

J. Annunciators

1. The graphic remote annunciators shall be mounted in stand-alone enclosures or integrated into the network panels. The annunciator graphical diagram shall be 1/16 inch per foot scale minimum and operating on normal 24 Vdc. All annunciator switches shall be system input points and shall be capable of controlling any system output or function. The graphic annunciator shall be UL and ULC listed. The graphic shall be back-lit using high intensity LEDs. The unit shall be semi-flush or surface mounted. The main graphic door shall be tamper resistant and equipped with a key lock. It shall be possible to update the graphic image in the field without replacing the entire graphic.
2. Network alpha-numeric annunciators shall be located throughout the facility as indicated on the design drawings. The system shall have the capacity to support 64 network annunciators or network panel nodes. Each annunciator shall contain a supervised, back lit LCD with a minimum of 8 lines with 21 characters per line. Where required, the annunciator shall include additional zonal annunciation and manual control without additional enclosures.
3. The annunciator shall support full ability to serve as the operating interface to the system and shall include the following features:
 - a. Matched appearance with other system displays.
 - b. Each LCD on each node (cabinet) in the system shall be configurable to show the status of any or all of the following functions anywhere in the system: Alarm, Supervisory, Trouble and Monitor.
4. Each annunciator shall be capable of supporting custom messages as well as system event annunciation. It shall be possible to filter unwanted annunciation of trouble, alarm or supervisory functions by point or by geographic area.

K. Intelligent Devices

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 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. 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.

L. Intelligent Detectors

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. 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. 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.
5. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that 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.
6. The intelligent analog detectors shall be suitable for mounting on a variety of orientation/condition-specific detector mounting bases.

M. Fixed Temperature/Rate of Rise Detector

1. Heat detectors 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. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135⁰F and a rate-of-rise alarm point of 15⁰F per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft centers and be suitable for wall mount applications.

N. Photoelectric Smoke Detector

1. Analog photoelectric detectors 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 or other equivalent program/service tool. The photo detector shall be rated for ceiling installation at a minimum of 30 ft 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 high and 3 ft wide with air velocities up to 4,000 ft/min. 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: 32⁰F to 120⁰F, Humidity: 0-93% RH, non-condensing, Elevation: no limit.

O. Multi-sensor Detector

1. Provide intelligent multi-sensor smoke detectors. The multi-sensor analog detector shall use a light scattering type photoelectric smoke sensor, a unipolar ionization smoke sensor and an

ambient temperature sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time based algorithms to dynamically examine values from the three sensors simultaneously and initiate an alarm based on that data. The multi-sensor detector shall be capable of adapting to ambient environmental conditions. The temperature sensor shall self-adjust to the ambient temperature of the surrounding air and input an alarm when there is a change of 65⁰F in ambient temperature. 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, age and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC. Separately mounted photoelectric detectors, ionization detectors and heat detectors in the same location are not acceptable alternatives. The multi-sensor smoke detector shall be rated for ceiling installation at a minimum of 30 ft centers and suitable for wall mount applications.

P. Detector Mounting Base

1. Detector mounting bases shall be 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 detector types and have the following minimum requirements: Removal of the respective detector shall not affect communications with other detectors, Terminal connections shall be made on the room side of the base; bases that must be removed to gain access to the terminals shall not be acceptable. The base shall be capable of supporting one (1) remote alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

Q. Duct Detector Housing

1. 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 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 and offer a harsh environment gasket option. Provide remote alarm LED Indicators and/or remote test station as indicated on the project plans.

R. Intelligent Modules

1. It shall be possible to address each 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 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, Humidity: 0-93% RH, non- condensing.

S. Single Input Module

1. Provide intelligent single input modules. The Single Input Module shall provide one (1) supervised Class B 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" 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 (Manual Stations, Heat Detectors, etc.), Normally-Open Alarm Delayed Latching (Waterflow Switches), Normally-

Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.), Normally-Open Active Latching (Supervisory, Tamper Switches).

T. Dual Input Module

1. Provide intelligent dual input modules. The Dual Input Module shall provide two (2) supervised Class B 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" deep 1-gang boxes and 1 ½" deep 4" square boxes with 1-gang covers. The dual input module shall support the following circuit types: Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.), Normally-Open Alarm Delayed Latching (Waterflow Switches), Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.), Normally-Open Active Latching (Supervisory, Tamper Switches).

U. Monitor Module

1. Provide intelligent monitor modules. The Monitor Module shall be factory set to support one (1) supervised Class B 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.

V. Universal I/O

1. Provide motherboards that provide mounting and wire terminations for modules. The motherboard shall support up to six modules. Locations: Communication Equipment Room, and Ancillary locations.

W. Waterflow/Tamper Module

1. Provide intelligent waterflow/tamper modules. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B 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.

X. Single Input Signal Module

1. Provide intelligent single input signal modules. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B 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. The single input signal module shall support the following operations: Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A).

Y. Control Relay Module

1. 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 2 ½" deep 1-gang boxes and 1 ½" deep 4" square boxes with 1-gang covers.

Z. Conventional Manual Pull Stations

1. It shall be double action model with single pole contact used for pre-signal or general alarm initiation. The model shall have terminals for field connection of wire. The manual stations

shall be provided with a key lock matching the FACP. The manual pull station shall not be provided with a glass break operation. Surface mount the manual pull station unless flush mount is possible. The fire alarm pull station shall be suitable for operation in the following environment: Temperature: 32°F to 120°F, Humidity: 0-93% RH, non- condensing. Provide accessories as required for the installation.

AA. Intelligent Manual Pull Stations

1. It shall be possible to address each fire alarm pull station without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The manual stations shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing up to 24 diagnostic codes that can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults. The fire alarm pull station shall be suitable for operation in the following environment: Temperature: 32°F to 120°F, Humidity: 0-93% RH, non-condensing.

BB. Manual Pull Station

1. Provide intelligent double action, single stage fire alarm stations. The fire alarm station shall be of metal construction with an internal toggle switch. Provide a locked test feature. Finish the station in red with silver "PULL IN CASE OF FIRE" English lettering. The manual station shall be suitable for mounting on North American 2 ½" deep 1-gang boxes and 1½" deep 4" square boxes with 1-gang covers.

CC. Notification Appliances

1. All appliances shall be FM Approved for Fire Protective Service. All strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act accessibility guidelines (ADA (AG)), and shall be UL 1971. All appliances shall be of the same manufacturer as the Fire 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. 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.

DD. Strobes

1. Provide low profile wall mounted strobes at the locations shown on the drawings. Strobes shall provide synchronized flash outputs. Strobe output shall be field selectable as indicated on the drawings in one of the following intensity levels; 15/75, 15cd, 30cd, 75cd or 110cd*. Low profile 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. Provide weatherproof type and associated components when strobe is located outside or in areas requiring weather proofing.

EE. Temporal Horn/Strobes

1. Provide low profile wall mount horn/strobes at the locations shown on the drawings. The horn/strobe 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*; 15/75, 15cd, 30cd, 75cd & 110cd devices. The horn shall have a selectable steady or synchronized temporal 3-3-3 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.

FF. Temporal Horn

1. 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. The horn shall have a selectable steady or synchronized temporal 3-3-3 output. Low profile horn 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.

GG. Speaker/Strobe

1. Provide low profile wall mount speaker/strobes at the locations shown on the drawings. The strobe output shall be as indicated on the drawings in one of the following field selectable intensity levels; 15cd, 30cd, 75cd & 110cd devices. Speakers shall operate between ¼ Watt and 2 Watts and shall provide an audible output between 80 dBA and 89 dBA.

HH. Speaker

1. Provide low profile wall mount speakers at the locations shown on the drawings. Speakers shall operate between ¼ Watt to 2 Watts and shall provide an audible output between 80 dBA and 89 dBA.

II. Multi-Voltage Control Relays

1. 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.

JJ. Electromagnetic Door Holders

1. Electromagnetic door holders 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.
2. Wall mounted, provide flush, semi-flush or surface wall mounted electromagnetic door holder/releases rated at 24 Vac/dc. Finish shall be brushed zinc.

KK. Surge Suppressor

1. Surge suppressors shall be multi-stage, hardwired base, field replaceable, with multiple voltage settings. 2 pairs shall be protected per module. UL497B listed with 10AWG max screw terminals. 0-75 service voltage, 6.6-108V list through voltage.

LL. Manual Pull Station Guards

1. Manual pull stations shall be provided with guards as required on the plans. They shall be surface or flush mounting, as required for each individual device.

MM. Voice Evacuation

1. The audio system must provide simultaneous page, alert, and evacuation signals. Systems that cause signaling devices to go silent while performing signaling functions will not be acceptable. The system must provide operation to 25Vrms or 70.7Vrms speakers. The system

must provide as a minimum the following paging common controls and indicators: Ready to page LED, VU display of paging output level, single switch function for paging to all — Alert zones, Evacuation zones, and areas not programmed for signaling. The system must provide high quality analog to digital conversion of paging sources. Digital transmission of paging must be provided between system nodes. The analog sources must be sampled and converted to digital with a sampling rate no less than 9600 samples per second. It must be possible to transmit signal sources (Alert, Alarm, Page, etc.) together over a single pair of wires between nodes. System amplifiers must be distributed zoned type. Centrally banked systems are not acceptable. An integral circuit for operating traditional Network Access Control (NAC) devices must be provided with each system amplifier. The circuit must carry a minimum rating of 3.5 Amps for operating 24 VDC signals. The system shall provide fully integrated fire fighters' telephone system that shall provide 2-way communication between the fire alarm control panel and any fire fighters' telephone station. The system shall include an alphanumeric user display and controls. When a telephone is activated, a call-in buzzer shall sound, and the location of the phone shall be shown on the alphanumeric display. The display shall be capable of bilingual operation, displaying English, Dutch, Finnish, French, German, Italian, Portuguese or Spanish messages. The incoming call shall be selected by activating a single button. All subsequent telephone call locations shall be displayed in full text. The system shall display all incoming calls, all connected phone(s) on the alphanumeric display. The system shall be configured so that page messages may be issued from any firefighter's telephone connected to the system, as directed by the emergency operator.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Shop drawings must be submitted and approved prior to execution of any installation or demolition activity.
- B. Circuiting
 1. Addressable analog signaling line circuit, initiating device circuit and notification appliance circuit loops shall be Class B. Conventional signaling line circuit, initiating device circuit and notification appliance circuit loops shall be Class B. Network communication and annunciator communication loops shall be Class A. Tee tapping is not permitted for any circuit.
 2. Device loading shall not exceed 80% of loop capacity for each addressable or conventional analog loop to accommodate the installation of future devices.
 3. Provide intelligent input modules to supervise Class B zone wiring where required to interface conventional initiating devices.
 4. Sprinkler systems shall be supervised as follows:
 - a. Provide one (1) supervisory module for each sprinkler valve supervisory switch.
 - b. Provide one (1) dual input addressable module where water flow and tamper switches exist at the same location.
 - c. Provide one (1) additional single input addressable module where odd numbers of devices exist at a single location.
 5. Notification appliance circuits:
 - a. Audible Signals: Provide sufficient spare capacity to assure that an increase of 20% of the audible devices can be supported without the need for additional components (power supplies, signal circuit modules, batteries, etc.).

- b. Visual Signals: Provide sufficient spare capacity to assure that an increase of 20% of the visual devices can be supported without the need for additional components (power supplies, signal circuit modules, batteries, etc.).
6. Each of the following types of remote equipment associated with the fire alarm system shall be provided with a form 'C' control relay contact as follows, unless otherwise noted on the drawings:
 - 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.
7. 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.
8. Each control or data gathering panel shall have a dedicated 20 Amp, 120VAC feed. This feed shall come from an emergency circuit breaker panel where available, and shall have a locked circuit breaker. Earth grounds shall also terminate to the same circuit breaker panel from each respective control panel.
9. The system shall have a CPU "watchdog" circuit to initiate trouble should the CPU fail.
10. All low voltage wiring terminated to the fire alarm system shall be plenum rated with no exceptions and no less than No. 18 AWG in size, and solid copper.
11. All line voltage (120VAC) wiring shall be no less than No. 12 AWG in size, and solid copper. This shall include all system grounding. FACP must have a dedicated 20 Amp circuit marked back at the power panel no exceptions.
12. All wiring shall be color-coded throughout, to National Electrical Code standards.
13. Power-limited/non-power-limited NEC wiring standards shall be observed.
14. All junction box covers shall be painted federal safety red and labeled FIRE ALARM SYSTEM ONLY in black letters.
15. Fire 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).
16. Auxiliary relays shall be appropriately labeled to indicate "FIRE ALARM SYSTEM" and their specific function (i.e. FAN S-1 SHUTDOWN).
17. All fire alarm wiring shall be continuous and without splices. 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 wire nuts).
18. All fire alarm wiring shall be installed in conduit. See Specification Section 16120.
19. All fire alarm wiring shall be sleeved when passing through any wall, using conduit sleeves (1"min.) with bushings, and fire stopped in accordance with Code.

20. The fire alarm 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.
21. 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.
22. 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 FACP. E.C. shall extend all existing wiring in order to make this work.
23. All WMATA protected premises report to two proprietary supervising station locations. The supervising station locations are located at the Jackson Graham Building and at the Carmen Turner Facility.

C. Fire Alarm System Sequence of Operation

1. The system shall identify any off normal condition and log each condition into the system database as an event.
 - a. 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.
 - b. The system shall have a Queue operation, and shall not require event acknowledgement by the system operator. The system shall have a labeled color coded indicator for each type of event; alarm shall be red, supervisory shall be yellow, trouble shall be yellow, monitor shall be yellow. When an unseen event exists for a given type, the indicator shall be lit.
 - c. 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 42 character custom user description.
 - d. The user shall be able to review each event by scrolling keys (up-down) for each event type.
 - e. New alarm, supervisory or trouble events shall sound an audible signal at the control panel; the operator shall be able to silence this audible signal.
2. Operation of any alarm initiating device shall automatically:
 - a. Update the control/display as described in this Section.
 - b. Sound all audible appliances in a Temporal-3 pattern. All audible appliances shall be synchronized with each other when two or more horns can be heard. Audible devices shall have the ability to be silenced.
 - c. Activate all strobe appliances throughout the facility. All strobe appliances shall be synchronized with each other in any location with two or more devices in a common field of view. Visual devices shall be non-silenced unless the system is successfully reset.
 - d. Operate control relay contacts to shutdown HVAC units in accordance with IMC requirements.

- e. Operate control relay contacts to return all elevators that serve the floor of alarm initiation to the ground floor. If the alarm originates from the ground floor, operate control circuits contacts to return all elevators to the floor above or to a level as directed by the local fire department.
 - f. Operate control relay contacts to release all magnetically held smoke doors throughout the building.
 - g. Visually annunciate the individual point of alarm on all remote annunciator panels. The visual indication shall remain activated until the alarm condition is reset to normal.
 - h. Transmit an alarm condition to central station/local fire department and/or proprietary supervising station (as required by the AHJ/WMATA).
3. Elevator smoke and heat detector sequences shall comply with ANSI A17.1 Safety Code for Elevators and Escalators requirements and local code requirements for main/alternate floor recalls, and shunt trip activations.
 4. Activation of a sprinkler supervisory initiating device shall:
 - a. Update the control/display as described in this Section.
 - b. Transmit a supervisory condition to central station/local fire department and/or proprietary supervising station (as required by the AHJ/WMATA).
 - c. Visually annunciate the individual point of alarm on all remote annunciator panels. The visual indication shall remain on until the alarm condition is reset to normal.
 5. All fire 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 system wiring and shorts across alarm signaling wiring shall automatically:
 - a. Update the control/display as described in this Section.
 - b. Transmit a trouble condition, via the integral central station communicator, to the central station/local fire department and proprietary supervising station (as required by the AHJ).
 - c. 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.
 6. Purge/Smoke Control
 - a. Smoke control panels shall be UUKL listed specifically for smoke control operation to allow the smoke purge control to be housed in the FACP cabinet. The smoke control switches shall be located behind a locked glass door.
 - b. Where required, each floor shall have a dedicated switch for fan shutdown via a listed addressable control module. Each damper shall also be monitored at the panel for open/close position via control module. This module shall illuminate the associated green LED when the damper is open and the red LED when the damper is closed. The dampers shall be interlocked with the fans to prevent the fan from activating while the damper is closed.
 7. All panel modules shall be supervised for placement and return trouble if damaged or removed.
 8. All WMATA protected premises report to two proprietary supervising station locations, and to the WMATA contracted third party monitoring location. The supervising station locations are located at the Jackson Graham Building and at the Carmen Turner Facility.

D. Device Mounting

1. The entire system shall be installed with aesthetics in mind as approved by WMATA. All control panels and remote annunciators installed in public spaces shall be semi-flush mounted with no exposed conduit or cable trays unless approved by WMATA.
2. All manual pull stations shall be mounted 48 inches above the finished floor, as measured to the handle.
3. Wall-mounted appliances shall be mounted such that the entire lens is not less than 80 in. and not greater than 96 in. above the finished floor. Where low ceiling heights do not permit mounting at a minimum of 80 in., appliances shall be mounted within 6 in. of the ceiling. All audiovisual devices shall have lexan covers in all areas.
4. No area smoke detectors shall be mounted within 36 inches of any HVAC supply, return air register or lighting fixture.
5. 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 guidelines for such devices.
6. 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, elevator recall, shunt trip, sprinkler status points, or door release. Label all addressable modules as to their function.
7. All fire 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 WMATA. Failure to bring such issues to the attention of WMATA shall be the exclusive liability of the installing Contractor.

3.02 CONSTRUCTION

- A. System cable and devices shall be installed and inspected based on Fire Marshal approved drawings. Original contract drawings are for bidding purposes only. The entire system shall be installed 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 herein.
- B. All penetration of floor slabs and firewalls shall be sleeved (1" conduit minimum) fire stopped in accordance with all local fire codes.
- C. The existing fire alarm system shall remain in operation until such time that approval has been granted for its removal.
- D. After acceptance of the new building fire alarm system, the installing Contractor shall be responsible for the removal of entire existing fire alarm system components and controls, upon approval of the AHJ and WMATA. WMATA reserves the right to retain any existing fire alarm system components, upon their request. All existing fire alarm system components requiring special handling for disposal (due to radioactivity) shall be the responsibility of the installing contractor.
- E. Prior to commencement and after completion of work notify Authorities Having Jurisdiction

3.03 FIELD/SITE 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 III fire alarm technicians dedicated to this project.
- C. The Installing Contractor and the Fire Alarm System Vendor shall, upon the request of the Consulting Engineer or WMATA 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 WMATA construction manager, the installing contractor shall be responsible for the cleaning of all smoke detectors prior to final acceptance.

3.04 SYSTEM STARTUP

A. Tests

1. The fire alarm system vendor shall test the system in accordance with the manufacturer's requirements and NFPA 72. The vendor shall provide final acceptance test reports to WMATA for review and approval prior to final acceptance.
2. Each individual system operation on a circuit by circuit basis shall be tested for its complete operation in accordance with NFPA 72 (2010ed.), Table 14.4.2.2 (see appropriate section from other editions). The procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the Engineer and the manufacturer.
3. Provide a NFPA 72 System Record of Completion Form for each part of the fire alarm system as required.

3.05 CLOSEOUT ACTIVITIES

A. Documentation and Training

1. The contractor shall compile and provide to WMATA a 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. An operational Video, on DVD media, shall also be included.
2. The Contractor shall provide the onsite services of a manufacturer's trained representative for two (2) separate calendar days for a period of eight (8) hours per day to instruct the WMATA's designated personnel on the operation and maintenance of the entire system.
3. Submit letter of approval for installation before requesting acceptance of system.

B. As-built Drawings

1. Revise existing drawings to incorporate contract work.
2. Point-to-point depiction of all device wiring on the device layout floor plans.
3. Full size, as-built drawings.
4. All drawings should be readable and printable in 11 x 17.
5. Provide electronic copies in AutoCAD and PDF.
6. Provide one copy inside PVC pipe next to FACP.

3.06 MAINTENANCE

- A. Provide a coded one-man walk test feature. Allow audible or silent testing. Signal alarms and troubles during test. Ensure 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, NFPA 72 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. WMATA shall retain complete rights and ownership to all software running in the system. The fire alarm equipment vendor shall provide useable hard and soft copies of the software database to WMATA 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.

END OF SECTION