
SECTION 28 31 00 EXISTING ADDRESSABLE FIRE ALARM SYSTEM WORK

PART 1 - GENERAL

- 1.1 This document includes the work required for the addition of wiring and devices to the existing addressable fire alarm system. .
- 1.2 The fire alarm system shall comply with applicable provisions of the NC Building Code, NFPA 70 - National Electrical Code (NEC), NC Fire Code, and NFPA 72 -National Fire Alarm and Signaling Code. The Contractor shall furnish all parts, materials, and labor customarily required or provided for a complete and operating system, in accordance with all requirements applicable, even if each needed item is not specifically shown or described in the project plans or specifications.
- 1.3 Systems have a separate and independent source of secondary power. Systems shall have a minimum of 60 hours battery power capacity, plus 15 minutes of full alarm load. If required for the added components, upgrade the existing batteries.
- 1.4 QUALITY ASSURANCE
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products are Listed and Labeled. Products of firms that do not maintain factory authorized service organization and spare parts stock are not acceptable for use.
 - B. Devices shall be new to match the existing manufacturer of the addressable fire alarm control panel. See plans for existing fire alarm control panel manufacturer and model numbers.
 - C. Installer's Qualifications: Company specializing in performing the work and making the final terminations and connections. Minimum of 5 years documented experience installing fire detection and alarm systems similar in size and scope to the project. Only the Installer may make program changes and must be present for the 100% test, Designer's pre-final review and Owner inspections.
 - D. All connections to the FACP and the system's programming shall be done only by the manufacturer, or by an authorized distributor that stocks a full complement of spare parts for the system. The technicians are required to be trained and individually certified by the manufacturer, for the FACP model/series being installed. This training and certification must have occurred within the most recent 24 months, except that a NICET Level III certification will extend this to 36 months. Copies of the certifications must be part of the Shop Drawing submittal to the Designers, prior to installation. The submittal cannot be approved without this information.
 - E. The person that programmed the system must be present for the Engineer's (and local fire marshal) final inspection.
 - F. NFPA Compliance: Comply with applicable requirements of NFPA-72, National Fire Alarm and Signaling Code.
 - G. NEC Compliance: Comply with applicable requirements of NFPA-70, National Electrical Code (NEC) standards pertaining to fire alarm systems.

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- H. Comply with applicable requirements of NC Building Code and NC Fire Code.
 - I. Testing Laboratory Compliance: Comply with provisions of UL safety standards pertaining to fire alarm systems. Provide products and components which are Listed and Labeled.
 - J. FM Compliance: Provide fire alarm systems and accessories which are FM approved.
- 1.5 Definitions:
- A. Authority Having Jurisdiction (AHJ).
 - a. The AHJ for code compliance is the engineer of record and the North Carolina State Construction Office. The contractor shall coordinate all permits and site inspections with the AHJ.
 - B. Fire Alarm Control Panel (FACP) - Also called a Fire Alarm Control Unit (FACU) by some entities. See requirements in Part B.
 - C. Remote Annunciator (FAA) – Provides LCD display with a text statement of the panel status and/or LED lamps to indicate the status of the fire alarm system. It is provided to assist fire fighters who respond to a call and to assist technicians who respond to a trouble condition.
 - D. Graphic Annunciator (GA) – Used to provide information regarding the status of detection, sprinkler, and supervisor devices by zone and or floor of the building.
- 1.6 Submittals
- A. Submittals shall address interface with other significant electrical subsystems (e.g., electrically controlled smoke dampers, door holders, smoke evacuation and smoke control systems, security lock door hardware, etc.).
 - B. Shop Drawings:
 - 1. The fire alarm contractor shall submit complete Shop Drawings to the engineer for review, prior to performing any work. They shall clearly demonstrate compliance with the engineer's plans and specifications, which have a System Response Matrix showing the fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal. Any non-compliant features must be fully described. Shop drawing submittals shall provide mA draw for each device submitted and the listed minimum voltage required to operate. Panel submittal shall list voltage drop allowed for panel and for individual NAC circuits.
 - 2. The submitted shop drawings shall show equipment, device identification numbers and locations, and connecting wiring of entire fire alarm system. Include wiring and riser diagrams. Wiring diagrams shall be based on the project floor plans, with devices and proposed conduit routing. The conductor composition for each conduit section shall be provided. The distance and route for each NAC (Notification Appliance Circuit) shall be shown. Riser diagrams shall show consecutive connections for all devices with addresses and candela and Candela ratings.
 - 3. Engineer's approval (with or without corrections) of contractor's Shop Drawings, samples, cut sheets, etc., is for general conformance with the contract documents and design

concept. It shall not relieve the contractor of responsibility for full compliance with the project plans and specifications, EXCEPT for any specific non-compliant features for which the engineer gives written authorization.

4. Installation Instructions: The contractor shall submit to the engineer of record the Manufacturer's detailed installation instruction for the Fire Alarm Control Panel and all duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.
5. Battery and Voltage Drop Calculations:
 - a. Include a copy of system battery sizing calculations with the shop drawing submittal to the engineer. Use manufacturer's battery discharge curve to determine expected battery voltage after 60 hours of providing standby power. Then use calculated Notification Appliance Circuit current draw in the alarm mode to determine expected voltage drop at End of the Line Resistor (EOL), based on conductor resistance per conductor manufacturer's data sheet or NEC.
 - b. Fire Alarm Vendor's calculations must be submitted with the shop drawings, and prior to installation of equipment. (Buildings without generators require minimum 60 hours of battery backup to cover the weekends and major power outages. Buildings with generators require minimum 24-hour battery backup.) In the submittal package identify Notification Appliance Circuits (NAC) current draws and voltage drops for each circuit. Vendor must utilize the "end offline" method for voltage drop calculations. The "mid-point" method is not acceptable. In no case shall the calculated voltage at any notification appliance fall below the minimum listed operating voltage for the devices used.
 - c. The voltage drop at EOL must not exceed 14% of the expected battery voltage, after the required standby time plus alarm time. (Typically, for a 24-volt system, this limits the voltage drop from the battery to the EOL to 3 volts). Determine "worst case" voltage at far end of each NAC, by subtracting its calculated V-drop from the expected battery voltage. The result must be no less than the minimum listed operating voltage for the alarm notification appliances used. All these calculations must be placed on a dedicated sheet of as-built drawings, for future reference by fire alarm service technicians.
 - d. Provide copies of battery and voltage drop calculations at final inspection.
6. Maintenance Data: The contractor shall submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual.
7. Maintenance Contract: The contractor shall submit a quote for a maintenance contract to provide all maintenance, test, and repair described below and/or in accordance with NFPA-72, "Guide for Testing Protection Signaling Systems". Also include a quote for unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment, and response travel costs. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of two (2) years after expiration of the guaranty. Maintenance and testing shall be on a semiannual basis or as required whichever is the most restrictive. A preventive

maintenance schedule shall be provided by the Contractor that shall describe the protocol for preventive maintenance. The schedule shall include:

- a. Inspection and testing of the fire alarm system in accordance with the requirements of NFPA 72 Chapter 14
8. Certifications:
- a. Submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses, and telephone numbers in the certification.
 - b. Installer's training certificate as defined under Quality Assurance.

PART 2 - PRODUCT

2.1 FIRE ALARM CONTROL PANEL (FACP)

- A. FACP - General: The FACP's are existing to remain.
1. Signal Line Circuits: (SLC) also called addressable loop - Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto an NFPA Style 6 (Class A) Signaling Line Circuit (SLC) with no "T" taps.
 2. Initiation Device Circuits: Initiation Device Circuits (IDC) shall be wired Class A (NFPA 72 Style D).
 3. Notification Appliance Circuits: Notification appliance circuits shall be wired Class B (NFPA 72 Style Y).
 4. Loss of Power: Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
- B. System Response to an Alarm Condition: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
1. The system alarm LED shall flash.
 2. A local piezo-electric signal in the control panel shall sound.
 3. An LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 4. On systems equipped with a printer, printing and history storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
 5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm

notification appliances and/or relays) shall be activated. Exact programming shall be provided by the Contractor to meet the Owner's requirements.

6. Detect activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
 7. Activate all fire alarm Notification Appliances in the building, sounding, and flashing in synchronization continuously until the initiating device and control unit have been reset to normal condition.
 8. Activate digital alarm communicator.
 9. Deactivate door hold control relay such that all smoke doors are allowed to close.
 10. Deactivate control relays so that HVAC units shut down. Exception is for hazardous exhaust systems and smoke control.
 11. Activate elevator recall sequence if smoke is detected in any elevator lobby, shaft, or in the elevator equipment room.
 12. Activate control relay(s) to release all magnetically locked egress doors.
- C. System Response to a Trouble Condition:
1. Systems AC power trouble signal shall not be sent unless maintained for 1 to 3 hours (or more) Provide additional relays as required for this purpose.
 2. Provide immediate transmission of all other supervising signals.
 3. Provide adjustable time delay for all other trouble signals prior to transmission.
- D. System Capacity and General Operation: The system shall have the following capacities and general operation modes:
1. All programming or editing of the existing program in the system shall be achieved with a personal computer on site. A copy of the database shall be left in the Document Box per NFPA 72.
 2. Notification Appliance Circuits with 20% spare capacity.
- E. Remote Transmissions: The Digital Alarm Communications Transmitter (DACT) is existing.
- F. Power Supply: The FACP power supplies shall operate on 120 VAC, 60 Hz and shall have a continuous rating adequate to power all equipment and functions in full alarm continuously. All modules and drivers must be able to withstand prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage. Further, the power supply shall be expandable for additional notification appliance power in 3.0 Ampere increments.
- G. The power supply shall provide a battery charger using dual rate charging techniques for fast battery recharge.

- H. Batteries: Shall be completely maintenance free, shall not require liquids, fluid level checks or refilling, and shall not be capable of producing spills and/or leaks. Batteries shall be sealed gel-cell type with expected life of 10 years. Battery voltage shall be as required by the FACP and related equipment. Battery shall have enough capacity to power the fire alarm system for not less than 60 hours plus 15 minutes of alarm upon a normal AC power failure. NAC circuits shall not exceed 75% of maximum current load allowed. (For batteries serving emergency voice communications the duration of alarm reserve shall be 15 minutes in lieu of 5 minutes)

2.2 ALARM APPLIANCES

- A. Programmable Electronic Sounders: Sounders located outdoors shall be listed for use in wet locations. Electric sounders shall operate with synchronized audible output and have the following specifications:
1. Voltage: Programmable electronic sounders shall operate on 24 VDC nominal.
 2. Programming: Electronic Sounders shall provide the ANSI S3.41 three-pulse temporal pattern audible evacuation signal, described in NFPA 72, with an output sound level of at least 90 dBA measured at 10 feet from the device. Output sound level shall be 110 dB maximum. Electronic Sounders shall be field programmable without the use of special tools.
- B. Strobe Lights shall be located as shown on the Drawings. Strobe lights indicated for use exterior to the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall operate with synchronized flash output and have the following specifications:
1. Voltage: Strobe lights shall operate on 24 VDC nominal.
 2. Maximum pulse duration: 2/10ths of one second.
 3. Strobe intensity and flash rate: Must meet minimum requirements of UL 1971. Provide strobe lights with minimum intensity Candela (Cd) rating of 15 Cd, or greater if such is indicated adjacent to the device symbol on the Drawings. The Fire Alarm Contractor shall verify all candela settings prior to conducting the voltage drop testing required later in this document. Contractor shall also verify the design candela settings are adequate for the space being covered. Care must be taken to assure the devices are mounted in the exact locations shown on the approved shop drawing documents. Notify the designer of any deficiencies.
- C. Horns: Where provided, shall provide average ambient sound level of 15 dBA as listed in the NFPA 72.
- D. Horns and sounder bases in bedrooms or other sleeping rooms shall operate at 520-Hz with frequency tolerance permitted in NFPA 72.
- E. Audible/Visual Combination Devices shall comply with all applicable requirements for both Programmable Electronic Sounders and Strobe Lights.
- F. Bells shall be 10" diameter vibrating type located as shown on the Drawings; bells located outdoors shall be listed for use in wet locations. Bells shall have the following specifications: Voltage: Bells shall operate on 24 VDC nominal.

2.3 INITIATING DEVICES

- A. Addressable Devices - General: All initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:
1. All addressable spot type and duct smoke detectors shall be the analog type, and the alarm system shall automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors. This feature must be armed, and sensitivities set prior to acceptance of the system.
 2. Address Setting: Addressable devices shall provide an address-setting means.
 3. Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with minimum two (2) wires.
 4. Operational Indications: Addressable smoke and heat detectors shall provide dual LEDs. LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. The flashing mode operation of the detector LEDs shall be optional through the system field program.
 5. Intelligent Initiation Devices: All smoke detectors shall be the "intelligent" in that smoke detector sensitivity shall be set through the FACP and shall be adjustable in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP on a time-of-day basis. Using software in the FACP, detectors shall be capable of automatically compensating for dust accumulation and other slow environmental changes that may affect performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
 6. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtails.
 7. Device mounting Base: Unless otherwise specified all detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
 8. Sounder Base: Provide bases with a built-in (local) sounder rated at 85 dBA minimum, measured at 10ft. Configure sounder bases such that sounders are activated under conditions as described in the Matrix. Provide low frequency sounder bases in sleeping areas.
 9. Test Means: The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel when in the "test" condition. Actual or synthetic smoke must be used during the 100% testing to assure smoke entry into the sensing chamber.
 10. Device Identification: Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device.
- B. Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

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- C. Ionization Smoke Detector: Ionization smoke detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.
- D. Thermal Detectors: Thermal Detectors shall be intelligent addressable devices rated at 135°F (58°C) and shall have a rate-of-rise element rated at 15° F. (9.4°C) per minute. It shall connect via minimum two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop. Thermal detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.
1. Non-Rate of Rise Detectors: Provide thermal detectors with non-rate of rise thermal elements. Non-rate of rise detectors is indicated by NRR adjacent to the thermal detector symbol. Where used in elevator machine rooms or hoist ways, select temperature rating nominal 10 degrees F less than the adjacent fire sprinkler.
 2. Specialized Element Temperature Ratings: Provide thermal detectors with specialized element temperature ratings. Specialized element temperatures are indicated by a temperature rating adjacent to the thermal detector symbol, e.g., 195°F.
- E. Multi-sensor Detectors: Detectors employ two or more of the above detection types with integrated operating principals, mounted in a single housing. The outputs of the analog sensors shall be transformed into digital signals that are combined and processed by special algorithms. The computations shall be designed to discriminate between normal ambient changes in a building and those changes associated with a fire. //Provide photoelectric smoke detection and rate of rise thermal detection. //Provide photoelectric smoke detection, ionization smoke detection and rate of rise thermal detection. //
- F. Duct Smoke Detector: In-Duct Smoke Detector Housings shall accommodate a velocity rated photoelectric detector. The device, independent of the type used, shall provide continuous analog monitoring and alarm verification from the panel. When enough smoke is sensed, a supervisory or alarm signal shall be initiated at the FACP. Coordinate with owner for response appropriate for the location.
- G. Addressable Pull Stations - General: Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except using a key. All pull stations shall be dual action, have a positive, visual indication of operation, and utilize a key type reset. The Glass-break rods are not allowed. Mount pull station with operating mechanism between 42-inches and 48-inches above finished floor.

2.4 MISCELLANEOUS SYSTEM ITEMS

- A. Addressable Dry Contact Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised zone (either Style D or Style B) of non-addressable Alarm Initiating Devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.

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1. Indication of Operation: An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
 2. Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler switch.
- B. Two Wire Detector Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone, Class B (Style D or B operation) of non-addressable 2- wire smoke detectors or alarm initiating devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings. Indication of Operation: Unless otherwise indicated on the Drawings. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
- C. Addressable Control Module: Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. The control module shall provide address-setting means. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel. If the voltage being controlled is 120 VAC or greater, an isolating 24 VDC relay shall be used.
1. Configuration: The control module NAC circuit may be wired for (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires. Designer shall confirm the relay contacts are rated for the attached load.
 2. Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, 3rd party listed remote power supply. A/V power sources and connections are not shown on the Drawings.
- D. Isolator Module: Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop to 20 addressable devices. Modules must be readily accessible (not above ceiling) and clearly labeled.
1. Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module's operations shall be totally automatic.
 2. The Isolator Modules shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

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- E. Serially Connected Remote Annunciator: Annunciator shall communicate with the fire alarm control panel via an EIA-485 communications loop (four-wire) and shall individually annunciate all zones in the system. System zones shall be as indicated on the Drawings. Up to 10 annunciators may be connected to the EIA-485 communications loop.
1. Annunciator Indicators: The annunciator shall provide a red Alarm LED per zone, and a yellow Trouble LED per zone. The annunciator shall also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom zone/function identification labels. Annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, and Global System Reset. All annunciator switches and indicators shall be software programmable.
 2. LCD Alphanumeric Display Annunciator: The Alphanumeric Display Annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text. The LCD Annunciator shall display all alarms and trouble conditions in the system.
 3. System Capacity: The system shall allow a minimum of four LCD annunciators. In addition to annunciation functions, each LCD annunciator shall be capable of the following software programmed system functions: Acknowledge, Signal Silence and Reset.
 4. Connections: The annunciator shall connect to a two-wire EIA-485 interface. The two-wire connection shall be capable operation at distances of 6,000 feet. Provide interface to fiber optic cable systems and/or repeater units where such are indicated on the Drawings.
- F. Remote Annunciator Indicator Lights (RAIL): RAILs shall be provided with a key type switch for testing of the annunciated device. In addition. RAILs shall have the following features: Voltage: RAILs shall operate on 24 VDC nominal.
- G. Battery Power Supply (BPS) &/or Supplementary Notification Appliance Circuit (SNAC): These types of panels shall be completely maintenance free, shall not require liquids, fluid level checks or refilling, and shall not be capable of producing spills and/or leaks. Batteries shall be sealed gel-cell type with expected life of 10 years. Battery voltage shall be as required by the FACP and related equipment. Battery shall have sufficient capacity to power the fire alarm system for not less than 60 hours plus 15 minutes of alarm upon a normal AC power failure. Battery cabinet shall be twice the size of the batteries it will contain. NAC circuits shall not exceed 75% of maximum current load allowed.
- H. Surge Protection: The following protection against voltage transients and surges must be provided by the fire alarm equipment supplier, and installed by the electrical contractor:
1. On AC Input: A feed-through (not shunt-type) branch circuit transient suppressor such as Leviton 51020-WM-DIN, or Ditek DTK-120SRD 20 Amp or equivalent UL 1449 - Latest Edition Listed device.
 2. On DC Circuits Extending Outside Building: At a point near entry to the building provide "pi"- type filter on each leg, consisting of a primary arrestor, series impedance, and a fast-acting secondary arrestor that clamps at 30v-40v.

Some acceptable models: Simplex 2081-9027, Simplex 2081-9028, Transtector TSP8601, Ditek DTK 2MHLP24BWB series, Citel America B280-24V, and Northern Technologies DLP-42.

Submit data on others to the engineer for approval. UL 497B listing is normally a prerequisite for their consideration. Devices using only MOV active elements are not acceptable.

2.5 Wiring

- A. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. Belden 5320FJ acceptable if only FPL rating needed. The cable jacket color shall be red, with red (+) and black (-) conductor insulation.
 - 1. Unshielded cable, otherwise equal to the above, is permitted to be used if the manufacturer's installation manual requires, or states preference for, unshielded cable.
 - 2. In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.

PART 3 - EXECUTION

3.1 FIRE ALARM SYSTEM:

- A. The fire alarm system shall be new and furnished with a warranty (parts & labor) of at least one year from the date of beneficial occupancy or final inspection by SCO and Owner. Equipment, initiating devices, and alarm appliances shall be arranged, and the annunciator zones shall be configured as described by the engineer's written specifications.
- B. All equipment supplied must be specifically listed for its intended use and shall be installed in accordance with the manufacture's recommendations. The contractor shall consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Contractor shall refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.
- C. Do not locate addressable modules in unconditioned spaces.
- D. All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure. See Symbol sheet.
- E. When programming the system, activate the automatic drift compensation feature for all spot type smoke detectors. Systems with alarm verification are not to have this feature activated without written direction from the owner's representative or the AHJ. Alarm verification must not be used with multi-sensor/multi-criteria detectors under any circumstances, as inadequate system response may result.

- F. Set spot-type smoke detector sensitivities to normal/medium, unless directed otherwise by the design engineer/owner's rep.
- G. Print a complete System Status and Programming Report after the above steps have been done. This must include the program settings for each alarm initiating device and the current sensitivity of each analog addressable smoke detector. This documentation shall be provided at the SCO inspection.

3.2 FIRE ALARM CONTROL EQUIPMENT INSTALLATION

- A. The technician who makes final connections and programs the FACP is the "installer" even though most field connections to system devices and appliances are normally made by electrical contractor personnel. The responsibility for assuring a proper installation overall rests with this individual fire alarm system technician. In addition to doing the final hookups and activating the system, this individual is expected to check the field connections to assure all work is properly done. The absence of system "trouble" signals is not an adequate measure of the field wiring, which could have "T" taps, the wrong type of wire, improper terminations, ground (drain wire) issues, etc.
- B. Notification Appliance Circuit booster power supplies must be individually monitored by the FACP and protected by a smoke detector per NFPA 72. They shall not be located above a ceiling, or in non- conditioned space. A 24vdc power circuit serving addressable control relays must also be monitored for integrity. All fire alarm power supplies shall have 120-volts surge suppressors.
- C. Basic operating instructions shall be framed and permanently mounted at the FACP. (If the owner concurs, they may instead be affixed to the inside of the FACP's door.) In addition, the NFPA 72 "Record of Completion" must either be kept at the FACP, or its location shall be permanently indicated there by an engraved label. All System documentation shall be provided and housed in a Documentation Cabinet at the control panel or other approved location. (Per 2013 NFPA 72: 7.7.2)
- D. Provide an engraved label on outside of the FACP door identifying its 120-vac power source, as follows: Panelboard location, panelboard identification, and branch circuit number. On inside of FACP door, indicate panelboard location.
- E. Alarm notification appliances (audible and visible) are to comply with NFPA 72, the North Carolina Building Code, and ANSI 117 criteria for intensity and placement. The standard audible evacuation signal is the ANSI S3.41 three-pulse temporal pattern. All strobe lights installed in a single space must be synchronized. Devices can be mounted on the ceiling. Wall mounted devices shall be mounted with the entire lens between 80" minimum and 96" maximum off finished floor. See the NFPA 72 for additional alarm notification appliance requirements for special situations.

3.3 SURGE PROTECTION

- A. For each AC power circuit that interfaces with fire alarm equipment, install an AC suppressor in a listed enclosure near the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns, about 1" diameter, and securely tie-wrapped. This series impedance will improve the effectiveness of the suppressor in clipping fast rise time voltage transients.

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- B. On DC Circuits Extending Outside Building: Install the surge arrestor in a labeled enclosure near the point of entry to or exit from each building.

3.4 SIGNALING LINE CIRCUITS

- A. One loop per floor for signaling-line circuits. Outgoing and return loops must be in separate raceways per 2013 NFPA 72. (12.3.7) Provide isolation modules (or isolator bases) along each SLC (addressable loop). 20 devices max between ISO's.

3.5 AC POWER

- A. Systems are to be provided with a separate and independent source of emergency power. Switching to emergency power during alarm shall not cause signal drop-out. Batteries must meet the appropriate NFPA capacity requirements, with a 25% safety factor. This requirement is in effect even if generator power is supplied to the Fire Alarm Control Panel.
- B. The branch circuit breaker(s) supplying the system must be physically protected by a breaker handle lock-on device and each must be identified with a 1/4" permanent red dot applied to handle or exposed body area.
- C. Provide an engraved label at each fire alarm system control unit, system sub-panel or data gathering panel, supplementary notification appliance (SNAC) panel, digital alarm communicator, etc. identifying the panel location, panel name, and breaker number for the 120VAC circuit. Example:

Electrical Rm 120 Panel EP1

Circuit 22

- D. The fire alarm system shall monitor 120-VAC power to shunt trip breakers used in conjunction with fire suppression systems. Examples include a shunt trip used for cooking appliance power shut-off when the kitchen hood fire suppression system shoots, or primary elevator power shut-down upon heat detector activation in sprinkled hoist ways or machine rooms. Use an addressable monitor module to accomplish this supervisory function. Provide a breaker handle lock-on device on circuits used for shunt trip power.

3.6 CONDUIT AND WIRING

- A. The exterior of all junction boxes containing fire alarm conductors shall be painted red; box interiors shall not be painted. Box covers for junction boxes containing fire alarm conductors shall be painted red on both sides.
- B. Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained therein. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.
- C. All fire alarm system wiring shall be in metal conduit or surface metal raceway. All fire alarm system raceway, couplers, and connectors must meet the performance and installation requirements of Electrical Specification Section "RACEWAYS".

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1. Cable size and the requirement to maintain a Class "A" or Class "X" loop on all Signaling Line Circuits cause conduit fill to exceed specified maximums for the 1/2" size; therefore, 3/4" raceway should be used.
 2. PVC conduit is permitted to be used underground, in concrete, and in locations approved by the AHJ.
- D. All conduits that penetrate outside walls from air-conditioned space must have internal sealing (duct- seal), to prevent condensation from infiltrating humid air.
- E. All wiring shall be color coded. All the circuits in the system shall be wired with AWG 14, minimum, stranded copper, THHN/THWN conductor, installed in metallic conduits. Color Coded wires shall be in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run:
1. Initiating Circuits, General ----- Red (+)/White (-)
 2. Initiating Circuits, Smoke Only ----- Violet (+)/Gray (-)
 3. Signal Line Circuit cable ----- Red jacket with Red (+)/Black (-)
 4. Alarm Indicating Appliance Circuits ----- Blue (+)/Black (-)
 5. AHU Shutdown Circuits ----- Yellow (+)/Brown (-)
 6. Door Control Circuits ----- Orange
 7. Elevator Capture Circuits ----- Brown
- F. To minimize wiring fault impact, isolation modules shall be provided in all the locations listed below. If ceiling height ≤ 10 feet, isolator base type initiating devices are permitted to be used to satisfy any or all the following.
1. In or immediately adjacent to the FACP, at each end of the addressable loop. These two isolators must be in the same room and within 15 feet of the FACP.
 2. After each 20 initiating devices and control points on the addressable loop, or a lesser number where recommended by the manufacturer. (Check instructions.)
 3. For loops with less than 20 devices and control points, install an isolator at the approximate middle of the loop (in addition to those at the FACP).
 4. Near the point any addressable circuit extends outside the building, except for those attached to the building exterior walls and well sheltered by walkways.
 5. For loops covering more than one floor, install isolator at terminal cabinet on each floor (with additional isolator[s] on any floor with over 20 addresses).
 6. Each isolation module must be clearly labeled, readily accessible for convenient inspection (not above a lay-in ceiling), and shown on as-built drawings.

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- G. Detection or alarm circuits must not be included in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power must be properly separated by a minimum of .25 inches per NEC, from other circuits, and the enclosure must have an appropriate warning label, to alert service personnel to the potential hazard. See NEC 760.136.
 - H. Class A or X Circuits Required: Systems with one or more addressable sub-panels that (1) have an integral addressable loop controller, or (2) monitor multiple non-addressable initiation zones, shall comply with the NFPA 72 requirements for Class "A" or "X" circuits for their networking cables.
 - I. There shall be no splices in the system other than at device terminal blocks, or on terminal blocks in cabinets. "Wire nuts" and crimp splices will not be permitted. Permanent wire markers shall be used to identify all connections at the FACP and other control equipment, at power supplies, and in terminal cabinets. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.
 - J. In multistory buildings, all circuits leaving the riser on each floor shall feed through a labeled terminal block in a hinged enclosure accessible from the floor. If building layout requires the terminal cabinet to be above a drop ceiling, its location must be clearly and permanently identified with a placard readable from floor. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.
 - K. All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be ten (10) megohms, as verified with an insulation tester. Provide advanced notice to the Engineer of record of these tests.
 - L. The system shall be electrically supervised for open or (+/-) ground fault conditions in SLC, alarm circuits, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.

3.7 ADDRESSABLE PULL STATIONS

- A. Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except using a key. All pull stations shall be dual action, have a positive, visual indication of operation, and utilize a key type reset. Glass-break rods are not allowed. Mount pull station with operating mechanism between 42-inches and 48-inches above finished floor.

3.8 NOTIFICATION DEVICES

- A. Both audible and visible alarm signals shall be provided. Visible signals for fire alarm must be the strobe (flash discharge) type, with white or clear lens, and shall comply with current ADA requirements for intensity and placement.
- B. Alarm notification appliance (NAC) circuits shall be NFPA 72 Class "A" or Class "B". The load connected to each circuit must not exceed 80% of rated module output. The NAC voltage drop during alarm must not exceed 14% of the voltage measured across the batteries at that time.

To achieve this, the design must consider wire size, length of circuit, device load, inherent voltage loss within the FACP power supply, etc. The contractor shall use power outage testing to verify that the NAC circuit was designed and installed properly.

- C. The location of all end of line devices shall be labeled on the device, with NAC panel number and NAC circuit number, and recorded on the "As-built" drawings. EOL shall not be located more than 12-feet above finished floor.

3.9 DETECTORS

- A. The FACP and all other control equipment locations, including any transponders, sub-panels, and booster power supplies, must be protected by a spot type smoke detector located within 15 feet of the equipment (measured horizontally).
- B. When installed in a room, detectors shall be oriented, so their alarm light is visible from the nearest door to the corridor, unless Remote Alarm Indicator Light (RAIL) is equipped.
- C. Spot-type smoke detectors shall secure the head to the base thru the built-in locking device. For detector mounted within 12 feet of the floor, activate this lock after the system has been inspected and given final acceptance.
- D. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors must be replaced by the contractor at no additional cost to the Owner. Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and must not be used for that purpose. They are suitable only during final, minor cleanup or touchup operations.
- E. A detector installed where accidental damage or deliberate abuse is expected shall be provided with a guard that is listed for use with it and is acceptable to the AHJ.
- F. Identification of individual detectors is required. Assign each a unique number as follows, in sequence starting at the FACP: (Addressable Loop # -- Device #) Show on the as-built plans, and permanently mount on each detector's base so that it is readable standing on the floor below without having to remove the smoke detector. Exception: For detectors with housings (i.e., air duct, projected beam, air sampling, flame), apply the identification to a suitable location on exterior of their housing. Device labels may not be affixed to the device. Identification labels must be printed labels with black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.
- G. Addressable Interface Modules (control and monitor modules)
 - 1. Addressable interface modules (used to monitor all contact type initiating devices) must be in a conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location.
 - 2. One module may serve as many as 6 heat detectors, in a single space.

3.10 DUCT MOUNTED SMOKE DETECTORS

- A. All air duct/plenum detectors must have a Remote Alarm Indicator Lamp with test switch (RAILS) installed in the nearest corridor or public area and identified by an engraved label

affixed to the wall or ceiling. Duct smoke detectors are permitted to be installed only inside an air duct. It is not appropriate to mount them in front of a return air opening. Duct detectors shall also be installed in a manner that provides suitable, convenient access for required periodic cleaning and calibration. The numbers of detectors per duct shall be per NFPA 72 requirements based on the size of the air duct, air duct configuration, air speed, and duct manufacture's installation requirements.

- B. Each duct detector installation shall have a hinged or latched duct access panel, 12x12 inches minimum, for sampling tube inspection and cleaning. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.
- C. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with far end support for stability.
 - 1. The preferred method for providing support is to extend the intake tube through the far side of the duct, seal around the tube where it penetrates the duct wall and plug the end with a rubber stopper. This facilitates visual inspection and intake tube cleaning.
- D. Duct smoke detector mounting position and air sampling tube orientation are critical for proper operation. The Manufacturer's detailed installation instructions must be followed. The contractor shall mark the direction of air flow on the duct at each duct detector location.
- E. Avoid the use of duct detectors on outside air intakes, as this can lead to nuisance alarms and troubles from moisture and dust.
- F. A fire alarm panel output for a duct detector signal shall be as required by NC Building Codes and NFPA 72.

3.11 FIRE ALARM SYSTEM INSTALLATION AND CONFIGURATION

- A. Supervision required: The connection between individual addressable modules and their contact type initiating device(s) must be supervised.
- B. Graphic Chart must be mounted behind Plexiglas and secured to surface. Mounting shall be such that charts cannot be removed without the proper tools.
- C. Floor Plans with Device Numbers: A copy of the floor plans shall be provided in the Documentation Cabinet at the control panel. A separate sheet shall be provided for each floor. Plans shall be reduced in size from engineering plans in order to fit on 11 x 14 sheets. All device addresses shall be clearly labeled on plans. Indicate locations of all cabinets, modules, and end of line device.
- D. Loop 1 shall be assigned to the lowest level devices and loop number shall increase with floor number. Device numbering starts in the same location on each floor and increase accordingly as circuit location increases.

3.12 SYSTEM DOCUMENTATION, TRAINING, AND MAINTENANCE

- A. Maintenance: The manufacturer, or authorized distributor, must maintain software version (VER) records on the system installed. The system software shall be upgraded free of any charge if a new VER is released during the warranty period. For new VER to correct operating problems, free upgrade shall apply during the entire life of the system.

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- B. System Report In addition to the Shop Drawing submittal described elsewhere, the fire alarm system contractor shall provide the engineer two bound copies of the following technical information, for transmittal to the owner:
1. As-Built wiring diagram showing all loop numbers and device addresses, plus terminal numbers where they connect to control equipment.
 2. As-built wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing all interconnections in the system.
 3. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
 4. Manufacturer detailed maintenance requirement.
 5. Technical literature on all control equipment, isolation modules, power supplies, batteries, detectors, manual stations, alarm/supervisory signal initiating devices, alarm notification appliances, relays, remote alarm transmission means, etc.
 6. The as-built "calculations" sheet.
- C. Electronic archive: Complete configuration data (site-specific programming) for the system must be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A USB drive or CD copy of this data shall be submitted to the engineer for transmission to the owner on the day the system is commissioned. A copy of this site-specific database shall also be placed in the Documentation Cabinet.
- D. The contractor shall provide the owner with one copy of the following:
1. All software required for the installed fire alarm system.
 2. Complete documentation for all software for both the installed fire alarm system and for any interface PC software necessary for system functions as described above.
 3. Framed floor plans mounted at the FACP: Plans shall show all system devices with the unique device identification numbers indicated adjacent to each device. The identification numbers shall match those represented in the as-built drawings and those reported at the FACP and the LCD annunciator. As-built room numbers shall match the signage in the building.
 4. Interconnection cable where such is required to connect the fire alarm system to a PC; (if Owner does not have the needed PC to check the system).
- E. The manufacturer's authorized representative must instruct the owner's designated employees in operation of the system, and in all required periodic maintenance. A minimum of 8 hours on-site time will be allocated for this purpose and, for those facilities operating on a 24-hour basis (prisons, hospitals, etc.) one additional hour of instruction will be individually provided for the 2nd and 3rd shift. Two copies of a written, bound summary will be provided, for future reference.
1. Some facilities maintain their own systems and require more in-depth training. Check to verify needs and requirements.

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2. Scheduling of training must be arranged to meet the Owner's schedule. Additional training shall be available at a cost to be mutually agreed upon by the Owner and the Contractor.
 3. Training shall be in the Owner's provided classroom.
 4. The training may not be waived, deleted, or reduced in the number of hours required.
 5. Training shall cover as minimum the following topics:
 - a. Preventive maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
 - b. Overall system concepts, capabilities, and functions. Training shall be in depth, so that the owner shall be able to take any device out of service and return any device to service without need of Manufacturer's approval or assistance.
 - c. Explanation of all control functions, including training to program and operate the system software.
 - d. Methods and means of troubleshooting and replacement of all field wiring devices.
 - e. Methods and procedures for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry, and interconnections.
 - f. Manuals, drawings, and technical documentation. Actual system software used for training shall be provided in digital form and shall be left with the Owner at the completion of training for the Owner's use in the future. *Training Quote: Provide a quote for one of the owner's Employees to receive factory certification level training on the system being installed. Quote is to include travel, room, and food allowance.

3.13 SPARE PARTS:

- A. The following spare parts shall be provided with the system. For multi-building projects, calculate quantities separately for each building that contains a dedicated fire alarm control panel. If FACP also serves auxiliary buildings (e.g., storage, boiler/chiller), calculate as if one building. Increase decimal quantities to the next higher whole number.

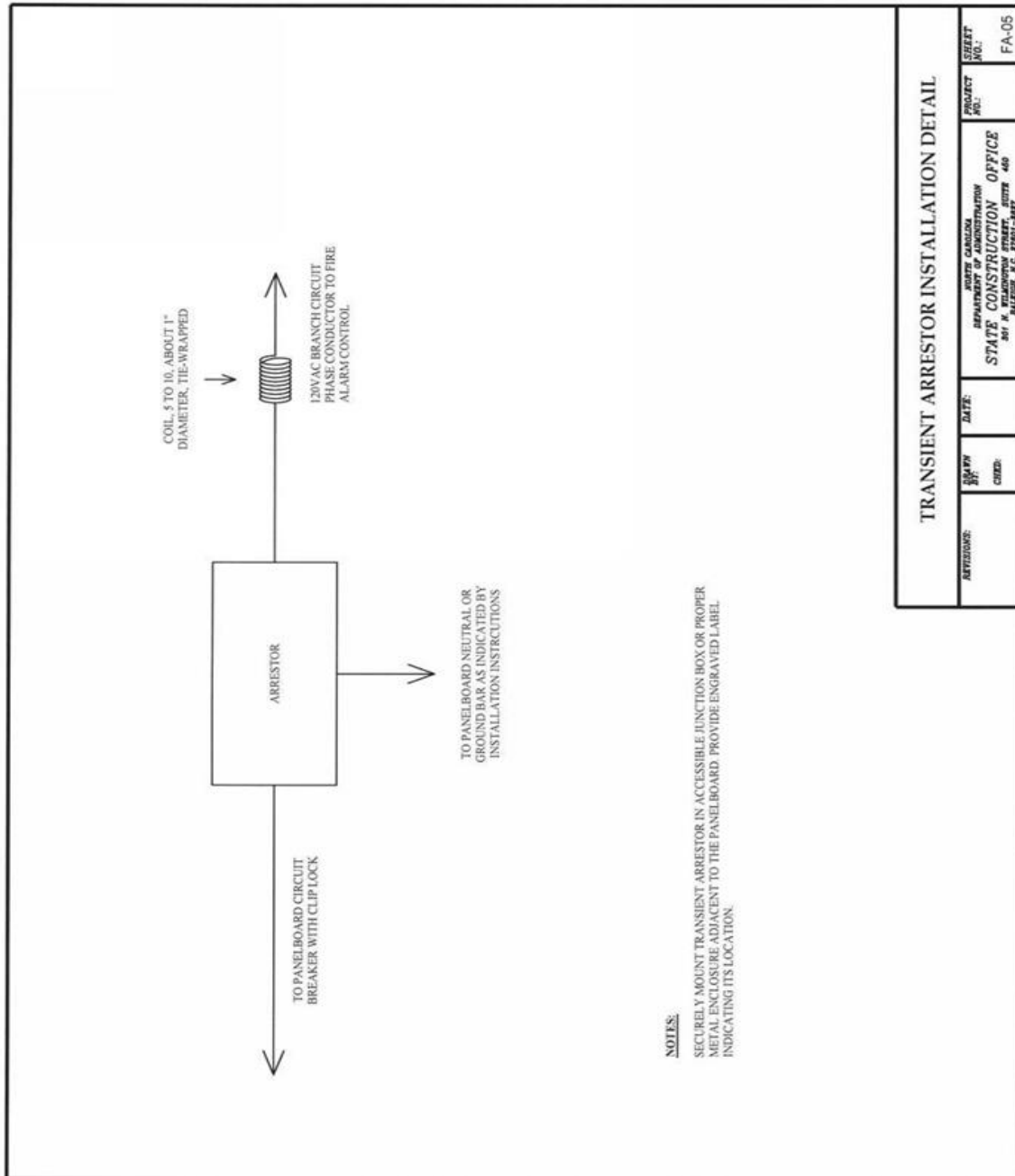
Fuses (If used)	2 of each size in system
Manual Fire Alarm Boxes	2% of installed quantity
Addressable Control Relays	4% of installed quantity
Indoor Horns/Speakers with Strobes Lights	4% of installed quantity
Indoor Strobe-only Notification Appliances	4% of installed quantity
Monitor Modules (Addressable Interface)	4% of installed quantity
Isolation Modules / Isolation Bases	4% of installed quantity
Addressable, Electronic Heat Detectors	4% of installed quantity
Spot-Type Smoke Detectors / Sounder Bases	6% of installed quantity

No spares are required for projected beam, air sampling, or duct smoke detectors.

3.14 SYSTEM TESTING & CERTIFICATION

- A. Upon completion of the installation the Contractor and the Manufacturer's authorized installer and designer together shall conduct a 100% performance test of every alarm initiating device for proper response. The system shall operate for 48 hours prior to start of test. The Contractor shall be present for the full 100% test. The person responsible for programming the system must be present.
- B. The A/E and owner must be given 7 days' notice of the tests. All Audio-Visual Device Testing shall be scheduled with the owner.
- C. 100% Test: The manufacturer or authorized distributor (by definition, "installer") must 100% test all site-specific software functions for the system and then provide a detailed report or check list showing the system's operational matrix. This documentation must be part of the "System Status and Programming Report". Provide an alarm and trouble history printout at the SCO inspection, documenting this 100% test.
 1. Upon completion of the installation and its programming, the installer's technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliances for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire, or smoke doors/dampers/shutters, etc. The engineer shall witness these tests.
 2. If AHU shutdown occurs for any alarm, then the matrix would indicate the specific control relay(s) for that function being commanded to operate for alarm from any initiating device. If a rolling steel fire door is to drop only upon water flow alarm from its sprinkler zone, or upon any two spot smoke detectors in adjacent spaces being simultaneously in alarm, the matrix would show the door's control relay activating upon alarm from the applicable

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- water flow switch(es), or from any two smoke detectors in the selected spaces (AND gate)
3. The digital communicator shall be on-line and tested for proper communication to the receiving station.
 4. All supervised circuits must also be tested to verify proper supervision. (Control circuits and remote annunciation lines are among those required to be supervised.)
 5. All testing described above shall be repeated if subsequent software or wiring modifications are determined necessary to meet the requirements of the contract documents. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.
 6. The contractor and engineer shall verify the voltage drop of each NAC circuit by testing and recording the voltage at the origin and at the EOL for each NAC circuit, under battery power only. Prior to conducting these tests, the contractor shall verify the candela settings of all strobes. Provide documentation of these tests at the SCO final inspection.
- D. Test Documentation: The installer must fill out and submit the following documentation to the owner, through the engineer, prior to the AHJ's system acceptance inspection:
1. Written verification that this 100% system test was done with copy of print out generated during test.
 2. The NFPA 72, "Record of Completion" Form. Use this form (no substitutes) to detail the system installation and to certify that: (a.) It was done per Code, and (b.) The Code required 100% test was performed. The fire alarm installer (manufacturer or authorized distributor's technician) must sign this form. If a representative of the AHJ, owner, or engineer witnesses the tests, in whole or in part, they must also sign the form to signify that fact only (annotating the form as needed to clarify their limited role).
 3. For buildings with a smoke control or smoke purge system, an HVAC balance report, in the smoke control / smoke purge mode.
 4. The System Status and Programming Report described in NFPA 72. This must be generated on the day of the system acceptance inspection and shall include the measured sensitivity of each smoke detector.
 5. The purpose of doing Item (4) on the day of the inspection is to assure detector sensitivity has not been affected by construction dust. Prudent contractors will have taken measures to prevent detector contamination during construction and will also have had the system do a detector sensitivity test and printout prior to the day of the inspection, to make certain all devices are properly programmed and operating within their limits.
- E. After completion of the 100% system test and submission of documentation as described above the installer is to request the engineer to set up an inspection. The system must operate for at least two days prior to this inspection. The responding Fire Department shall be notified of this, for pre- fire planning purposes. On local government projects, local fire authorities may also want to participate in system acceptance inspections. However, for State-owned property they have no inspection jurisdiction and, if present, are only to observe.



END OF SECTION 28 31 00