

## SECTION 28 31 11

### FIRE ALARM AND SMOKE DETECTION SYSTEMS WITH VOICE EVACUATION NOTIFICATION

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Fire Alarm and Smoke Detection Systems with Voice Evacuation Notification.

##### 1.2 REFERENCES

The equipment and installation shall comply with the current provisions of the following codes and standards:

- A. NFPA 70—National Electric Code®.
- B. NFPA 72—National Fire Alarm Code®.
- C. NFPA 90A—Air Conditioning Systems.
- D. NFPA 92A—Smoke Control Systems.
- E. NFPA 92B—Smoke Management Systems in Malls, Atria, and Large Areas.
- F. NFPA 101—Life Safety Code®.
- G. UL 864—Control Units for Fire Protective Signaling Systems.
- H. UL 268—Smoke Detectors for Fire Protective Signaling Systems.
- I. UL 268A—Smoke Detectors for Duct Applications.
- J. UL 217—Single and Multiple Station Smoke Alarms.
- K. UL 521—Heat Detectors for Fire Protective Signaling Systems.
- L. UL 228—Door Closers-Holders, With or Without Integral Smoke Detectors.
- M. UL 464—Audible Signaling Appliances.
- N. UL 38—Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.
- O. UL 346—Waterflow Indicators for Fire Protective Signaling Systems.
- P. UL 1971—Signaling Devices for the Hearing-Impaired.
- Q. UL 1481—Power Supplies for Fire Protective Signaling Systems.
- R. UL 1711—Amplifiers for Fire Protective Signaling Systems.

- S. UL 1635—Digital Alarm Communicator System Units.
- T. Florida Building Code.
- U. FAC Chapter 61C-5—Florida Elevator Safety Code.
- V. FAC 4A-60—Florida Fire Prevention Code.
- W. FADAIA 10/97—Florida ADA Implementation Act.
- X. Federal Codes and Regulations.
- Y. Americans with Disabilities Act (ADA).
- Z. Factory Mutual (FM) Approval.
- AA. International Standards Organization (ISO).
- AB. ISO-9001.
- AC. Florida Fire Prevention Code.

### 1.3 REGULATORY REQUIREMENTS

- A. System: UL listed, Factory Mutual approved.
- B. Conform to requirements of NFPA 101.
- C. UL Listed—UL 1076.

### 1.4 SYSTEM DESCRIPTION

- A. Furnish, install, and place in operating condition an electronically operated fire alarm system, as described herein and shown in the plans. All units on the fire alarm system shall be listed by Underwriters' Laboratories, Inc. for fire alarm use and the control panel shall bear the UL label. The system shall be installed in accordance with requirements set by National Electrical Code and in compliance with applicable provisions of Standard 72 published by the National Fire Protection Association (NFPA).

- B. **Fire Alarm:** The system shall be a microprocessor based, point annunciated, fire alarm system with network monitoring capability and walk-through test capability. The control panel shall provide a pre-recorded voice evacuation message with pre-warning tones. Provide remote manual microphone stations, as shown on drawing. The control panel and each individual component used in conjunction with the system shall be UL listed for its' use. The system shall be totally supervised with a dynamic LCD display. The control panel shall also be able to monitor and receive analog signals from smoke and duct smoke detectors which indicate obscuration rate and set detector sensitivity. The input power shall be 120 volts AC, 60 Hz connected per NFPA 72 and NEC. The operating power shall be by distributed power sources of 24 volts DC and filtered and regulated within 110% of the normal rating. Total power supply capacity shall be 50% greater than the total alarm load. The control panel shall be supervised on the input power line with automatic switch over to battery backup. The battery backup supply shall be capable of powering the system for a minimum of 24 hours and still be capable of energizing all signal devices for a minimum of 15 minutes. Bypass switches shall be provided for gas and air handling unit shutdowns and door holders for alarm drills testing and servicing without the loss of equipment.
- C. **System's Connection:** The control panel shall be capable and wired so that anyone or multiples of fire alarm devices, upon activation, shall sound alarm throughout the entire facility.
- D. **Annunciator:** A remote annunciator shall be provided capable of all the functions of the main fire alarm control panel including bypass switches for gas shutdown, AHU shutdown, and door holders.
- E. **SEQUENCE OF OPERATION:** Upon alarm activation of any area smoke detector, heat detector, manual pull station, or sprinkler waterflow; the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel.
  2. The alarm event shall display on the main control panel(s).
  3. The LCD display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time/date.
  4. All system activities/events shall be documented on the system printer.
  5. Any remote or local annunciator LCDs or LEDs associated with the alarm zone shall be illuminated.
  6. An evacuation message shall be sounded throughout the facility. It shall be the intent of this message to advise occupants hearing this message that they are to evacuate the building, via the quickest route, immediately.
  7. Simultaneously all visual strobes shall operate synchronously. The visual strobe shall continue to flash until the alarm has been acknowledged.
  8. A signal to the building automation system and to the central station with point identification shall be transmitted. Automatic smoke control sequences shall be activated.
  9. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

10. All self-closing fire/smoke doors held open shall be released.
11. Simultaneously all audible notification appliances shall operate throughout the facility. The audible notification appliances shall continue to sound until the alarm has been acknowledged.

#### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in smoke detection and fire alarm systems with five years documented experience.
- B. Installer: Company specializing in smoke detection and fire alarm systems with five years' experience and certified by Florida State Licensing Board as a fire alarm and security system Installing Contractor (EF or EC).

#### 1.6 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1.
- B. Provide wiring diagrams, point to point with voltage drop calculations, data sheets, and equipment ratings, layout, dimensions, finishes, and battery calculations.
- C. Submit manufacturer's installation instructions under provisions of Division 1.
- D. Submit manufacturer's certificate under provisions of Division 1 that system meets or exceeds specified requirements, certification per NFPA 72.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 1.
- B. Store and protect products under provisions of Division 1.

#### 1.8 EXTRA MATERIALS

- A. Provide spare parts under provisions of Division 1.

#### 1.9 CLOSE-OUT DOCUMENTS

- A. Refer to Division 23 Section "Common Work Results for HVAC" for close-out document requirements, including, but not limited to the following:
  1. Operation and Maintenance manuals;
  2. List of Contractors and Parts and Equipment Suppliers—complete with contact person, proper company name, address, and telephone numbers;
  3. All Contractor and Manufacturer warranties;
  4. List of attic stock signed for by Owner;
  5. Training video and training sign-in sheet.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Edwards Systems Technology ANS XXMDR.
- B. Siemens Model FC901-U3/FC901-R3
- C. No Substitutions shall be allowed.

### 2.2 GENERAL

- A. The fire alarm system shall be a Class B analog, addressable system. It shall be capable of remote annunciation.
- B. The system shall be supervised at the control panel and the remote annunciator, so that the operation of any station or device shall sound all alarm signals continuously.
- C. An audible signal shall, also, sound if there is any trouble with the system such as an open circuit, a ground fault, or tamper switch activation for fire sprinkler valves or for Knox box.
- D. The system shall provide for the following:
  - 1. System reset.
  - 2. Remote reset at annunciator where applicable.
  - 3. Ground fault indicator.
  - 4. Lamp test.
  - 5. Trouble silencing.
  - 6. Power on indicator.
  - 7. Separate system visual trouble indicator by zone/circuit.
  - 8. Audible trouble indicator.
  - 9. Alarm silence (located in a keyed-operated locked cabinet).
  - 10. All remote alarm indicators for duct smoke detectors (installed standard switch height) shall be labeled per NFPA 72.
- E. Provide a battery charger module as an integral part of the control panel with a constant trickle charge to maintain emergency power. Battery power shall automatically connect to the alarm system upon failure of the commercial power source.
- F. Provide a remote annunciator that is capable of all control functions for the fire alarm control panel.
- G. In facilities with an elevator, provide an addressable module to monitor the elevator's shunt trip breaker.

- H. In facilities with a fire pump, provide an addressable module to monitor the fire pump's control cabinet for trouble alarms.
- I. In facilities with two-story atriums, only the smoke detectors monitoring the atrium shall activate the smoke evacuation system. Provide a manual pull station at the Administration Reception desk to activate atrium smoke evacuation system with a sign above desk that reads "Atrium Smoke Evacuation."

### 2.3 FIRE ALARM CONTROL PANEL (FACP)

- A. Provide a modular control panel with solid state, microprocessor based electronics. The control panel shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.
- B. FACP shall operate from a 120 VAC input supply via emergency circuit panel (where available) and be capable of operating from a standby battery. It shall also provide 24 volt DC power for all control panel modules and supervised circuits.
- C. FACP shall be provided with bypass capability for gas valve, HVAC fan shut down, magnetic door holder release, and signal bypass (speaker and strobe) for use during alarm drills, testing, and servicing without the loss of equipment.
- D. A local audible device shall sound during alarm, trouble, or supervisory condition. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key-press to provide an audible feedback to ensure that the key has been pressed properly.
- E. The following primary controls shall be visible through a front access panel:
  - 1. Eighty character liquid crystal display.
  - 2. Individual red system alarm LED.
  - 3. Individual yellow supervisory service LED.
  - 4. Individual yellow trouble LED.
  - 5. Green "power on" LED.
  - 6. Alarm acknowledge key.
  - 7. Priority two alarm acknowledge key.
  - 8. Supervisory acknowledge key.
  - 9. Trouble acknowledge key.
  - 10. Alarm silence key.
  - 11. System reset key.
- F. The FACP shall provide the following:
  - 1. Setting of time and date.

2. LED testing.
  3. Alarm, trouble, and abnormal condition listing.
  4. Enabling and disabling of each monitor point separately.
  5. Activation and deactivation of each control point separately.
  6. Changing operator access levels.
  7. Walk test enable.
  8. Running diagnostic functions.
  9. Displaying software revision level.
  10. Displaying separate alarm and trouble logs.
  11. Displaying card status.
  12. Point listing.
  13. Monitoring detector obscuration rate.
  14. Setting of detector sensitivity.
- G. For maintenance purposes, the following lists shall be available from the point lists menu.
1. All points listed by address.
  2. Monitor point list.
  3. Auxiliary control list.
  4. Feedback point list.
  5. Pseudo point list.
  6. LED/switch status list.
  7. Speaker silence switch.
  8. AHU shutdown override switch.
  9. Power supply current draw in alarm condition.
  10. Power supply current draw in standby condition.

#### 2.4 VOICE EVAC CONTROL PANEL/MODULE AND AMPLIFIER

- A. Provide Voice EVAC Control Panel/Module and amplifier with the following functions:
1. Receive alarms from system.
  2. Provide fire alarm operation as an evacuation voice system.

3. Provide a microphone.
  4. Provide temporal tone and message sequencing.
  5. Provide manual and automatic operation.
  6. Provide a minimum of six, custom, digitally recorded messages: one for alarm, one for test, one for storm, one for owner approved message, one for security (terror, natural disaster, or student violence), and one for all clear.
- B. Voice EVAC control panel and amplifier shall be capable of operating with battery backup for 30 minutes upon power failure. Provide battery charger.
- C. Amplification shall be zoned modular based on capacity with 50% spare. Provide back-up amplifier(s) capable of automatically replacing any failed amplifier(s).

## 2.5 DEVICES AND ACCESSORIES

- A. All devices on system shall be addressable. Addressable shall be defined as an intelligent device that is assigned an address in plain language for monitoring on the LCD and printer tapes and is field programmable by the Maintenance Personnel. All addressable devices shall have the capability of being disabled or enabled individually.
- B. Should a device fail, it shall not hinder the operation of other system devices.
- C. All devices on system shall be supervised. A supervised system shall detect troubles in panel or wiring, removal or tampering of point devices, monitor either open or closed circuits, and verify system integrity.
- D. The communication format must be a completely digital poll/response protocol to allow tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
- E. Each addressable device must be uniquely identified by an address code entered electronically at time of installation. The use of jumpers to set address shall not be acceptable due to the potential of vibration and poor contact. Device identification schemes that do not use electronically set addresses are unacceptable. The system must verify that proper type device is in place and matches the desired software configuration.
- F. All addressable smoke and heat detector heads, as specified below, shall be pluggable into their bases. The bases shall contain electronics that communicate the detector status (i.e., normal, alarm trouble) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Different detectors heads (smoke or heat) must be interchangeable. Upon removal of the head, a trouble signal shall be transmitted to the control panel. Auxiliary contacts shall be provided and wired to the elevator controller where shown as smoke detectors with elevated recall contacts.

### 1. PHOTOELECTRIC DETECTOR HEAD

- a. The photoelectric type detector shall be a plug-in unit which mounts to a twist-lock base and shall be UL approved. Detector to provide an analog signal to the panel for monitoring of obscuration rate and maintenance of constant detector sensitivity.



- b. To minimize nuisance alarms; voltage and RF transient suppression techniques shall be employed as-well-as a smoke verification circuit and an insect screen. The detector design shall provide full solid-state construction and compatibility with other normally open fire alarm detection loop devices (i.e., heat detectors, pull stations, etc.). The detector head shall be easily disassembled to facilitate cleaning.
- c. The detectors shall be of the solid-state photoelectric type and shall contain no radioactive material. They shall use a pulsed, infrared, LED, light source and be sealed against rear air flow entry.
- d. The detector shall fit into a verifiable type base that is common with both the heat detector and ionization type detector and shall be compatible with other addressable detectors, addressable manual stations, and addressable zone adapter modules on the same circuit. The detector shall also fit into a non-addressable base that is capable of being monitored by an addressable zone adapter module.
- e. There shall be no limit to the number of detectors or zone adapter modules which may be activated or in alarm simultaneously. The operating voltage shall be 24 VDC and operate on a supervised loop.
- f. The control panel shall maintain a moving average of the sensors' smoke chamber value to automatically compensate for duct and dirty conditions that could affect detection operations. The adjustable level shall be between 0.2% and 3.7% smoke obscuration.
- g. The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value, a "SENSOR MAINTENANCE" trouble condition shall be audibly and visually indicated at the control panel. Additionally, the LED on the sensor base shall glow steady. If a "SENSOR MAINTENANCE" is further contaminated, a "NON-SILENCABLE" trouble condition shall be indicated at the control panel.
- h. The control panel shall continuously perform an automatic self-test routine on each sensor to ensure the accuracy of the values being transmitted to the control panel by the sensor. Any problem with the self-test shall be indicated by a "SELF TEST ABNORMAL" trouble condition at the panel.
- i. Each sensor shall be capable of being individually set for date of installation, percent smoke, time of day for percent, and multiple threshold settings.

## 2. ADDRESSABLE PULL STATIONS

- a. Addressable pull stations shall contain electronics that communicate the stations' status (i.e., alarm, normal) to the transponder over two wires which also provide power to the pull station. They shall be manufactured from ABS plastic with raised white lettering and a smooth high gloss finish.
- b. Stations shall mechanically latch upon operation and remain so until manually reset. Pull stations shall be normally open, dual action, manual stations. The front of the station shall be hinged to a backplate assembly and must be opened with a common key to reset the station. Stations which use breakglass shall not be accepted.

- c. The addressable manual station shall be capable of field programming of its "address" location on all addressable initiating circuits through the FACP. The manual station shall be fitted with screw terminals for field wire attachment.
- d. There shall be no limit to the number of stations, detectors, or zone adapter modules which may be activated or in alarm simultaneously.
- e. Stations shall be wall mounted per height requirements of NFPA 72: at 44" AFF to bottom. Provide pull station signage.

**3. AUTOMATIC HEAT SENSORS**

- a. Device shall be a compensating rate of rise detector.

**4. EXTERIOR SPEAKERS**

- a. The speakers shall be polarized and shall be operated by 24 VDC. Each speaker assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors shall not be accepted. All exterior alarm signals shall be mounted a minimum of eight feet above grade in a weatherproof box.
- b. Minimum dB: 87 dB at 10 feet not to exceed 120 dBA.

**5. VISUAL FLASHING LAMPS**

- a. Visual indicating appliances shall be comprised of Lexan clear lens and be entirely solid-state. These devices shall be UL listed and be capable of either ceiling or wall mounting. Separate alarm operation shall be provided for strobes by means of separate circuits or through programming at the panel. The maximum strobe pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The intensity shall be field selectable with a minimum candela rating of 75 candela and the flash rate shall be at least 1 Hz but not to exceed 3 Hz. All visual alarms shall be mounted eighty inches (80") above the finished floor to bottom or six inches below the ceiling, whichever is lower. All visual indicating appliance output levels shall be sized per NFPA 72, Chapter 6. Submitted shop drawings shall show output level for each strobe.

**6. COMBINATION ALARM UNIT**

- a. Provide manufacturer's heavy duty construction combination speaker and strobe (clear lens) unit. Speakers shall be listed for fire alarm use by Underwriter's Laboratories, Inc. The alarm signals shall be semi-flush mounted at the locations indicated on the plans.
- b. All audible alarms must be 15 dBA above ambient or exceed any maximum sound level for 60 seconds by 5 dBA, whichever is louder. Sound levels shall not exceed 120 dBA.
- c. Combination alarm units shall be wall mounted 80 inches above the finished floor to bottom or six inches below the ceiling, whichever is lower.
- d. Speaker shall have field switchable wattage taps of ¼, ½, 1, and 2 watts.

- e. Strobe shall have field switchable candela levels of 15, 30, 75, and 110 candelas.

**7. DUCT DETECTOR**

- a. Provide photoelectric type duct detector with sampling tube, of design and dimensions as recommended by the manufacturer, for the specific duct size. Install detectors in ductwork within mechanical room with respective air handling unit.
- b. The addressable duct smoke sensors shall operate on the light scattering, photo-diode principle and shall communicate actual smoke chamber values to the system control. The sensors shall not have a self-contained smoke sensitivity setting and shall automatically communicate actual smoke chamber values to the system control unit. The sensor's electronics shall be shielded to protect against nuisance alarms from EMI and RFI.
- c. The duct detector housing shall provide an auxiliary alarm relay with two, "Form C" contacts rated at 2A @ 28 VDC or 120 VAC resistive. This auxiliary relay operates when the sensor reaches its alarm threshold or when the control unit (via software control, manually, or automatically) operates the relay in response to inputs from other devices.
- d. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
- e. Each duct detector shall have a Remote Indicator with an alarm LED. Group remote indicators together in the closest mechanical room, labeled for detector served, and mounted at 48" AFF to top.

**8. WATERFLOW SWITCHES**

- a. Fire detection/signaling systems shall be interconnected to the fire sprinkler systems. Waterflow switches shall be set for a 60 second or greater delay/retard not to exceed 90 seconds prior to the "ALARM."
- b. Each waterflow switch shall be monitored with a unique digital address on the SLC.
- c. It is the responsibility of the Sprinkler Contractor to locate the waterflow switches to assure indication of water flow within the building and at each level of the building to reduce water damage.

**9. SUPERVISORY (TAMPER) SWITCHES**

- a. Connect tamper switches installed on all sprinkler or standpipe system valves to the fire alarm system to indicate closing or opening of the valves.
- b. Each tamper switch shall be monitored with a unique digital address on signaling line circuit.

## 2.6 FIRE ALARM REMOTE ANNUNCIATOR (FARA)

- A. Where shown on the plans, provide and install a serial LCD annunciator. The annunciator(s) shall have an enamel finish. The annunciator shall communicate to the control panel over two, twisted pair of wires shall have an operating power of 24 VDC and shall be fused at the control panel.
- B. The serial annunciator shall provide a common alarm and trouble circuit consisting of:
  - 1. Control pushbutton switches for: alarm silence, trouble silence, system reset, and manual evacuation duplicating the control panel switches. A key "enable" switch shall be provided to activate or deactivate the control switches, bypass switches for gas shutdown, AHU shutdown, door holders, and signals (speakers and strobes) for system drills.
  - 2. Tone Alert—Duplicates the FACPs tone alert during alarm and trouble conditions.
  - 3. System trouble LED.
  - 4. Power on LED.

## 2.7 REMOTE MICROPHONE

- A. Provide a remote microphone at locations shown on the drawings.
- B. Provide key switch for controlled access.
- C. Provide "talk" LED.

## 2.8 NETWORK

- A. The system must provide communication with initiating and control devices, individually and with other control panels. Each device shall be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
  - 1. Alarm.
  - 2. Trouble.
  - 3. Open.
  - 4. Short.
  - 5. Device missing/failed.
- B. All addressable devices shall have the capability of being disabled or enabled individually.
- C. Provide quantity of addressable devices required to comply with drawings. Provide no less than two loops with no more than 70% loading per loop.
- D. The communication format shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability shall be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

- E. Each addressable device shall be uniquely identified by an electronic address entered at time of installation. The use of jumpers to set address shall not be acceptable due to the potential of vibration and poor contact. Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel are unacceptable. The system shall verify that proper type device is in place and matches the desired software configuration.

## 2.9 NETWORK PRINTER

- A. Provide network printer to print all system activities/events. Provide one case of printer paper. Confirm location with Owner prior to installation.

## 2.10 LOCKABLE TERMINAL CABINET

- A. The terminal cabinet shall be constructed of 16 gauge (0.062 thick), cold rolled steel and finished with a durable red textured, heat-resistant, baked-on enamel finish. The front cover shall be engineered with a removable, formed, lift-a-way hinge and display "FIRE ALARM TERMINAL CABINET" in 2" white screened, indelible lettering. A CAT 30 keyed door lock shall secure the front cover. The interior of the box shall have field identification labels on the inside cover corresponding to the terminal strip's labeling inside the back box. Overall dimensions shall have a minimum measure of 14" W by 14" H x 3 1/4" D. The cabinet shall include 1/2", 3/4", 1", 1 1/2", and 2" EMT knockout clusters on the top, bottom, and left side. Interior barrier terminal strips shall be rated for 12 gauge wire and 20 amp max 250V (Class B/UL) 300V (CSA) and shall be screw lug type.
- B. Approved Manufacturers:
  - 1. Space Age Electronics, #TC Series.
  - 2. Pre-approved Equal.

## 2.11 BATTERY BACK-UP

- A. The system shall be battery back-up for 24 hours with 15 minutes of alarm capabilities (per 72A).

## 2.12 SURGE PROTECTION

- A. Provide surge protection at all points entering and leaving each building and at the FACP and FATC locations shown on drawings (Ditek).
- B. Surge protection shall be manufactured and listed for use with the fire alarm system.
- C. Provide AC surge protection on power feeding the panel.

## 2.13 LIGHTNING PROTECTION

- A. Isolated Loop Circuit Protector (ILCP)
  - 1. Install an isolated loop circuit protector module on all fire alarm (initiating device circuit), (signaling line circuit), (audio riser), (telephone riser or circuit) wiring, (including shields), which extends beyond the main methods (walkways, bridges, or other above ground connectors).

2. The ILCP shall be located as close as practical to the point at which the circuits leave or enter a building.
3. The ILCP grounding conductor shall be a #12 AWG wire having a maximum length of 28 feet to be run in as straight a line as practical and connected to a building ground electrode system (unified ground) per the National Electrical Code.
4. The ILCP furnished shall have a line to line response time of less than one nanosecond capable of accepting greater than 2,000 amps (35 joules each line) to earth. Shield to earth current shall be 5,000 amps maximum.
5. The ILCP shall be protected by a high dielectric insulating material and of small enough size to mount in a standard 4" square by 2-1/8" deep electrical box.
6. Spark gap devices or devices incorporated in or installed within the fire alarm control panel in lieu of the specified ILCP are not acceptable.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF FIRE ALARM SYSTEM

- A. Install fire alarm system in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC's and NECA's Standards of Installation.

#### 3.2 WIRING SYSTEMS AND MATERIALS

- A. Wiring shall be in accordance with requirements of the National Electrical Code and NFPA Regulation 72. The fire alarm system, including components and wiring, shall be completely installed and wiring shall be properly tagged and color coded. The Electrical Contractor shall make final connections, as shown and required by the Equipment Manufacturer's wiring instructions.
  1. Initiating Device Circuits: Initiating device circuits monitoring manual fire alarm stations, smoke and heat detectors, waterflow switches, valve supervisory switches, fire pump functions, and air pressure supervisory switches shall be Class B initiating device circuits.
  2. Notification Appliance Circuits: All notification appliance circuits shall be Class B (Style "Y"). All notification appliance circuits shall have a minimum circuit output rating of 2 amps @ 24 VDC; 50 watts @ 70 V audio. The notification circuits shall be power limited.
  3. Signaling Line Circuits: When a signaling line circuit covers more than one fire/smoke compartment, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments. The signaling line circuit connecting network panel/nodes, annunciators, and command centers shall be Class B. The media shall be copper except where fiber optic cable is specified on the drawings. The signaling line circuit connecting to addressable/analog devices including detectors, monitor modules, control modules, isolation modules, and notification circuit modules shall be Class B (Style 4).
- B. Install wiring in conduit along with continuous ground wire. Provide wiring of adequate size to prevent voltage drop. Submit load calculations for each signal circuit and zone circuit

indicating actual voltage drop and proper size conductors. Wires shall be rated for fire alarm use per NEC 70A.

- C. Color Code—All new, fire alarm cabling shall conform with the following:
  - 1. Yellow and Blue #16 AWG or higher stranded for all data circuits.
  - 2. Red and Black #12 AWG, stranded, for all strobe circuits.
  - 3. Red #16 AWG, twisted pair, for all speaker circuits.
  - 4. Orange and Brown #12 AWG, stranded, for all door magnets and all other control circuits.
  - 5. Yellow and Yellow #14 AWG, stranded, for all other auxiliary circuits.
  - 6. Black and White #12 AWG, stranded, for 120 VAC power to FACP.
  - 7. Green #12 AWG, stranded, for ground throughout system.
- D. Fire alarm system raceways are to be RED its entire length as provided by the manufacturer. All junction-box covers are to be painted RED in color.
- E. Shutdown relays and control equipment shall be mounted within three feet of controlled device.
- F. Visual flashing strobes shall be wired on a separate circuit from speakers and other indicating and initiating devices or programmable to provide the same separation on a common circuit.
- G. All connector wires throughout the fire alarm system shall be terminated at terminal strips, where necessary, within fire alarm terminal cabinets.
- H. All wire to be Belden quality or equivalent and the wiring shall be in accordance with NFPA 72 and N.E.C., properly tagged (labeled) and color coded.
- I. All conductors shall be installed in conduit raceways that are mechanically continuous.
- J. Provide an equipment grounding conductor (#12 AWG minimum) in all conduit raceways and grounded per N.E.C. Article 250.
- K. Wiring
  - 1. Stranded conductors shall be used within the Fire Alarm Control Panel (FACP) and throughout the fire alarm system with the following two exceptions:
    - a. All remote annunciator panels shall be wired with cable per the manufacturer, as required.
    - b. Data lines (addressable systems) shall be wired with cable per the manufacturer, as required.
  - 2. There shall not be any wire splices underground or within conduit bodies.
  - 3. There shall be no splices within FACPs.

4. All high voltage shall be installed in a separate fire alarm conduit system.
  5. Fire alarm primary power (120 volt) shall be on a dedicated branch circuit from the facility's emergency power service. All remote power supplies and equipment requiring primary power shall be on dedicated branch circuits from the facilities emergency power service.
- L. Expansion: One pull string shall be installed in each terminal cabinet raceway throughout the facility to provide for future coverage (expansion or loop failure).

### 3.3 HARDWARE

- A. Minimum size conduit shall be  $\frac{3}{4}$ " throughout the fire alarm system; however,  $\frac{1}{2}$ " conduit may be used from a junction box to a device or appliance.
- B. All outside speakers shall be of a weatherproof construction and correctly mounted on surface-mounted weatherproof back boxes provided by the manufacturer.

### 3.4 LABELING

- A. All fire alarm circuits shall be identified at the FACP terminal cabinets and junction boxes. Circuits shall be durably marked where plainly visible in accordance with Articles 760-10 and 760-42 of the N.E.C.
- B. All fire alarm cabinets and enclosures to be provided with a laminated affixed label having white letters on red background.
- C. The battery and surge suppression boxes shall be permanently labeled with white lettering on a predominately red background.

### 3.5 ACCESSIBILITY

- A. Remote annunciator panels shall be mounted in the administration office or other required offices at eye level and within full view of Owner personnel and visiting authorities (i.e., Fire and Police Departments) per NFPA 72.
- B. All control equipment shall be located in an electrical or mechanical room near the equipment to be controlled.
- C. Transponders, relay controls, surge protection, and batteries shall not be located above the ceiling.
- D. Fire alarm batteries shall be located in a separate battery box below the FACP and labeled per NFPA 72.
- E. A separate cabinet for terminal connections and surge suppression shall be located immediately adjacent to the fire alarm control panel and labeled per NFPA 72.
- F. Battery and surge suppression may be installed in the same enclosure.
- G. E.O.L. resistors shall be located at the fire alarm termination cabinet for each building.



### 3.6 ADDRESSABLE SYSTEMS

- A. Main FACP shall be located in the MDF.
- B. The FACP shall be equipped with a RS-232 Communications Port.
- C. Final programming shall be done with the addresses and locations of devices.

### 3.7 QUALITY ASSURANCE

- A. NEC Compliance—Comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories.
- B. UL Compliance and Labeling—Provide fire alarm and detection system components which are UL listed and labeled. Installation is to be by a UL listed installer.
- C. Miscellaneous Compliance—The fire alarm system is to be installed in accordance with the equipment manufacturer's written instructions and complying with all applicable portions of the NECA's Standard of Installation and all local codes and ordinances.

### 3.8 FIELD QUALITY CONTROL

- A. Inspect relays and signals for malfunctioning. Where necessary adjust units for proper operation to fulfill project requirements. Any final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of fire alarm and detection system equipment. The Manufacturer's Representative shall perform a quality inspection of the final installation and, in the presence of the Electrical Contractor, Fire Marshal, and Owner's Representatives, shall perform a complete functional test of this system. A system certification verifying the proper system operation shall be required prior to acceptance by the Owner.
- B. Testing: The Contractor shall perform all electrical and mechanical tests required by the Equipment Manufacturer's form and National Fire Protection Association 72A and 72H. All test and report costs shall be in the contract price. A checkout report shall be prepared by the installation technicians and submitted in triplicate, one (1) copy of which shall be registered with the Equipment Manufacturer. The report shall include, but not be limited to:
  - 1. A complete list of equipment installed and wired.
  - 2. Indication that all equipment is properly installed and functions and conforms with these specifications.
  - 3. Tests of individual zones, as applicable.
  - 4. Serial numbers, locations by zone, and model numbers for each installed detector.
  - 5. Response time on thermostats and flame detectors (if used).
  - 6. Technician's name, certificate number and date.
  - 7. Provide typewritten report of all audible "dB" levels in all normally occupied spaces throughout the facility.

8. Final tests and inspection shall be held in the presence of the Owner and Engineer's Representatives and to their satisfaction. The Contractor shall supply personnel and required auxiliary equipment for these tests without additional cost.
- C. Documentation: After completion of the tests and adjustments listed above, the Contractor shall submit the following information to the Owner's Project Coordinator and leave a copy at the site in the fire alarm log book adjacent to the main control panel.
  1. Two copies of the test report described in this specification and a Certificate of Compliance prepared as per National Fire Protection Association Standard 72A Chapter 2, Section 2-2.4, and State Fire Marshall's Rule 4A-48 to be complete at final test.
- D. Affixed to FACP a standard service tag, as described in Rule 4A-48 for fire alarm contractors by the Office of the State Fire Marshall.
- E. To assure that wire size, power supply, number of devices on a circuit, etc. are suitable to support 100% of devices being in alarm or operated simultaneously, this test shall include the following:
  1. Place all sensors and monitor modules in alarm. Each shall display it's address or zone and alarm condition. At least the first five devices on each circuit shall also have their alarm LEDs lighted.
  2. Operate all control modules for the alarm or operated condition. Each module shall display it's address and condition.
  3. Reset all alarmed and operated devices. The panel shall display the address or zone of any off-normal devices.
  4. Test a representative number of sensors for alarm verification by momentarily testing for alarm. The sensor shall not initiate an alarm. Then, test by placing the sensor in alarm such that it remains in alarm for the selected verification time. The sensor shall initiate an alarm.
- F. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a 90 day test period without any unwarranted alarms. Should unwarranted alarm(s) occur, the Contractor shall readjust or replace the detector(s) and begin another 90 day test period. As required by the Engineer, the Contractor shall recheck the detectors using the fire test after each readjustment or replacement of detectors. This test shall not start until the Owner has obtained beneficial use of the building under tests.
  1. If the requirements provided in the paragraph above are not completed within 30 days after beginning the tests described therein, the Contractor shall replace the system with another acceptable manufacturer and the process repeated until acceptance of the equipment by the Owner.
- G. A statement of guarantee including date of termination and name and telephone number of the person to be called in the event of equipment failure.
- H. Individual factory issued manuals containing all technical information on each piece of equipment installed. In the event that such manuals are not obtainable from the factory, it shall be the responsibility of the Contractor to compile and include them. Advertising

brochures or operational instructions shall not be used in lieu of the required technical manuals.

### 3.9 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Division 1.
- B. Computer Software
  - 1. All documentation for repair or replacement of local and remote panels shall be provided and backed up on CD-ROMs that are IBM ASCII (American Standard Code For Information Interchange) compatible.
  - 2. Three sets of all software on CD-ROM shall be provided for programming and reprogramming: one to the site and two to the Owner's Project Coordinator.
- C. Project Documentation - The Fire Alarm Contractor shall provide the Owner's Project Coordinator with the following:
  - 1. In addition to project requirements listed under Division 1, provide three sets of signed/sealed construction prints per NFPA 72 (as-built drawings). Additionally, include a CD-ROM formatted disk(s) reflecting all the work with actual device and equipment locations. Drawings to be submitted in .dwg or .dxf format (i.e., AutoCAD 2010 or higher).
  - 2. Three riser diagrams (block representation of the fire alarm system) including the location of all E.O.L.s.
  - 3. Three equipment manuals.
  - 4. Three printouts of the points list ( a copy of all addresses and fault codes).
- D. Operation and Maintenance Data
  - 1. Submit data under provisions of Division 1.
  - 2. Include operating and maintenance instructions and repair procedures with parts list.
  - 3. Provide three copies of complete troubleshooting and repair manuals.
  - 4. Include Manufacturer's letter stating that system is operational.
- E. On-Site Documentation
  - 1. Provide 4" diameter by 24" long, red tube mounted to the wall adjacent to the main control panel. Provide a copy of as-builts/shop drawings in tube. Tube shall be provided with a threaded top cap.
  - 2. Provide a legal size, plastic, file folder mounted to the wall adjacent to the main control panel. Provide a copy of the riser diagrams, a copy of the points list, and a copy of the test results.

3. Provide a written description of standard control panel functions and user instructions at each FACP. These instructions shall be written in standard laymen's English so that an unfamiliar operator can accomplish basic functions such as reset.

### 3.10 ON-SITE TRAINING

- A. The Contractor shall provide two, separate, four hours of training, including system operations and location of components, to Owner personnel responsible for the system on a daily basis. Training sessions shall be scheduled with the Owner personnel at their convenience with no less than 48 hours advance notice. One shall be held at final substantial completion and one shall be held within six months after final substantial completion. Training shall be of the highest level of service authorized by the factory in the field. Where software is used, the training shall include instruction on writing configuration changes for future expansion, deletion of points and system programming. This software shall be included with the training.

### 3.11 SYSTEM GUARANTEE/WARRANTY

- A. All components, parts, and assembles supplied by the Manufacturer shall be guaranteed against defects in materials and workmanship for a period of 24 months commencing the date of Final Acceptance by the Fire Department or Final Substantial Completion, whichever is later. Warranty service shall be provided by a qualified factory-trained representative of the Equipment Manufacturer during normal working hours. The representative must be able to respond to warranty calls within 12 hours of notice, including weekends, whether oral or written.
- B. Provide, within one year after final acceptance, testing as per National Fire Protection Association 72, which shall consist of:
  1. Regularly and systematically examine, adjust and clean all the electrical and mechanical components of waterflow switches, as required by Code.
  2. Test and provide a written report certifying that all initiating devices have been tested and the result of the inspection.

\*\*\* END OF SECTION 28 31 11 \*\*\*