

## SECTION 16B

### FIRE DETECTION AND ALARM SYSTEM

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

Federal Specifications (Fed. Spec.):

W-B-134C                      Battery, Storage, (Lead-Acid, Industrial Floating Service)

W-B-137C                      Battery, Storage, (Nickel Alkaline, Industrial, Floating Service)

National Fire Protection Association (NFPA) Standards:

No. 70-1981                      National Electrical Code

No. 72A-1979                      Local Protective Signaling Systems

No. 72D-1979                      Proprietary Protective Signaling Systems

No. 72E-1978                      Automatic Fire Detectors

No. 90A-1981                      Installation of Air Conditioning and Ventilating Systems

1.3 Underwriters Laboratories, Inc. (UL) Publications:

Fire Protection Equipment Directory (Jan 1982 with Quarterly Supplements)

UL 38                              Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems (Jul 23, 1981, 4th Ed.; Rev Sep 21, 1981)

UL 217                              Single and Multiple Station Smoke Detectors (Feb 20, 1980; Rev thru Nov 17, 1981)

UL 268                              Smoke Detectors for Fire Protective Signaling Systems (Jun 9, 1981, 2nd Ed.; Rev thru Nov 23, 1981)

UL 464                              Audible Signal Appliances (Dec 1, 1981, 5th Ed.; Rev Dec 2, 1981)

UL 521                              Heat Detectors for Fire Protective Signaling Systems (Sep 29, 1978, 4th Ed.; Errata Sep 29, 1978; Rev thru Jun 5, 1980)

UL 864                              Control Units for Fire-Protective Signaling Systems (Jun 6, 1980, 6th Ed.; Rev May 28, 1982)

## 2. GENERAL REQUIREMENTS:

2.1 Standard Products: Material and equipment shall be the latest standard products of a manufacturer regularly engaged in the manufacture of the products.

2.2 Nameplates: Major components of equipment shall have the manufacturer's name, address, type or style, and catalog number on a plate securely attached to the equipment.

2.3 Tags: Tags with stamped identification number shall be furnished for keys and locks. Hard cardboard tags shall be furnished to identify cable and conduit runs, wiring circuits, and all spare parts furnished for Government's stock to maintain the system.

Keys and Locks: All locks shall be keyed alike.

2.5 Accessibility: Enclosures shall be provided with ample gutter space to allow proper clearance between the enclosure and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate all units, and allow ample gutter space for interconnections of panels and field wires.

## 3. SUBMITTALS:

3.1 Shop Drawings: Shop drawings shall be submitted in accordance with the SPECIAL PROVISIONS and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

3.2 Spare Parts Data: After approval of the list of shop drawings, and not later than 3 months prior to the date of beneficial occupancy, the Contractor shall furnish copies of spare-parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies with current unit prices and source of supply, a list of supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified to be furnished in accordance with paragraph Special Tools and Spare Parts and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days.

### Operating and Maintenance Instruction Manuals:

3.3.1 Operating instruction manuals outlining the step-by-step procedures required for system start-up and operation shall be furnished. The instructions shall include the manufacturer's name, model number, service manual parts list and brief description of all equipment and their basic operating features.

3.3.2 Maintenance instruction manuals outlining maintenance procedures shall be furnished. The manual shall include a trouble shooting guide

listing possible break-down and repairs and a simplified connection wiring diagram for the system as installed.

3.4 Performance Test Reports: Upon completion of the installed system the Contractor shall submit in booklet form all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

4. DELIVERY AND STORAGE: All equipment placed in storage shall be protected from the weather, humidity and temperature variations, dirt, dust, and other contaminants.

#### 5. MATERIALS AND EQUIPMENT:

5.1 Fire Detecting Devices: Fire detective devices shall comply with the applicable requirements of NFPA No. 72E, UL 217, UL 268, UL 521 and NFPA No. 90A. Locations shall be as indicated. The detector shall be surface-mounted type unless otherwise indicated. Detector base shall have terminals for making connections. No soldering will be required.

5.1.1 Smoke detectors, ionization type, shall be of dual chamber design with one reference and one sampling chamber. Smoke detectors containing radium shall not be used. Sensitivity of detectors shall be adjustable. Each detector shall be capable of withstanding ambient air velocity up to 3100 fpm, suitable for operating at 24 volts d.c., and shall be provided with a visible lamp to indicate condition and alarm status of detector. Duct-mounted detectors shall be provided with air sampling tubes of length equal to width of duct.

5.2 Fire Alarm Stations: Stations shall conform to the applicable requirements of UL 38. The stations shall be electrically supervised single-action type, and shall be provided with spring-loaded interchangeable code wheel for zone coded systems and without code wheels for non-coded systems. Station test key shall be provided to operate station without opening door. Key lock for test and reset shall be tamperproof. Locks shall be keyed alike with fire alarm control panel. Stations shall be break glass and pull-lever or single-action break glass rod types, semi-flush or surface mounted complete with back boxes and conduit openings, type indicated. Stations shall be provided with a painted red cast housing with label showing function and operation and shall be fabricated with metal mechanical parts (plastic will not be acceptable). The finish shall be high impact gloss and shall be smooth to prevent chipping or collecting dust.

5.3 Signaling Devices: Audible signal devices shall be heavy duty and of a sound level adjustable type and shall comply with the applicable requirements of UL 464. Locations shall be as indicated. Bells shall be interchangeable, modular, and suitable for mounting over standard outlet box.

5.3.1 Electrical vibrating bells shall be used for noncoded signals. Single stroke, electrically operated, supervised, heavy duty, solenoid bells shall have a minimum sound rating of 90 db for 10-inch bell, and shall

operate on 24 volts d.c. Bells shall be 10-inch diameter, located as indicated, mounted on removable adapted plates over outlet boxes, and shall be weatherproof type with metal housing and protective grilles for exterior use.

5.3.2 Trouble indicators shall be electrically operated, supervised type with audible bell signal and shall be provided with integral silencing switch, test switch, and trouble light in modular enclosure. Indicators shall be flush mounted in panels.

5.4 Control Units: Fire alarm control units shall comply with the applicable requirements of UL 864. Solid state supervision and indicating devices may be used including the use of light emitting diodes in lieu of lamps or meters. A suitable means shall be provided for testing the control panel visual indicating devices (meters or LED's). LED's or meters and indicating lamps shall be plainly visible when the cabinet of the control unit is closed.

5.4.1 The control units shall be suitable for connecting to the central fire station, with cut-off switch and pilot light for tests, and visual and audible indication of central system activation. The control units shall be provided with zone and trouble annunciators, zone indicators, relays, and supervisory circuits and accessories to complete entire concept of designed system. The system shall be complete with transmitter and supervisory relays for non-coded actuating devices, indicated auxiliary relays for fan shutdown, the number of station and bell circuits indicated with spare capacity for two bell and four zone circuits, and a special presignal cut-off switch to condition the board to sound either a presignal alarm or a general alarm as desired. Labels indicating the position of the switch shall be provided. One position should be labeled PRESIGNAL ALARM, and the other position labeled GENERAL ALARM. A red pilot lamp shall be installed to indicate when the switch is in the GENERAL ALARM position. A nameplate engraved to read "SYSTEM IN CENTRAL ALARM POSITION" shall be installed adjacent to the pilot lamp. Panel shall be suitable to operate on 120 volts a.c. Upon failure of power supply, system shall operate from back-up power supply. Panel shall be fabricated of metal modular in construction with factory applied color as approved. Panel shall have front access and shall be surface mounted.

5.4.2 Annunciator panel shall be suitable for connecting to fire alarm control panel by means of a terminal strip, and shall be back lighted with zone light indicators with one common trouble light, audible high frequency trouble indicator, silencing switch, reset switch, and lamp test switch per each module. Lamp test switch shall be accessible from inside the cabinet. Each zone indicator shall be minimum 3 inch by 1.4 inch in size with a minimum of four zones for each module. Each zone indicator shall be provided with two lights to operate on 24 volts d.c. Panel shall be fabricated of metal, modular in construction with factory applied color as approved, shall be tamperproof, shall be free of any screws or other fasteners on front panel, and shall be suitable for surface mounting.

5.5 Power Supply: Power supply shall comply with the applicable requirements of NFPA Nos. 72A and 72D.

5.5.1 Power Feeder: The power feeder shall consist of a neutral and two separate phase wires or a neutral and one phase. Each ungrounded conductor shall have independent overload protection. All equipment, except the trouble bell and visual trouble-indicating pilot light, shall be operated from the neutral and one phase. Supervisory power for operation of audible and visual trouble-indicating devices shall be obtained from the grounded neutral and a phase not used for the operating power or from the secondary standby power supply. Supply voltage shall be supervised. Loss of operating power shall sound a trouble signal powered from the phase of the 3-wire system that is not used for the operating power or from the secondary standby power supply.

5.5.2 Back-Up Power Supply: Primary input shall be 120 volts a.c. with batteries and charger and shall comply with the requirements of Fed. Spec. W-B-134 or W-B-137. Batteries shall be sealed lead-acid or nickel cadmium type and capable of operating the system for 24 hours in supervisory mode and after the 24-hour reserve shall sound all alarms for a period of 5 minutes. Charger shall be rated to recharge fully discharged batteries in 8 hours, shall operate in an automatic mode, and shall maintain batteries fully charged.

5.6 Wiring: Wiring shall be in accordance with NFPA No. 70 and as indicated. All station wiring shall be color coded unless of a sufficiently different size to identify.

## 6. DESCRIPTION OF SYSTEM:

6.1 Fire Alarm System: The fire alarm system shall automatically initiate fire alarm signals whenever any manual or automatic fire detecting devices are placed into an alarm mode. The system shall indicate areas of annunciation and at the same instant selectively deactivate HVAC fans and their dampers and sound local alarms. Alarm signal shall be consistent throughout the building. The operation of any alarm initiating device shall cause alarm to sound throughout building. Manual and automatic station shall transmit non-coded alarm signals without interference. The station loops and bell loops shall be complete with necessary switches, meters, relays, pilot lights, and resistors. A minimum of one thermal cut-out or fuse, one supervisory relay for every bell circuit, and one contactor for each bell loop shall be provided. A minimum of one milliampere meter shall be provided to indicate the supervisory current flowing in the station supervisory circuit. The station supervisory circuit is defined as a combined loop through the signal initiating circuit, alarm sounding circuit and the leads to the transmitter. The system shall be capable of operating with a single break or single ground fault condition in the single initiating or alarm sounding circuits.

6.2 Non-Coded Evacuation Alarms: A non-coded evacuation alarm signal shall be employed for notifying the occupants to evacuate. An annunciator will indicate the specific location of the fire.

6.3 Trouble Signals: During abnormal conditions such as an open wire or a ground fault, or where both conditions occur at one point, the system shall be capable of automatically transmitting clear, intelligible, trouble

signals in response to activation of the positive non-interfering fire alarm building transmitters.

6.4 Power Supply for the System: A single dedicated branch-circuit connection for supplying power to each building system shall be provided. An approved battery and charger shall be provided for the auxiliary power supply.

## 7. OPERATION AND PERFORMANCE REQUIREMENTS:

7.1 Smoke Detectors, Ionization Type: Detectors shall sense invisible products of combustion using the air ionization principle.

7.2 Non-Coded Fire Alarm Stations: The mechanism for non-coded stations shall be designed to transmit a non-coded signal. Special keys shall be provided to permit testing the station without causing alarm and to reset station when actuated.

7.3 Bells: Bells shall sound when fire alarm system is activated through fire alarm stations or automatic fire and smoke detection devices.

### Trouble Signals:

7.4.1 Trouble Bells: Trouble bells shall be used for external or remote audible annunciation of trouble condition in an electrically supervised fire alarm system. When the fire alarm circuit is in normal supervisory standby state, switch shall be in normal position. When trouble condition occurs, bell signal shall sound and pilot (trouble) lamp illuminate. Switch shall silence the bell signal only and light shall stay on until trouble is corrected; the bell signal shall sound again until the switch is reset to normal standby supervisory position.

7.4.2 Trouble Indicators: Trouble indicators shall be used for local audible annunciation of trouble condition in an electrically supervised fire alarm system. When the fire alarm circuit is in normal supervisory standby state, switch shall be in normal position. When trouble condition occurs, audible signal shall sound and pilot (trouble) light come on. The switch shall silence the audible signal only and light shall stay on until trouble is corrected. When light is extinguished, upon the trouble correction, the audible signal shall sound again until the switch is reset to normal standby supervisory position.

### Fire Alarm Control Panel:

7.5.1 Operation of coded and non-coded systems shall be identical, except for audible signal sound generation and type. A non-coded system shall sound bells continuously with a non-coded signal.

7.5.2 Alarm activation of control panel shall be transmitted to central fire station, and shall activate auxiliary relays to shut down fans.

7.5.3 An audible trouble signal shall be actuated by opens or grounds in the system wiring. Silencing switch with pilot light shall permit silencing the audible trouble signal until the fault is cleared. The pilot

light shall remain illuminated and flashing between operation of silencing switch and clearing of fault.

7.6 Transmitters: Transmitters shall transmit coded signals when actuated by manual and automatic fire detective device and shall supervise the interconnecting wires and components. Actuation of the coder shall cause code pulses to be sent back to the control panel which sounds this code over the alarm signals for four complete rounds of code, without interruption for coded system and continuously for non-coded system.

8. INSTALLATION: All work shall be installed as shown on the drawings in accordance with the manufacturer's diagrams and recommendations, except where otherwise indicated.

8.1 Wiring: Wiring for systems shall be installed in rigid conduit, intermediate metallic conduit, or electric metallic tubing as specified in SECTION: ELECTRICAL WORK, INTERIOR. Station loops shall be arranged to permit disconnecting and bypassing the system at the base of each riser. External wiring between the control panel and the stations and bells shall connect to terminal strips in accessible locked cabinets. Connections to the terminal strips shall be made with terminal spade lugs or with approved type terminal blocks. Terminal cabinets shall be installed at each point where a station circuit riser originates or any point along a circuit where a tap is made. The conductors for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. The sum of the cross-sectional areas of individual conductors shall not exceed 40 percent of the interior cross-sectional area of the conduit. All conduit shall be 3/4-inch minimum. A 3/4-inch empty conduit from control panel to the nearest telephone closet shall be provided. Ample gutter space to accommodate all necessary wiring shall be provided.

8.2 Panels: Panel enclosures shall comply with the requirements of UL 864. Enclosures having doors over 48 inches in height shall be provided with a three-point catch and lock; all other doors shall contain a cabinet type cylinder lock. Inserts shall be blind fastened so that no screws show on panel front.

8.3 Detectors: Detectors shall be installed in accordance with manufacturer's written instructions.

9. TESTING AND SPECIFICATIONS: The Contractor shall notify the Contracting Officer 30 days before the performance and acceptance tests are to be conducted. The tests shall be performed in the presence of the Contracting Officer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests. Tests shall be conducted for the following:

a. Verify that the system is free of grounds or open circuits. The central control board shall indicate when a ground or open circuit exists.

b. Verify that all bells, stations, transmitters, automatic detectors and supervisory devices are functioning as specified. Criteria for testing shall be as follows:

(1) Bells shall deliver the sound pressure levels (decibels) of the specified device.

(2) Stations shall close the circuits specified and deliver specified alarm codes.

(3) Automatic detectors shall actuate the specified zones when the appropriate fire or smoke conditions are generated.

(4) Panels and supervisory devices shall display and control functions as specified.

c. Performed under the supervision of the fire alarm system contractor's qualified representative.

d. Reconducted to verify correction of any defect found in the initial testing.