

SECTION 16510/OCCUPANCY SENSORS1 GENERAL1.1 Related Documents

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

- 1.2.1 This Section includes occupancy sensors for lighting control.

1.3 Definitions

- 1.3.1 DT: Dual Technology

- 1.3.2 LED: Light-emitting diode.

- 1.3.3 PIR: Passive infrared.

1.4 Quality Assurance

- 1.4.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- 1.4.2 All products shall be UL listed.

1.5 Coordination

- 1.5.1 Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.6 Approval Submittals:

- 1.6.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

1.6.2 Shop Drawings:

- 1.6.2.1 Show installation details for occupancy and light-level sensors.

- 1.6.2.2 1/8" or 1/4" scaled lighting plan showing location, orientation, and coverage area of each sensor.

- 1.6.2.3 Interconnection diagrams showing field-installed wiring.

1.7 Test Reports and Verification Submittals:

- 2.1.2.4.2 Relay: Externally mounted through a ½-inch knockout in a standard electrical enclosure.
- 2.1.2.4.3 Time Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- 2.1.2.5 Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
- 2.1.2.6 Bypass Switch: Override the on function in case of sensor failure.
- 2.1.2.7 Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keeps lighting off when selected lighting level is present.
- 2.1.3 PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
  - 2.1.3.1 Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in.
  - 2.1.3.2 Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.
  - 2.1.3.3 Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot high ceiling.
- 2.1.4 Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
  - 2.1.4.1 Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  - 2.1.4.2 Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch high ceiling.
  - 2.1.4.3 Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on an 8-foot high ceiling.
  - 2.1.4.4 Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch high ceiling.
  - 2.1.4.5 Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot high ceiling in a corridor not wider than 14 feet.
- 2.1.5 Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
  - 2.1.5.1 Sensitivity Adjustment: Separate for each sensing technology.



- 3.2.4 Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- 3.2.5 Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- 3.2.6 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- 3.3 Identification
- 3.3.1 Identify components and power and control wiring according to Division 16 Section "Basic Electrical Materials and Methods."
- 3.4 Adjusting
- 3.4.1 Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION

SECTION 16520/INTERIOR LIGHTING1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Interior lighting fixtures with lamps and ballasts.

1.2.1.2 Lighting fixtures mounted on exterior building surfaces.

1.2.1.3 Emergency lighting units.

1.2.1.4 Exit signs.

1.3 Quality Assurance

1.3.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.3.2 Comply with NFPA 70.

1.3.3 NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.4 Coordination

1.4.1 Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.5 Approval Submittals:

1.5.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of lighting fixture scheduled.

1.5.1.1 Arrange data in the order as they appear in the Lighting Fixture Schedule.

1.5.1.2 Include with each light fixture product data the ballast and lamp product data for that particular fixture. This information must accompany the light fixture product data.

1.6 Test Reports and Verification Submittals:



- 2.2.7 Electromagnetic-Interference Filters: A component of fixture assembly. Suppress conducted electromagnetic-interference as required by MIL-STD-461D. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
- 2.3 Lighting Fixtures
- 2.3.1 Fixtures shall be as indicated in the Lighting Fixture Schedule.
- 2.4 Fluorescent Lamp Ballasts
- 2.4.1 Ballasts for Low-Temperature Environments: Fluorescent ballast having a minimum starting temperature of zero degrees F in fixtures mounted in outdoors, in unheated buildings, and as indicated.
- 2.4.2 Programmed Start Solid State Electronic Ballasts: Electronic ballasts shall include the following features, unless otherwise indicated:
- 2.4.2.1 The electronic ballast shall be physically interchangeable with standard electromagnetic ballasts and standard electronic ballasts.
- 2.4.2.2 The electronic ballast shall have a maximum height of 1.18 in. and maximum weight of 1.8 lbs.
- 2.4.2.3 The electronic ballast shall be furnished with integral leads, color-coded to ANSI C82.11.
- 2.4.2.4 The electronic ballast shall operate from a nominal line voltage of 120 or 277 volts, +/-10%, 60Hz.
- 2.4.2.5 The electronic ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when used with primary lamp.
- 2.4.2.6 The electronic ballast shall have a Power Factor greater than 98% when used with primary lamp.
- 2.4.2.7 The electronic ballast shall withstand a sustained short to ground or open circuit of any output leads.
- 2.4.2.8 The electronic ballast shall be Sound Rated A.
- 2.4.2.9 The electronic ballast shall be specifically designed for use with the specified lamps.
- 2.4.2.10 The electronic ballast output frequency to the lamps shall be above 40kHz to minimize interference with infrared control systems and eliminate visible flicker.
- 2.4.2.11 The electronic ballast shall meet ANSI C82.11, where applicable.
- 2.4.2.12 The electronic ballast shall withstand transients specified in ANSI C62.41, Location Category A3.
- 2.4.2.13 The electronic ballast shall be CBM certified, where applicable.

- 2.4.3.11 Lamp Life: average lamp life meets or exceeds rating of lamp manufacturer.
- 2.4.3.12 Ballast Factor: greater than .85.
- 2.4.3.13 Power Factor: greater then .95.
- 2.4.3.14 Total Harmonic Distortion (THD): less than 10% at full light output.
- 2.4.3.15 Frequency of Operation: greater than 42kHz.
- 2.4.3.16 Maximum Inrush Current: 7 amps per ballast at 120V.
- 2.4.3.17 Sound Rating: Inaudible in a 27dBa ambient.
- 2.4.3.18 Maximum Ballast Case Temperature: 75°C (167°F).
- 2.4.3.19 UL Listed (evaluated to the requirements of UL935).
- 2.4.3.20 CSA certified (evaluated to the requirements of C22.2 No. 74).
- 2.4.3.21 Class P thermally protected.
- 2.4.3.22 Meets ANSI C82.11 High Frequency Ballast Standard.
- 2.4.3.23 Meets FCC Part 18 non-consumer requirements for EMI/RFI emissions.
- 2.4.3.24 Meets ANSI C62.41 Category A surge protection standards up to and including 6kV.
- 2.4.3.25 Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20.
- 2.4.3.26 Manufacturer registered to ISO 9001.2000.
- 2.4.3.27 Approved Manufacturer: Lutron Tu-wire, Advance Mark 10 Powerline.
- 2.5 Exit Signs
  - 2.5.1 General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
  - 2.5.2 Internally Lighted Signs:
    - 2.5.2.1 Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
  - 2.5.3 Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - 2.5.3.1 Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.



- 2.7.1.6 1400 lumen output for a minimum of 90 minutes depending upon lamp type and quantity.
- 2.7.1.7 Approved manufacturers are Bodine, Beghell and Emergi-lite.
- 2.7.1.8 In exterior locations, provide equipment capable of operating at temperatures from 0° F to 130° F.
- 2.8 Fluorescent Lamps:
  - 2.8.1 T8 Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rapid start, low mercury, rated 32 watts, 2950 approximate initial lumens, 24,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
  - 2.8.2 T5 Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rapid start, low mercury, rated 28 watts, 2900 approximate initial lumens, 24,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
  - 2.8.3 T5HO Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rapid start, low mercury, rated 54 watts, 5000 approximate initial lumens, 24,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
  - 2.8.4 Compact Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rated, 10,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
- 2.9 Fixture Support Components
  - 2.9.1 Comply with Division 16 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.
  - 2.9.2 Single-Stem Hangers: ½-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
  - 2.9.3 Twin-Stem Hangers: Two, ½-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
  - 2.9.4 Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage (2.68 mm).
  - 2.9.5 Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
  - 2.9.6 Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
  - 2.9.7 Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

- 3.3.1 Inspect each installed fixture for damage. Replace damaged fixtures and components.
- 3.3.2 Verify normal operation of each fixture after installation.
- 3.3.3 Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.
- 3.3.4 Clean all fixtures. Wipe down and remove finger prints, dust, dirt, grime, etc.
- 3.3.5 Lamp "Burn-in": All lamps, at initial energization, shall be "burned-in" at 100% output for a minimum of 100 hours.

END OF SECTION



SECTION 16731/FIRE DETECTION AND ALARM SYSTEM - ADDRESSABLE1 GENERAL1.1 Related Documents

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

- 1.2.1 This Section includes fire alarm systems.

1.3 Definitions

- 1.3.1 FACP: Fire alarm control panel.
- 1.3.2 LED: Light-emitting diode.
- 1.3.3 NAC: Notification Appliance Circuit.
- 1.3.4 NICET: National Institute for Certification in Engineering Technologies.
- 1.3.5 SLC: Signaling Line Circuit.
- 1.3.6 Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 System Description

- 1.4.1 Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1.5 Performance Requirements

- 1.5.1 Fire alarm signal initiation: Shall be by one or more of the following devices:

- 1.5.1.1 Manual stations.
- 1.5.1.2 Heat detectors.
- 1.5.1.3 Area smoke detectors.

- 1.5.2 Fire alarm signal: Shall initiate the following actions:

- 1.5.2.1 Alarm notification appliances shall operate continuously.
- 1.5.2.2 Identify alarm at the FACP and remote annunciators.
- 1.5.2.3 Transmit an alarm signal to the remote alarm receiving station.

Engineer.

- 1.6.1.3 Firms shall have a factory authorized service organization and stock spare parts.
- 1.6.2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. All equipment shall be UL listed.
- 1.7 Extra Materials
  - 1.7.1 Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    - 1.7.1.1 Smoke and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
    - 1.7.1.2 Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
    - 1.7.1.3 Keys and Tools: One extra set for access to locked and tamper proofed components.
    - 1.7.1.4 Audible and Visual Notification Appliances: One of each type installed.
    - 1.7.1.5 Fuses: Two of each type installed in the system.
- 1.8 Approval Submittals:
  - 1.8.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of device provided.
  - 1.8.2 Calculations:
    - 1.8.2.1 Battery size calculations
    - 1.8.2.2 NAC circuit cable voltage drop calculations.
  - 1.8.3 Qualification Data: For Installer.
  - 1.8.4 Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Engineer for review.
  - 1.8.5 Shop Drawings:
    - 1.8.5.1 Shop Drawings shall be prepared by persons with the following qualifications:



approval submittals (product data & shop drawings) in O&M manual.

- 1.10.2 Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

## 2 PRODUCTS

### 2.1 Manufacturers

- 2.1.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

#### 2.1.1.1 FACP and Equipment:

2.1.1.1.1 Edwards Systems Technology Inc.

2.1.1.1.2 NOTIFIER; a GE-Honeywell Company.

2.1.1.1.3 SimplexGrinnell LP; a Tyco International Company.

2.1.1.1.4 Siemens XLS.

#### 2.1.1.2 Wire and Cable:

2.1.1.2.1 Comtran Corporation.

2.1.1.2.2 Helix/HiTemp Cables, Inc.; a Draka USA Company.

2.1.1.2.3 Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.

2.1.1.2.4 West Penn Wire/CDT; a division of Cable Design Technologies.

### 2.2 FACP

#### 2.2.1 General Description:

2.2.1.1 Modular, power-limited design with electronic modules, UL 864 listed.

2.2.1.2 Addressable initiation devices that communicate device identity and status.

2.2.1.3 Smoke sensors shall additionally communicate sensitivity setting.

2.2.1.4 Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

2.2.1.5 Addressable control circuits for operation of mechanical equipment.

2.2.2 Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display

"alarm silence" light. Display of identity of the alarm zone or device is retained.

- 2.2.8.2 Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
- 2.2.8.3 When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- 2.2.9 Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- 2.2.10 Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.
- 2.2.11 Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter.
- 2.2.12 Service Modem: Port for connection to a dial-in terminal unit.
- 2.2.12.1 The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- 2.2.13 Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines and trouble signal shall be powered by the 24-V dc source.
- 2.2.13.1 The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
- 2.2.13.2 Power supply shall have a dedicated circuit breaker for this connection at the service entrance equipment. Paint the circuit breaker red and identify it with "FIRE ALARM SYSTEM POWER."
- 2.2.14 Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
- 2.2.14.1 Batteries: Shall be capable of providing power to the system for a minimum of 24 hours.
- 2.2.14.2 Battery and Charger Capacity: Comply with NFPA 72.
- 2.2.15 Surge Protection:
- 2.2.15.1 Install surge protection on normal ac power for the FACP and its accessories.



- 2.4.1.8 Shall contain an environmental compensation algorithm, which identifies and sets ambient "Environmental Thresholds" continually and periodically. In this manner, the environmental impact of temperature, humidity, environmental contaminates as well as detector aging shall be automatically monitored. This process shall employ digital compensation techniques to adapt the detector to both long term and short-term changes in the environment in which they are installed. The microprocessor shall monitor this environmental compensation value and alert the system operator when the detector 80% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the derived base line sensitivity that the detector has sensed in its environment. The base line sensitivity information shall be automatically and periodically updated and permanently stored in the detector.
- 2.4.1.9 Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- 2.4.1.9.1 Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.
- 2.4.1.9.2 Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).
- 2.4.1.9.3 Provide a minimum of 5 levels of detection sensitivity for each sensor.
- 2.4.2 Photoelectric Smoke Detectors:
- 2.4.2.1 Sensor: LED or infrared light source with matching silicon-cell receiver.
- 2.4.2.2 Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
- 2.4.3 Duct Smoke Detectors:
- 2.4.3.1 Shall utilize addressable photoelectric smoke detectors arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- 2.4.3.2 Sensor: LED or infrared light source with matching silicon-cell receiver.
- 2.4.3.3 Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
- 2.4.3.4 Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
- 2.4.3.5 Duct Housing Enclosure: UL listed for use with the supplied detector.
- 2.4.3.6 Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.



candela strobe shall be used to comply with visual coverage.

## 2.7 Remote Annunciator

2.7.1 Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.

2.7.2 Mounting: Flush cabinet, NEMA 250, Class 1.

2.7.3 Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

## 2.8 Addressable Interface Device

2.8.1 Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

2.8.2 Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and to a circuit-breaker shunt trip for power shutdown.

## 2.9 Digital Alarm Communicator Transmitter

2.9.1 Listed and labeled according to UL 632.

2.9.2 Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

## 2.10 Wire and Cable

2.10.1 Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

2.10.2 Signaling Line Circuits: Twisted, unshielded or shielded (as recommended by manufacturer) pair, not less than No. 18 AWG. Color shall be red.

2.10.3 Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

2.10.3.1 Low-Voltage Circuits: No. 14 AWG, minimum.

2.10.3.2 Line-Voltage Circuits: No. 12 AWG, minimum.



- 3.2.2.2 Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.
- 3.2.3 Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved pressure-type terminal blocks
- 3.2.4 Cable Taps: Not allowed.
- 3.2.5 Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- 3.2.5.1.1 Horns = Red +/- Black -
- 3.2.5.1.2 Strobes (if separate) = White +/- Purple -
- 3.2.5.1.3 Alarms = Blue +/- Yellow -
- 3.2.5.1.4 A/C Ventilation = Shut Down Brown +/- Orange -
- 3.2.5.1.5 Magnetic Doors = Pink +/- Grey -
- 3.2.5.1.6 Misc. Circuits = Violet +/- Tan -
- 3.2.6 Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- 3.3 Identification
- 3.3.1 Identify system components, wiring, cabling, and terminals according to Division 16 Section "Basic Electrical Materials and Methods" & "Cable Identification."
- 3.3.2 Install instructions frame in a location visible from the FACP.
- 3.3.3 Label power-supply circuit breaker "FIRE ALARM."
- 3.4 Grounding
- 3.4.1 Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.
- 3.5 Adjusting

SECTION 16900/WORK REQUIRED FOR EQUIPMENT FURNISHED BY OTHER DIVISIONS1 GENERAL

## 1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.1.2 Division-16 Basic Electrical Materials and Methods Sections apply to work of this Section.
- 1.1.3 Review all project drawings to be aware of conditions affecting work herein.

2 PRODUCTS

- 2.1 Materials for this section are specified in the Section "Basic Materials and Methods."

3 EXECUTION

- 3.1 Provide raceway boxes, fittings, devices and conductors for the electrical power to equipment furnished and installed in the other Divisions.
- 3.2 Make connections for the electrical power to equipment furnished and installed in other Divisions.
- 3.3 Verify voltage, phase, and current requirements for all equipment being supplied by other divisions. Any modifications shall be incorporated into the electrical submittals with references to any modification and reason. The electrical system is designed around the specified equipment. Any change in the equipment shall be coordinated so that proper electrical protection is obtained. In addition, if the supplied equipment has higher minimum circuit ampacity than the equipment specified, the contractor shall call the modification to the Engineer's attention and make necessary conduit, wire, circuit breaker and equipment changes to accommodate the higher ampacity requirements.
- 3.4 Any change from the specified equipment requirements shall be the responsibility of the contractor.
- 3.5 The electrical contractor shall meet with the Division 15 contractor and fully coordinate locations of mechanical equipment, duct work and piping to ensure that proper working clearance as required in the NEC is obtained. Any conflict shall be reported to the Engineer in writing prior to the installation of any of the equipment. Refer to additional requirements for planning drawings.
- 3.6 Coordinate exact locations and electrical rough-in requirements with other Divisions prior to installation to ensure proper clearances and code requirements are met.

END OF SECTION

WORK REQUIRED FOR EQUIPMENT FURNISHED BY  
OTHER DIVISIONS

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