

- (3) Emergency systems
- (4) Legally required standby systems
- (5) Critical operations power systems

**750.30 Load Management.** Energy management systems shall be permitted to monitor and control electrical loads and sources in accordance with 750.30(A) through (C).

Systems necessary for life safety, fire protection, and critical operations must continue to operate even with the loss of primary power. Load shedding is often employed for the alternate power source of a backup system to give priority to needed equipment. Disconnecting some equipment — such as a ventilation system that prevents an explosive concentration from being reached — could introduce safety hazards and must be avoided. An energy management system must not disconnect or override the control of those systems.

**(A) Load Shedding Controls.** An energy management system shall not override the load shedding controls put in place to ensure the minimum electrical capacity for the following:

- (1) Fire pumps
- (2) Emergency systems
- (3) Legally required standby systems
- (4) Critical operations power systems

**Δ (B) Disconnection of Power.** An energy management system shall not cause disconnection of power to the following:

- (1) Elevators, escalators, moving walks, or stairway lift chairs
- (2) Positive mechanical ventilation for hazardous (classified) locations
- (3) Ventilation used to exhaust hazardous gas or reclassify an area
- (4) Circuits supplying emergency lighting
- (5) Essential electrical systems in health care facilities

**(C) Capacity of Branch Circuit, Feeder, or Service.** An energy management system shall not cause a branch circuit, feeder, or service to be overloaded. If an EMS is used to limit the current on a conductor, 750.30(C)(1) through (C)(4) shall apply:

**N (1) Current Setpoint.** A single value equal to the maximum ampere setpoint of the EMS shall be permitted for one or more of the following:

- (1) For calculating the connected load per 220.70
- (2) For the maximum source current permitted by EMS control

**N (2) System Malfunction.** The EMS shall use monitoring and controls to automatically cease current flow upon malfunction of the EMS.

**N (3) Settings.** Adjustable settings shall be permitted if access to the settings is accomplished by at least one of the following:

- (1) Located behind removable and sealable covers over the adjustment means

- (2) Located behind a cover or door that requires the use of a tool to open
- (3) Located behind locked doors accessible only to qualified personnel
- (4) Password protected with password accessible only to qualified personnel
- (5) Software that has password protected access to the adjusting means accessible to qualified personnel only

**N (4) Marking.** The equipment that supplies the branch circuit, feeder, or service shall be field marked with the following information:

- (1) Maximum current setting
- (2) Date of calculation and setting
- (3) Identification of loads and sources associated with the current limiting feature
- (4) The following or equivalent wording: “The setting for the EMS current limiting feature shall not be bypassed”

The markings shall meet the requirements in 110.21(B) and shall be located such that they are clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

**Δ 750.50 Directory.** Where an energy management system is employed to control electrical power through the use of a remote means, a directory identifying the controlled device(s) and circuit(s) shall be posted on the enclosure of the controller, disconnect, or branch-circuit overcurrent device.

## ARTICLE 760

## Fire Alarm Systems

### Part I. General

**Δ 760.1 Scope.** This article covers the installation of wiring and equipment of fire alarm systems, including all circuits controlled and powered by the fire alarm system.

Informational Note No. 1: Fire alarm systems include fire detection and alarm notification, guard's tour, sprinkler waterflow, and sprinkler supervisory systems. Circuits controlled and powered by the fire alarm system include circuits for the control of building systems safety functions, elevator capture, elevator shutdown, door release, smoke doors and damper control, fire doors and damper control, and fan shutdown, but only where these circuits are powered by and controlled by the fire alarm system.

Informational Note No. 2: See *NFPA 72, National Fire Alarm and Signaling Code*, for further information on the installation and monitoring for integrity requirements for fire alarm systems.

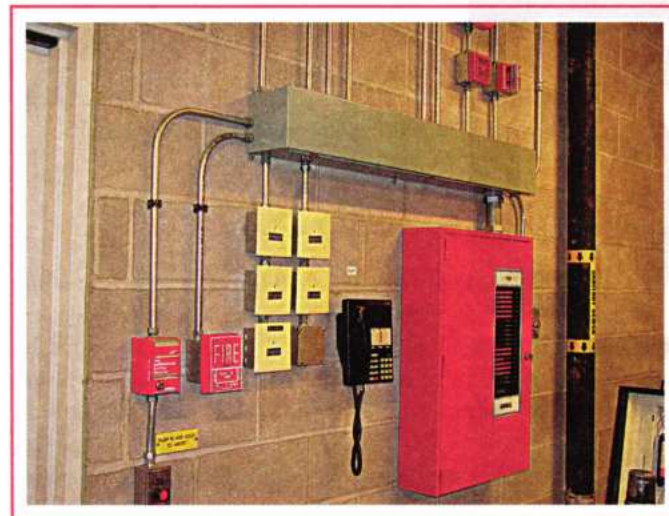
Article 760 covers only circuits that are powered and controlled by the fire alarm system, including fire safety features such as smoke door control, damper control, fan shutdown, and elevator recall. Circuits powered and controlled by other building systems such as heating, ventilating, and air conditioning (HVAC); security; lighting controls; and time recording are covered by Article 725.



*NFPA 72®*, *National Fire Alarm and Signaling Code®*, requires that all wiring, cable, and equipment be in accordance with the *NEC®* and specifically with Article 760. *NFPA 72* provides the requirements for the listing, selection, installation, performance, use, testing, and maintenance of fire alarm system components. To determine if a specific occupancy is required to have a fire alarm system, see *NFPA 101®*, *Life Safety Code®*, or other local codes.

Examples of fire alarm equipment and devices are shown in Exhibits 760.1 and 760.2. Single- and multiple-station smoke alarms, such as those commonly installed in dwelling units, are supplied through 120-volt branch circuits rather than through a fire alarm signaling circuit that is powered and controlled by a fire alarm control panel. Branch circuits supplying power to single- and multiple-station smoke alarms are not subject to the requirements of Article 760.

**760.3 Other Articles.** Circuits and equipment shall comply with 760.3(A) through (O). Only those sections of Article 300 referenced in this article shall apply to fire alarm systems.



**EXHIBIT 760.1** Typical fire alarm control unit. (Courtesy of the International Association of Electrical Inspectors)



**EXHIBIT 760.2** Typical spot-type smoke detector.

**(A) Spread of Fire or Products of Combustion.** Installation of fire alarm circuits shall comply with 300.21.

**(B) Ducts, Plenums, and Other Air-Handling Spaces.** Power-limited and non-power-limited fire alarm cables installed in ducts, plenums, or other spaces used for environmental air shall comply with 300.22.

*Exception No. 1: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 722.135 and 300.22(B), Exception, shall be permitted to be installed in ducts specifically fabricated for environmental air.*

*Exception No. 2: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 722.135 shall be permitted to be installed in other spaces used for environmental air (plenums).*

#### See also

**300.22(B), 300.22(C)**, and associated commentary for more information on wiring installed in ducts, plenums, or other air-handling spaces

**Δ (C) Corrosive, Damp, or Wet Locations.** Fire alarm circuits and equipment installed in corrosive, damp, or wet locations shall comply with 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).

Cables and equipment used in wet or damp locations, high ambient temperature areas, or corrosive locations must be identified as suitable for the environment. Underground installations are considered wet locations.

**Δ (D) Building Control Circuits.** Building control systems (e.g., elevator capture, fan shutdown) associated with the fire alarm system shall comply with Article 725.

**(E) Optical Fiber Cables.** Where optical fiber cables are utilized for fire alarm circuits, the cables shall be installed in accordance with Article 770.

**(F) Installation of Conductors with Other Systems.** Installations shall comply with 300.8.

**(G) Raceways or Sleeves Exposed to Different Temperatures.** Installations shall comply with 300.7(A).

Condensation often forms in conduit that runs between spaces having different temperatures, such as from an air-conditioned space to a space that is not air conditioned or into a freezer. Section 300.7(A) requires blocking of the circulation of warm air into the colder section of the raceway.

**(H) Vertical Support for Fire-Resistive Cables and Conductors.** Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of fire-resistive cable systems shall be installed in accordance with 300.19.

Support requirements for fire-rated cable are located in 300.19(B). The strength of cables and conductors decreases with heat, and they could break if not properly supported. Support of vertical runs of fire-rated cables helps ensure continued



performance if the cable is exposed directly to a fire or to high temperatures caused by a fire.

**(I) Installation of Cables and Conductors in Raceway.** The number and size of cables and conductors shall comply with 300.17.

Compliance with the raceway fill requirement protects conductors from abrasion or other physical damage resulting from too many conductors being pulled through a raceway. In addition, the ability to install and withdraw conductors simplifies maintenance.

**(J) Bushing.** A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

**(K) Cable Routing Assemblies.** Power-limited fire alarm cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

**(L) Communications Raceways.** Power-limited fire alarm cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing apply.

**(M) Temperature Limitations of Power-Limited and Non-Power-Limited Fire Alarm Cables.** The requirements of 310.14(A) (3) on the temperature limitation of conductors shall apply to power-limited fire alarm cables and non-power-limited fire alarms cables.

**(N) Identification of Equipment Grounding Conductors.** Equipment grounding conductors shall be identified in accordance with 250.119.

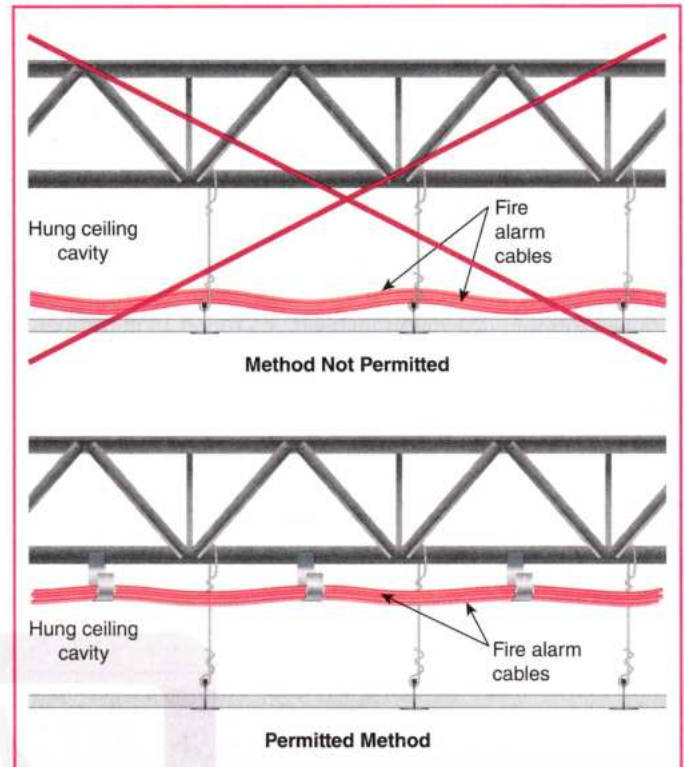
*Exception: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors for Types FPLP, FPLR, FPL, and substitute cables installed in accordance with 760.154(A).*

**N (O) Cables for Power-Limited Fire Alarm (PLFA) Circuits.** The listing and installation of cables for power-limited fire alarm circuits shall comply with Part III of this article and Parts I and II of Article 722.

**N 760.10 Hazardous (Classified) Locations.** Cables and equipment shall be permitted to be used in hazardous (classified) locations where specifically permitted by other articles in this Code.

**760.21 Access to Electrical Equipment Behind Panels Designed to Allow Access.** Access to electrical equipment shall not be denied by an accumulation of conductors and cables that prevents removal of panels, including suspended ceiling panels.

An excess accumulation of wires and cables can limit access to equipment by preventing the removal of access panels. See Exhibit 760.3.



**EXHIBIT 760.3** Incorrect cable installation (upper diagram) and correct method (lower diagram).

## 760.24 Mechanical Execution of Work.

**(A) General.** Fire alarm circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by hardware, including straps, staples, hangers, listed cable ties identified for securement and support, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4 and 300.11.

**Informational Note:** Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants might result in an undetermined alteration of PLFA and NPLFA cable properties.

The location of fire alarm cables should be carefully evaluated to ensure that activities and processes within the building do not cause damage to the cable.

The reference to 300.4 calls attention to the hazards to which cables are exposed where they are installed on framing members. Such cables are required to be installed in a manner that protects them from nail or screw penetration. This section permits attachment to baseboards and non-load-bearing walls, which are not structural components.

**(B) Circuit Integrity (CI) Cable.** Circuit integrity (CI) cables shall be supported at a distance not exceeding 610 mm (24 in.). Where located within 2.1 m (7 ft) of the floor in accordance with 760.53(A)(1) and 760.130(B)(1), as applicable, the cable shall



be fastened in an approved manner at intervals of not more than 450 mm (18 in.). Cable supports and fasteners shall be steel.

**760.25 Abandoned Cables.** The accessible portion of abandoned fire alarm cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

Abandoned cables increase fire loading unnecessarily and, if installed in plenums, can affect airflow.

#### See also

**Article 100** for the definition of the term *cable, abandoned* (*abandoned cable*)

**760.30 Fire Alarm Circuit Identification.** Fire alarm circuits shall be identified at terminal and junction locations in a manner that helps to prevent unintentional signals on fire alarm system circuit(s) during testing and servicing of other systems.

One way to facilitate circuit identification is to use a terminal cabinet with permanently mounted and labeled terminals, such as the one shown in Exhibit 760.4. Another common method is to paint fire alarm system circuit junction box covers red and/or label them with the words "FIRE ALARM." Some jurisdictions require that all conduits carrying fire alarm system circuits be red. Other jurisdictions require a red stripe every 10 feet or red fittings where specific lengths of conduit are joined for fire alarm system circuit conduits.

Δ **760.32 Fire Alarm Circuits Extending Beyond One Building.** Non-power-limited fire alarm circuits and power-limited fire alarm circuits that extend beyond one building and run outdoors shall meet the installation requirements of Parts II, III, and IV of Article 805 and shall meet the installation requirements of Part I of Article 300.

N **760.33 Supply-Side Overvoltage Protection.** A listed surge-protective device (SPD) shall be installed on the supply side of a fire alarm control panel in accordance with Part II of Article 242.



**EXHIBIT 760.4** Fire alarm terminal cabinet. (Courtesy of JENSEN HUGHES, Warwick, RI)

**760.35 Fire Alarm Circuit Requirements.** Fire alarm circuits shall comply with 760.35(A) and (B).

(A) **Non-Power-Limited Fire Alarm (NPLFA) Circuits.** See Parts I and II.

(B) **Power-Limited Fire Alarm (PLFA) Circuits.** See Parts I and III.

Power source limitations for power-limited fire alarm circuits used by testing laboratories are found in Chapter 9, Tables 12(A) and 12(B). Table 12(A) covers alternating-current (ac) source limitations, and Table 12(B) covers direct-current (dc) source limitations.

## Part II. Non-Power-Limited Fire Alarm (NPLFA) Circuits

### 760.41 NPLFA Circuit Power Source Requirements.

(A) **Power Source.** The power source of non-power-limited fire alarm circuits shall comply with Chapters 1 through 4, and the output voltage shall be not more than 600 volts, nominal. The fire alarm circuit disconnect shall be permitted to be secured in the "on" position.

This section correlates with *NFPA 72, National Fire Alarm and Signaling Code*, which requires the circuit disconnecting means to be accessible only to authorized personnel. Limiting access decreases the chance that the power to the fire alarm system is turned off.

Δ (B) **Branch Circuit.** The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

*NFPA 72, National Fire Alarm and Signaling Code*, requires that the power to the fire alarm system be supplied from a branch circuit dedicated to the fire alarm system. The dedicated circuit can be used to power other equipment that is part of the system, but this power circuit cannot be used to power other equipment, such as telephone switches, computer stations, and other equipment that is not directly associated with the fire alarm system functions. Further, *NFPA 72* requires the location of the branch-circuit disconnecting means to be permanently identified at the control unit.

To minimize interruption of the normal ac power, non-power-limited fire alarm equipment is not permitted to be supplied by a branch circuit protected with a GFCI device or with an AFCI device. The AFCI protection requirements apply to outlets supplying single- or multiple-station smoke alarms where the smoke alarm outlet is located in an area covered by the requirements of 210.12(A). These smoke alarms are supplied by a branch circuit covered by the requirements of Article 210, not by the fire alarm control panel. In new construction, single- and multiple-station smoke alarms are required by *NFPA 72* to have a backup battery



that will supply power in the event that the branch-circuit power is interrupted due to the operation of an AFCI device.

**760.43 NPLFA Circuit Overcurrent Protection.** Overcurrent protection for conductors 14 AWG and larger shall be provided in accordance with the conductor ampacity without applying the ampacity adjustment and correction factors of 310.14 to the ampacity calculation. Overcurrent protection shall not exceed 7 amperes for 18 AWG conductors and 10 amperes for 16 AWG conductors.

*Exception: Where other articles of this Code permit or require other overcurrent protection.*

**760.45 NPLFA Circuit Overcurrent Device Location.** Overcurrent devices shall be located at the point where the conductor to be protected receives its supply.

*Exception No. 1: Where the overcurrent device protecting the larger conductor also protects the smaller conductor.*

*Exception No. 2: Transformer secondary conductors. Non-power-limited fire alarm circuit conductors supplied by the secondary of a single-phase transformer that has only a 2-wire (single-voltage) secondary shall be permitted to be protected by overcurrent protection provided by the primary (supply) side of the transformer, provided the protection is in accordance with 450.3 and does not exceed the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. Transformer secondary conductors other than 2-wire shall not be considered to be protected by the primary overcurrent protection.*

*Exception No. 3: Electronic power source output conductors. Non-power-limited circuit conductors supplied by the output of a single-phase, listed electronic power source, other than a transformer, having only a 2-wire (single-voltage) output for connection to non-power-limited circuits shall be permitted to be protected by overcurrent protection provided on the input side of the electronic power source, provided this protection does not exceed the value determined by multiplying the non-power-limited circuit conductor ampacity by the output-to-input voltage ratio. Electronic power source outputs, other than 2-wire (single voltage), connected to non-power-limited circuits shall not be considered to be protected by overcurrent protection on the input of the electronic power source.*

**Informational Note:** A single-phase, listed electronic power supply whose output supplies a 2-wire (single-voltage) circuit is an example of a non-power-limited power source that meets the requirements of 760.41.

**760.46 NPLFA Circuit Wiring.** Installation of non-power-limited fire alarm circuits shall be in accordance with 110.3(B), 300.7, 300.11, 300.15, 300.17, 300.19(B), and other appropriate articles of Chapter 3.

*Exception No. 1: As provided in 760.48 through 760.53.*



**EXHIBIT 760.5** Typical manual fire alarm pull station box. (Courtesy of the Protectowire Fire Systems)

*Exception No. 2: Where other articles of this Code require other methods.*

Section 300.15 requires non-power-limited circuit terminations to be made in a box or conduit body. However, 300.15(E) permits devices with integral terminal enclosures and mounting brackets to be used without a box. Devices must be mounted on a box or conduit body where the instructions or the listing requires the use of a box. Fire alarm system components such as manual fire alarm boxes are tested frequently. Therefore, secure mounting is necessary to ensure that the manual fire alarm device will remain in place. (See Exhibit 760.5.)

**760.48 Conductors of Different Circuits in Same Cable, Enclosure, or Raceway.**

**(A) Class 1 with NPLFA Circuits.** Class 1 and non-power-limited fire alarm circuits shall be permitted to occupy the same cable, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the enclosure or raceway.

**(B) Fire Alarm with Power-Supply Circuits.** Power-supply and fire alarm circuit conductors shall be permitted in the same cable, enclosure, or raceway only where connected to the same equipment.

**760.49 NPLFA Circuit Conductors.**

**(A) Sizes and Use.** Only copper conductors shall be permitted to be used for fire alarm systems. Size 18 AWG and 16 AWG conductors shall be permitted to be used, provided they supply loads that do not exceed the ampacities given in Table 402.5 and are installed in a raceway, an approved enclosure, or a listed cable. Conductors larger than 16 AWG shall not supply loads greater than the ampacities given in 310.14, as applicable.

*NFPA 72, National Fire Alarm and Signaling Code, requires fire alarm device and appliance voltages to be between 85 and*