Mike Holt’s Illustrated Guide to
UNDERSTANDING NEC® REQUIREMENTS FOR
FIRE ALARM WIRING

Extracted from Mike Holt’s Understanding the National Electrical Code® - Volume 2

Article 760 Based on the 2017 NEC®
I dedicate this book to the Lord Jesus Christ, my mentor and teacher.
Proverbs 16:3
Article 760 covers the installation of wiring and equipment for fire alarm systems, including circuits controlled and powered by the fire alarm. These include fire detection and alarm notification, guard’s tour, sprinkler workflow, and sprinkler supervisory systems. NFPA 72, National Fire Alarm Code provides other fire alarm system requirements.

**Author’s Comment:**
- Residential smoke alarm systems, including interconnecting wiring, aren’t covered by Article 760, because they aren’t powered by a fire alarm system as defined in NFPA 72.

**Note 1:** Fire alarm systems include fire detection and alarm notification, guard’s tour, sprinkler workflow, and sprinkler supervisory systems. Other circuits that might be controlled or powered by the fire alarm system include elevator capture, elevator shutdown, door release, smoke doors and damper control, fire doors and damper control, and fan shutdown. NFPA 72, National Fire Alarm and Signaling Code, provides the requirements for the selection, installation, performance, use, testing, and maintenance of fire alarm systems.

**Author’s Comment:**
- Building control circuits associated with the fire alarm system, such as elevator capture and fan shutdown, must comply with Article 725 [760.3(E)]. Article 760 applies if these components are powered and directly controlled by the fire alarm system.
- NFPA 101—Life Safety Code or the local building code specifies when and where a fire alarm system is required.
### 760.2 Definitions

**Abandoned Fire Alarm Cable.** A cable that isn’t terminated to equipment and not identified for future use with a tag.

**Author’s Comment:**
- Section 760.25 requires the accessible portion of abandoned cables to be removed.

**Fire Alarm Circuit.** The portion of the wiring system and connected equipment powered and controlled by the fire alarm system. Fire alarm circuits are classified as either nonpower-limited or power-limited.

**Nonpower-Limited Fire Alarm Circuit.** A nonpower-limited fire alarm circuit can operate at up to 600V, and the power output isn’t limited [760.41 and 760.43].

**Power-Limited Fire Alarm Circuit.** A power-limited fire alarm circuit must have the voltage and power limited by a listed power supply that complies with 760.121 as follows:

#### Inherently Limited (ac) [Chapter 9, Table 12(A)]

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>0V to 20V</td>
<td>5.00 x V</td>
</tr>
<tr>
<td>21V to 100V</td>
<td>100 VA</td>
</tr>
</tbody>
</table>

**Author’s Comment:**
- Inherently limited power supplies are designed to burn out if overloaded.

### 760.3 Other Articles

Only those sections contained in Article 300 specifically referenced below apply to fire alarm systems.

#### (A) Spread of Fire or Products of Combustion.
Fire alarm circuits installed through fire-resistant-rated walls, partitions, floors, or ceilings must be firestopped to limit the possible spread of fire or products of combustion in accordance with the instructions supplied by the manufacturer for the specific type of cable and construction material (drywall, brick, and so forth) [300.21].

#### (B) Ducts and Plenum Spaces.
Power-limited and nonpower-limited fire alarm cables installed in ducts or plenum spaces must comply with 300.22.
(E) Building Control Circuits. Class 1, 2, and 3 circuits used for building controls (elevator capture, fan shutdown, and so on), associated with the fire alarm system, but not controlled and powered by the fire alarm system, must be installed in accordance with Article 725 [760.1].

(F) Optical Fiber Cables. Optical fiber cables utilized for fire alarm circuits must be installed in accordance with Article 770.

(H) Raceways or Sleeves Exposed to Different Temperatures. If a raceway or sleeve is subjected to different temperatures, and where condensation is known to be a problem, the raceway or sleeve must be filled with a material approved by the authority having jurisdiction that will prevent the circulation of warm air to a colder section of the raceway. An explosionproof seal isn’t required for this purpose [300.7(A)].

(J) Number and Size of Conductors in a Raceway. Raceways must be large enough to permit the installation and removal of conductors without damaging conductor insulation [300.17].

Author’s Comment:
- When all conductors within a raceway are the same size and insulation, the number of conductors permitted can be found in Annex C for the raceway type.
(L) **Cable Routing Assemblies.** Power-limited fire alarm cables can be installed in 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.  

![Figure 760–9](https://www.mikeholt.com)

(M) **Communications Raceways.** Power-limited fire alarm cables can be installed in 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.  

![Figure 760–10](https://www.mikeholt.com)

(K) **Bushing.** When a raceway is used for the support or protection of cables, a bushing to reduce the potential for abrasion must be placed at the location where the cables enter the raceway in accordance with 300.15(C).  

![Figure 760–8](https://www.mikeholt.com)

**Example:** How many 18 TFFN fixture wires can be installed in trade size ½ electrical metallic tubing?  

![Figure 760–7](https://www.mikeholt.com)

**Answer:** Twenty-two 18 TFFN fixture wires can be installed in trade size ½ electrical metallic tubing conductors [Annex C, Table C.1].

![Figure 760–7](https://www.mikeholt.com)
Access to equipment isn’t permitted to be prohibited by an accumulation of cables that prevents the removal of suspended-ceiling panels. **Author’s Comment:**

- Cables must be located so suspended-ceiling panels can be moved to provide access to electrical equipment.

### 760.24 Mechanical Execution of Work

**(A) General.** Equipment and cabling must be installed in a neat and workmanlike manner.

Exposed cables must be supported by the structural components of the building so the cable won’t be damaged by normal building use. Cables must be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed in a manner that won’t damage the cable. **Figure 760–11**

**Author’s Comment:**

- Raceways and cables above a suspended ceiling must be supported by independent support wires attached to the suspended ceiling [300.11(B), 760.46, and 760.130]. **Figure 760–12**

- Cables installed through or parallel to framing members or furring strips must be protected where they’re likely to be penetrated by nails or screws, by installing the wiring method so it isn’t less than 1¼ in. from the nearest edge of the framing member or furring strips, or by protecting them with a 1/16 in. thick steel plate or the equivalent [300.4(D)]. **Figure 760–13**
760.30 Fire Alarm Circuit Identification

Fire alarm circuits must be identified at terminal and junction locations. The identification must be in such a manner that will help to prevent unintentional signals on the fire alarm system circuits during testing and servicing of other systems. ▶️ Figure 760–16

Authors Comment:

- Red raceways and fittings are sometimes used but the red color isn’t an NEC requirement. ▶️ Figure 760–17

Author’s Comment:

- Cables installed in concealed raceways aren’t considered “accessible”; therefore, they’re not required to be removed.

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The branch-circuit overcurrent protection device must be identified in red, accessible only to qualified personnel, and identified as "FIRE ALARM CIRCUIT." The red identification must not damage the overcurrent protective device or obscure any manufacturer’s markings.

The location of the branch-circuit overcurrent protection device for the power-limited fire alarm equipment must be permanently identified at the fire alarm control unit.

Fire alarm equipment supplying power-limited fire alarm cable circuits must be durably marked to indicate each circuit that’s a power-limited fire alarm circuit.

Fire alarm circuits must be marked at terminal and junction locations [760.30].
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Author’s Comment:

- Exposed cables must be supported by the structural components of the building so the cable won’t be damaged by normal building use. Cables must be secured by straps, staples, hangers, or similar fittings designed and installed in a manner that won’t damage the cable. Cables installed through or parallel to framing members or furring strips must be protected where they’re likely to be penetrated by nails or screws, by installing the wiring method so it isn’t less than 1¼ in. from the nearest edge of the framing member or furring strips, or it must be protected by a ¼ in. thick steel plate or the equivalent [760.24(A)].

760.135 Installation of PLFA Cables in Buildings

Installation of power-limited fire alarm cables in buildings must comply with 760.135(A) through (J).

(A) Listing. PLFA cables installed in buildings must be listed.

(B) Ducts Specifically Fabricated for Environmental Air Spaces. Plenum rated PLFA cables are permitted to be installed within ducts specifically fabricated for environmental air spaces in accordance with 300.22(B) if the cable is directly associated with the air distribution system and complies with (1) and (2):

(1) The cable is plenum rated with a length as short as practical to perform the required function.

(2) The cable is nonplenum rated within a raceway in accordance with 300.22(B).

(C) Plenum Spaces. Plenum rated FPLP cables are permitted in plenum spaces as described in 300.22(C). ▶Figure 760–23

(H) Other Building Locations. The following cables are permitted to be installed in building locations other than the locations covered in 770.113(B) through (H):

(1) Types FPLP, FPLR, and FPL cables

(2) Types FPLP, FPLR, and FPL cables installed in:
   a. Plenum communications raceways
   b. Plenum cable routing assemblies
   c. Riser communications raceways
   d. Riser cable routing assemblies
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1. General-purpose communications raceways
2. General-purpose cable routing assemblies

(3) Types FPLP, FPLR, and FPL cables installed within a raceway of a type recognized in Chapter 3

**Installation of PLFA Cables, Plenum Spaces 760.135(C)**

- Plenum rated FPLP cables are permitted in plenum spaces as described in 300.22(C).

**Figure 760–23**

### 760.136 Separation from Power Conductors

**(A) General.** Power-limited fire alarm conductors aren’t permitted to be placed in any enclosure, raceway, or cable with conductors of electric light, power, or Class 1 circuits.

**(B) Separated by Barriers.** If separated by a barrier, power-limited fire alarm circuits are permitted with electric power conductors.

**Author’s Comment:**

- Separation is required to prevent a fire or shock hazard that can occur from a short between the fire alarm circuit and the higher-voltage circuits.

**(D) Associated Systems Within Enclosures.** Power-limited fire alarm conductors can be mixed with electric light, power, and Class 1 circuit conductors in enclosures where these other conductors are introduced solely for connection to the same equipment, and:

1. A minimum of ¼ in. separation is maintained from the power-limited fire alarm cable conductors.

**(G) Other Applications.** Power-limited fire alarm circuit conductors must be separated by not less than 2 in. from insulated conductors of electric light, power, or Class 1 circuits unless:

1. Electric light, power, Class 1 circuit conductors, or power-limited fire alarm circuit conductors, are within a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, or underground feeder cables. **Figure 760–24**

**Figure 760–24**

### 760.139 Fire Alarm Circuits, Class 2, Class 3, and Communications Circuits

**(A) Two or More PLFA Circuits.** Power-limited fire alarm circuits, communications circuits, or Class 3 circuits can be in the same cable, enclosure, cable tray, raceway, or cable routing assembly. **Figure 760–25**

**(B) PLFA and Class 2 Circuits.** Class 2 circuits can be within the same cable, cable routing assembly, enclosure, cable tray, or raceway as conductors of power-limited fire alarm circuits provided the Class 2 circuit conductor insulation isn’t less than that required for the power-limited fire alarm circuits.

**Author’s Comment:**

- Listed Class 2 cables have an insulation voltage rating of at least 150V [725.179(G)], whereas listed power-limited fire alarm cables have a voltage rating of not less than 300V [760.179(C)].
Part IV. Listing Requirements

760.143 Support

Power-limited fire alarm cables aren’t permitted to be strapped, taped, or attached to the exterior of any raceway as a means of support. ▶ Figure 760–26

760.154 Applications of Listed Fire Alarm Cables (PLFA)

PLFA cables must meet the requirements of Table 760.154, or the substitutions allowed in 760.154(A). ▶ Figure 760–27

760.179 Listing and Marking of Power-Limited Fire Alarm Cables (PLFA)

PLFA cables installed as wiring within buildings must be listed as being resistant to the spread of fire and other criteria in accordance with 760.179(A) through (H) and be marked in accordance with 760.179(I).

Cable used in a wet location must be listed for use in wet locations or have a moisture-impervious metal sheath. ▶ Figure 760–28

(C) Ratings. Fire alarm cable must have a voltage rating of not less than 300V and a temperature rating of no less than 60°C. ▶ Figure 760–29
(D) Type FPLP. Type FPLP plenum cable must be listed as being suitable for use in a plenum space. Figure 760–30

Listing and Marking of PLFA Cable
Type FPLP
760.179(D)

Type FPLP power-limited fire alarm cable must be listed as being suitable for use in a plenum space and listed as having adequate fire-resistance and low smoke producing characteristics.

Figure 760–30

(I) Marking. Cables must be marked in accordance with Table 760.179(I). Voltage ratings aren’t permitted to be marked on the cable.

Note: Voltage markings on cables may suggest that the cables are suitable for Class 1 or electric power and light applications, which they aren’t.
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