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Mike Holt's Illustrated Guide to

# Article 760

## FIRE ALARM SYSTEMS

Extracted from Understanding the National Electrical Code® Volume 2



**Mike Holt Enterprises**

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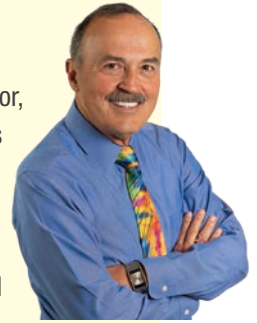
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## ABOUT THE AUTHOR

**Mike Holt** is an author, businessman, educator, speaker, publisher and *NEC*® expert. He has written hundreds of electrical training books and articles, founded three successful businesses, and has taught thousands of electrical *Code* seminars across the United States and internationally.



Mike's approach to electrical training is based on his own experience as an electrician, contractor, inspector and teacher. He's always felt a responsibility to his students and to the electrical industry to provide education beyond the scope of just passing an exam. This commitment, coupled with the lessons he learned at the University of Miami's MBA program, have helped him build one of the largest electrical training and publishing companies in the United States.

Mike's one-of-a-kind presentation style and his ability to simplify and clarify technical concepts explain his unique position as one of the premier educators and *Code* experts in the country. His passion for the electrical field drives his goal to increase electrical safety and improve lives.

Mike's commitment to pushing boundaries and setting high standards extends into his personal life. He's an eight-time Overall National Barefoot Waterski Champion with more than 20 gold medals, many national records, and he has competed in three World Barefoot Tournaments. In 2015, at the tender age of 64, he started a new adventure—competitive mountain bike racing. Every day he continues to find ways to motivate himself, both mentally and physically.

Mike and his wife, Linda, reside in New Mexico and Florida, and are the parents of seven children and six grandchildren. As his life has changed over the years, a few things have remained constant: his commitment to God, his love for his family, and doing what he can to change the lives of others through his products and seminars.

*I dedicate this book to the  
Lord Jesus Christ,  
my mentor and teacher.  
Proverbs 16:3*



# ARTICLE 760

## FIRE ALARM SYSTEMS

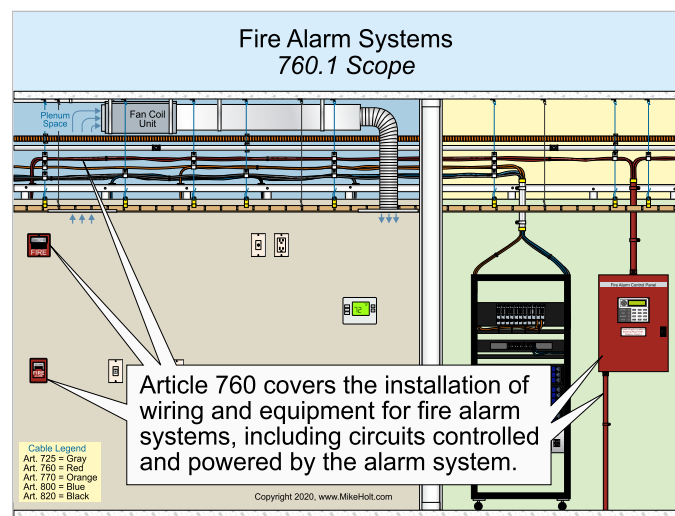
### Introduction to Article 760—Fire Alarm Systems

Article 760 covers the installation of wiring and equipment for fire alarm systems including circuits controlled and powered by the fire alarm. These systems include fire detection and alarm notification, guard's tour, sprinkler waterflow, and sprinkler supervisory systems. NFPA 72, *National Fire Alarm and Signaling Code*, provides the requirements for the selection, installation, performance, use, testing, and maintenance of fire alarm systems.

### Part I. General

#### 760.1 Scope

Article 760 covers the installation of wiring and equipment for fire alarm systems, including circuits controlled and powered by the fire alarm system. ▶ **Figure 760-1**



▶ **Figure 760-1**

#### Author's Comment:

- ▶ Residential smoke alarm systems, including interconnecting wiring, are not covered by Article 760 because they are not powered by a fire alarm system as defined in NFPA 72, *National Fire Alarm and Signaling Code*.

**Note 1:** Fire alarm systems include fire detection and alarm notification, guard's tour, sprinkler waterflow, 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:

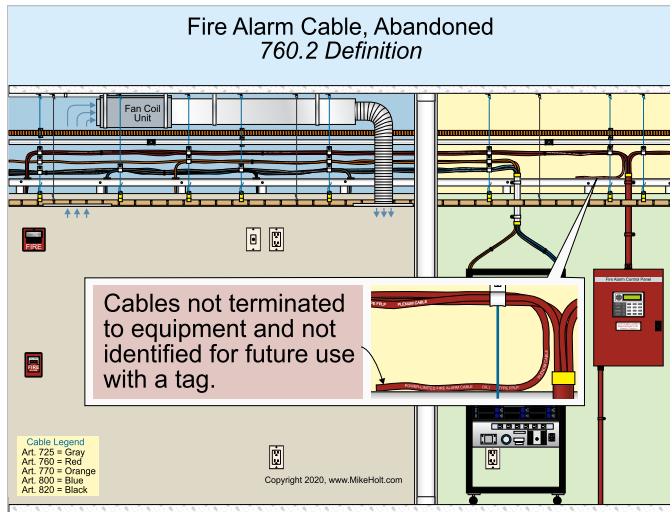
- ▶ Building control circuits associated with the fire alarm system, such as elevator capture and fan shutdown, must comply with Article 725 [760.3(E)]. Article 760 applies if these components are powered and directly controlled by the fire alarm system.
- ▶ NFPA 101, *Life Safety Code*, or the local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

#### 760.2 Definitions

The definitions in this section only apply to this article.

**Abandoned Fire Alarm Cable.** A cable that is not terminated to equipment and not identified for future use with a tag. ▶ **Figure 760-2**



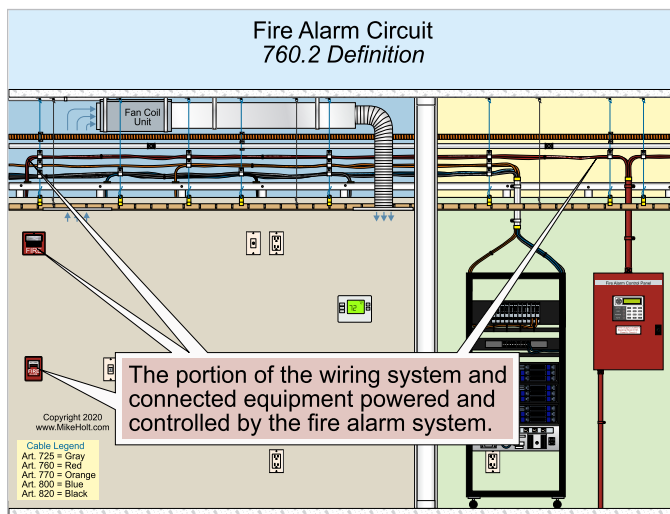


▶ Figure 760-2

**Author's Comment:**

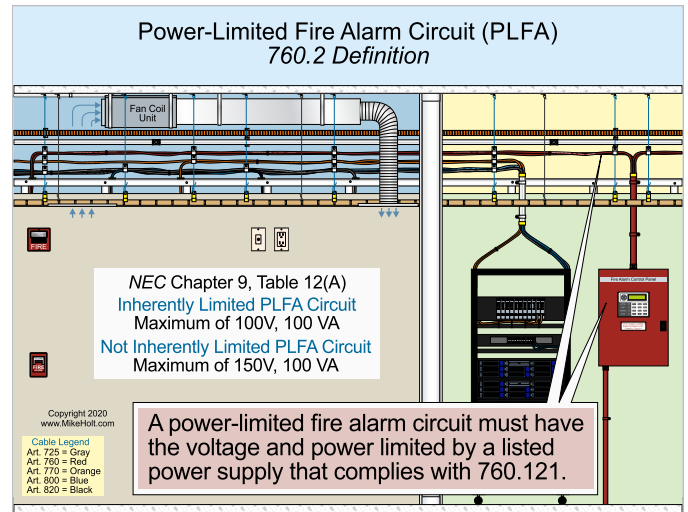
- ▶ Section 760.25 requires the accessible portion of abandoned cables to be removed.

**Fire Alarm Circuit.** The portion of the wiring system and connected equipment powered and controlled by the fire alarm system. ▶Figure 760-3



▶ Figure 760-3

**Power-Limited Fire Alarm Circuit (PLFA).** A power-limited fire alarm circuit must have the voltage and power limited by a listed power supply that complies with 760.121. ▶Figure 760-4

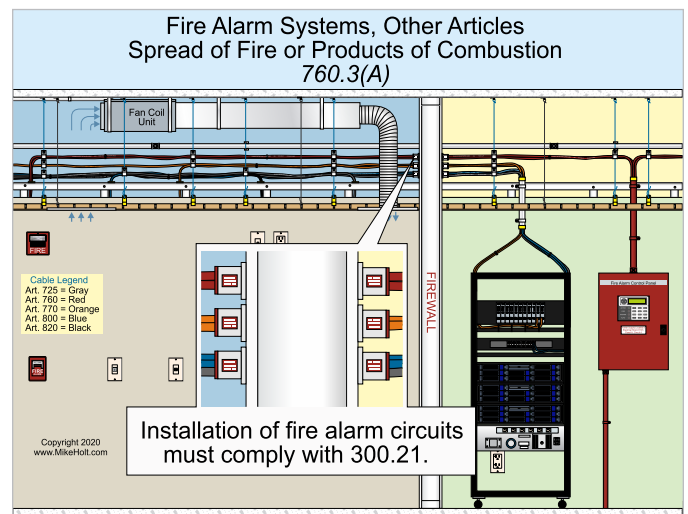


▶ Figure 760-4

**760.3 Other Articles**

Fire alarm circuits and equipment must comply with 760.3(A) through (O). Only those sections contained in Article 300 specifically referenced below apply to fire alarm systems.

**(A) Spread of Fire or Products of Combustion.** Installation of fire alarm circuits must comply with 300.21. ▶Figure 760-5

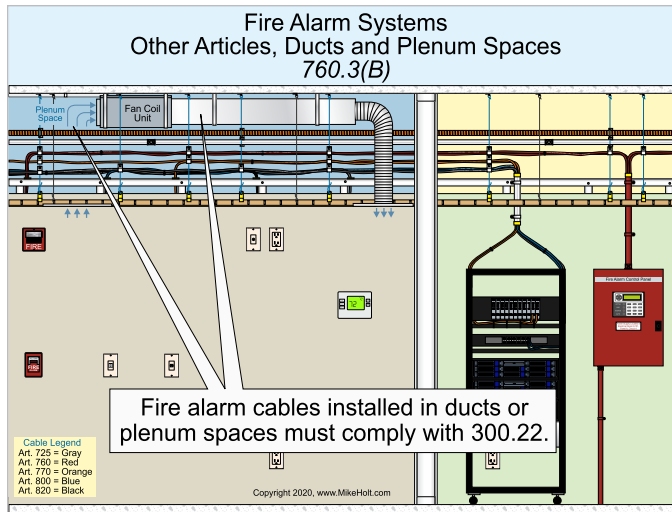


▶ Figure 760-5

**(B) Ducts and Plenum Spaces.** Fire alarm cables installed in ducts or plenum spaces must comply with 300.22. ▶Figure 760-6

*Ex 1: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 760.135(B) and 300.22(B) Ex are permitted to be installed in ducts specifically fabricated for environmental air.*





▶ Figure 760-6

*Ex 2: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 760.135(C) are permitted to be installed in plenum spaces.*

**(D) Corrosive, Damp, or Wet Locations.** Fire alarm circuits installed in corrosive, damp, or wet locations must be identified for use in the operating environment [110.11], must be of materials suitable for the environment in which they are to be installed, and must be of a type suitable for the application [300.5(B), 300.6, 300.9, and 310.10(F)].

**(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.

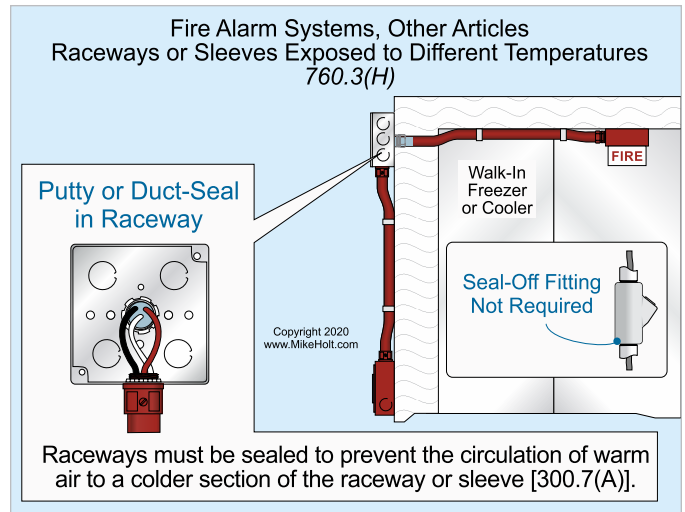
**(F) Optical Fiber Cables.** Optical fiber cables utilized for fire alarm circuits must be installed in accordance with Article 770.

**(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 in accordance with 300.7(A). ▶ Figure 760-7

**(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.



▶ Figure 760-7

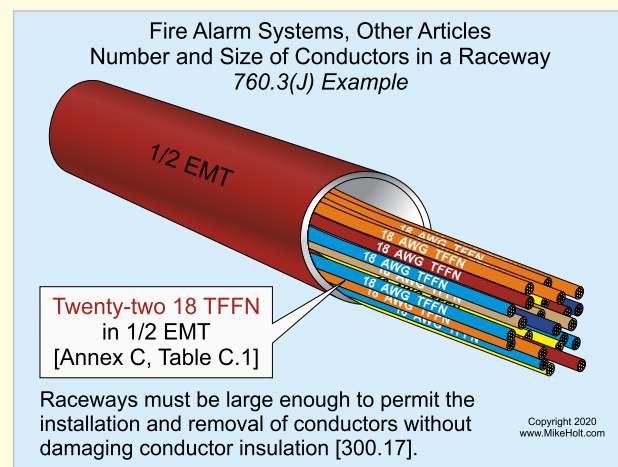
#### Author's Comment:

- ▶ For conductors not included in Chapter 9 (such as multiconductor cable), the actual dimensions must be used. If one multiconductor cable is used inside a raceway the single conductor percentage fill area must be used [Chapter 9, Notes to Tables, Note 5 and 9].

#### ▶ Example

**Question:** How many 18 TFFN fixture wires can be installed in trade size 1/2 electrical metallic tubing? ▶ Figure 760-8

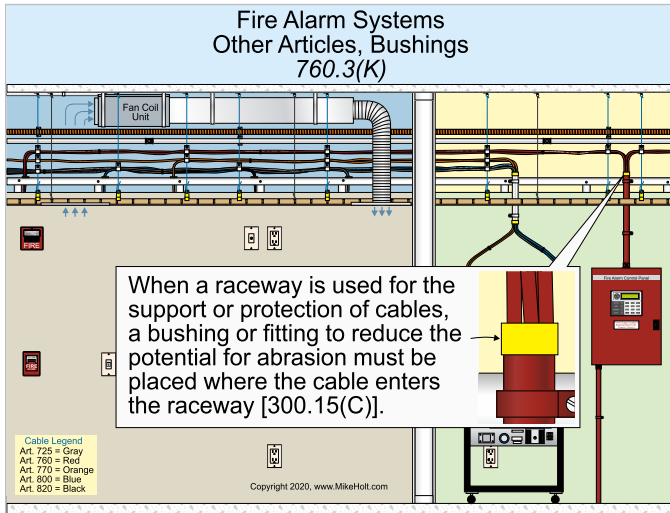
- (a) 16      (b) 18      (c) 22      (d) 38



▶ Figure 760-8

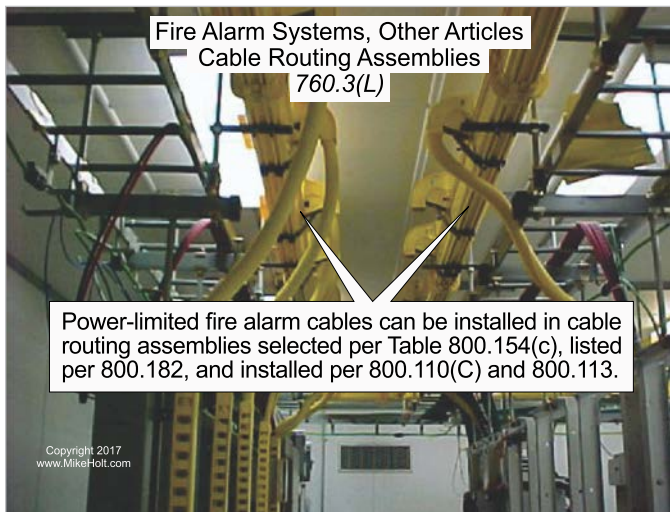
**Answer:** (c) 22  
[Annex C, Table C.1]

**(K) Bushing.** When a raceway is used for the support or protection of cables, a bushing or fitting is required to reduce the potential for abrasion and must be placed at the location the cables enter the raceway in accordance with 300.15(C). ▶Figure 760-9



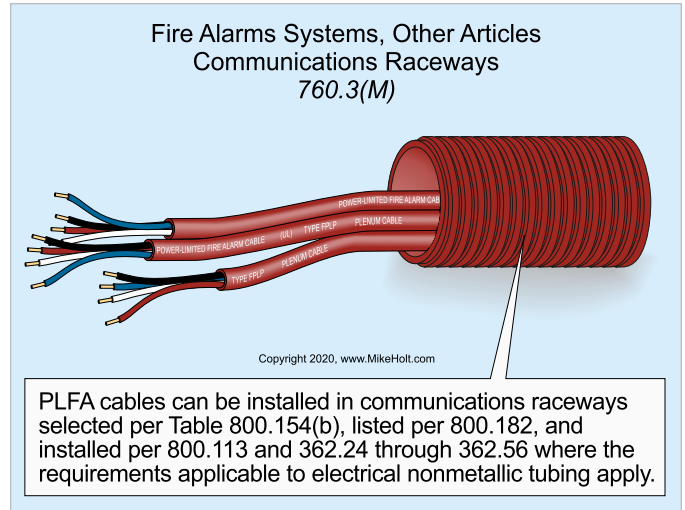
▶Figure 760-9

**(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 760-10



▶Figure 760-10

**(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 760-11



▶Figure 760-11

**(N) Temperature Limitations.** The requirements of 310.14(A)(3) on the temperature limitation of conductors apply to power-limited fire alarm cables and nonpower-limited fire alarm cables.

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

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

## 760.21 Access to Electrical Equipment Behind Panels Designed to Allow Access

Access to equipment is not permitted to be prohibited by an accumulation of cables that prevents the removal of suspended-ceiling panels.

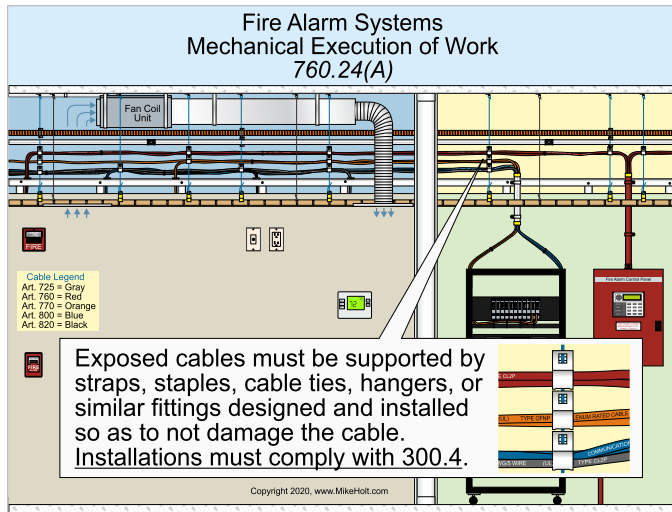
### Author's Comment:

- ▶ 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.

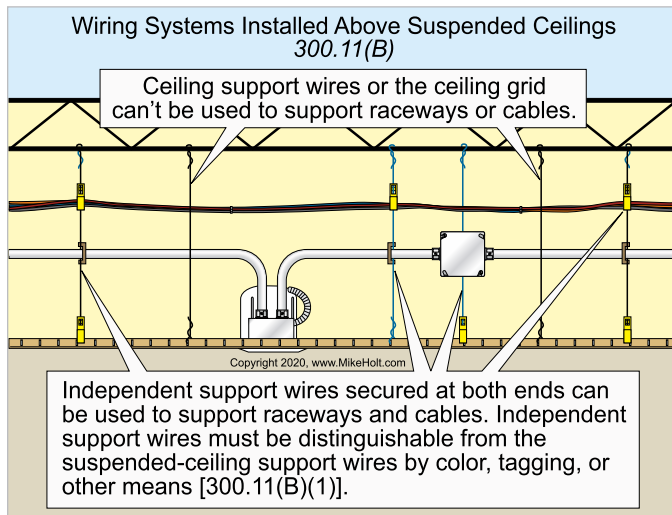
Exposed cables must be supported by the structural components of the building so the cable(s) will not be damaged by normal building use. Support must be by straps, staples, hangers, cable ties, or similar fittings designed and installed in a manner that will not damage the cable. Installations must comply with 300.4. ▶Figure 760-12



► Figure 760-12

**Author's Comment:**

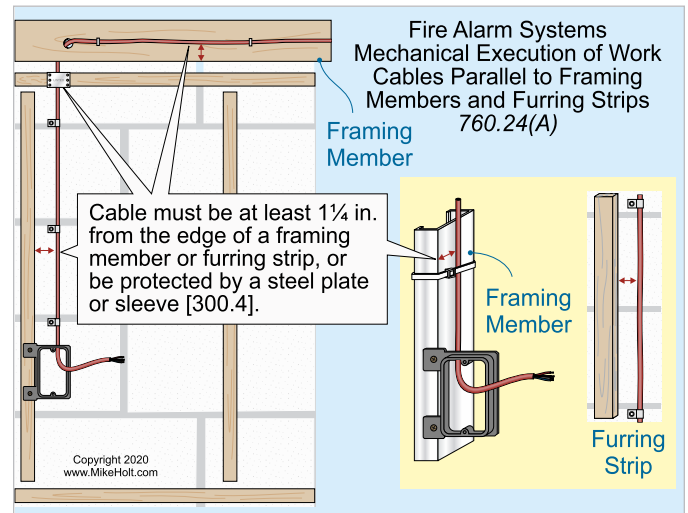
- Raceways and cables can be supported by independent support wires attached to the suspended ceiling in accordance with 300.11(B) [760.130(B)]. ► Figure 760-13



► Figure 760-13

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

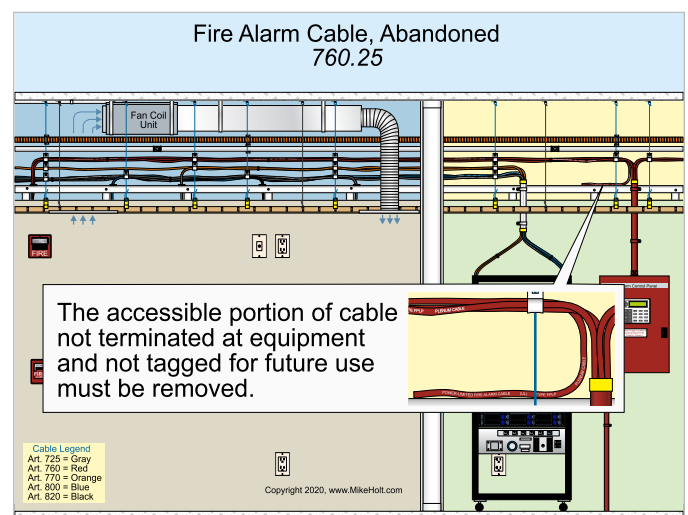
Cables installed through or parallel to framing members or furring strips must be protected where they are likely to be penetrated by nails or screws by installing the wiring method so it is not less than 1 1/4 in. from the nearest edge of the framing member or furring strips, or by protecting them with a 1/16 in. thick steel plate or the equivalent [300.4]. ► Figure 760-14



► Figure 760-14

**760.25 Abandoned Cables**

To limit the spread of fire or products of combustion within a building, the accessible portion of cable that is not terminated at equipment and not tagged for future use must be removed. ► Figure 760-15



► Figure 760-15



Tags identifying cables for future use must be able to withstand the environment involved.

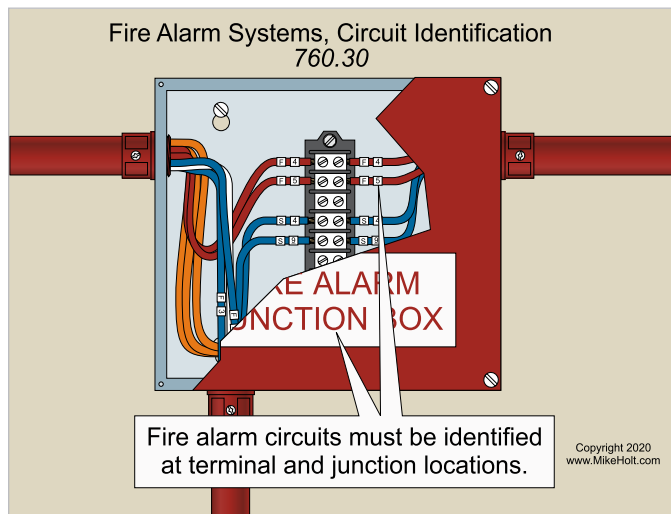
#### Author's Comment:

- ▶ Cables installed in concealed raceways are not considered accessible; therefore, they are not required to be removed. See the definition of "Abandoned Fire Alarm Cable" in 760.2.

### 760.30 Fire Alarm Circuit Identification

Fire alarm circuits must be identified at terminal and junction locations.

▶Figure 760-16

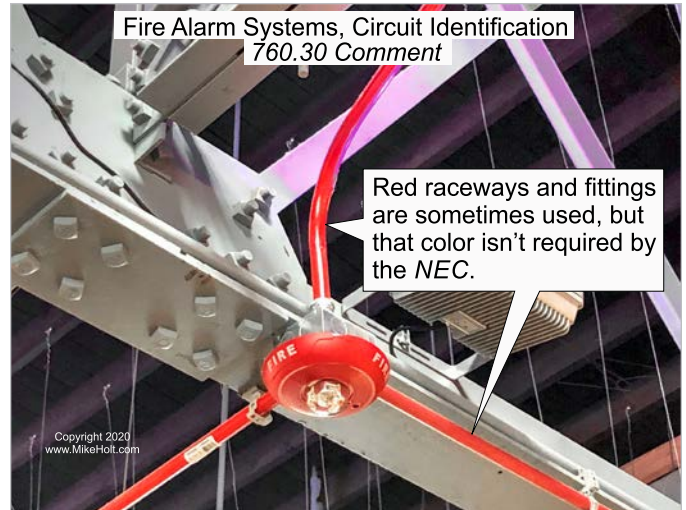


▶Figure 760-16

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.

#### Author's Comment:

- ▶ Red raceways and fittings are sometimes used, but that color is not required by the NEC. ▶Figure 760-17



▶Figure 760-17

### 760.35 Fire Alarm Circuit Requirements

**(B) Power-Limited Fire Alarm Circuits.** Power-limited fire alarm (PLFA) circuits must comply with Parts I and III of this article.

## Part III. Power-Limited Fire Alarm (PLFA) Circuits

### 760.121 Power Sources for Power-Limited Fire Alarm Circuits

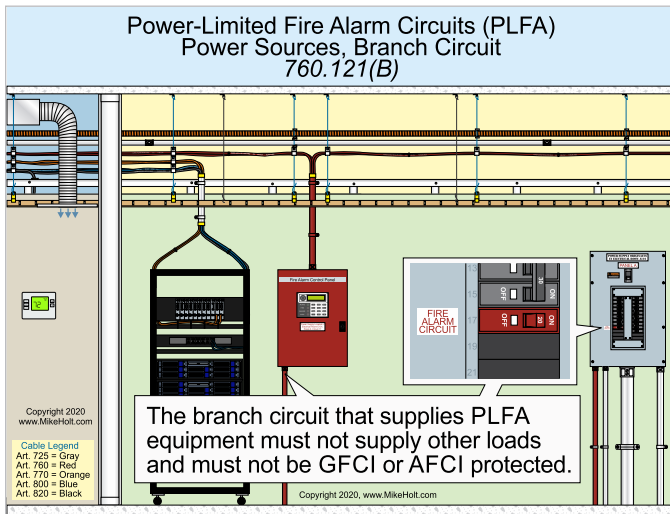
**(A) Power Source.** The power source for a power-limited fire alarm circuit must be:

- (1) A listed PLFA transformer or,
- (2) A listed PLFA power supply or,
- (3) Listed equipment marked to identify the PLFA power source.

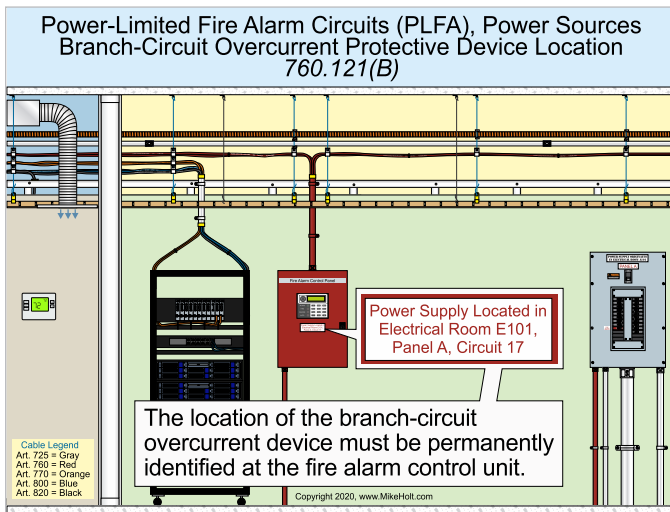
**Note:** Examples of listed equipment are:

- ▶ a fire alarm control panel with integral power source.
- ▶ a circuit card listed for use as a PLFA source, where used as part of a listed assembly.
- ▶ a current-limiting impedance, listed for the purpose or part of a listed product, used in conjunction with a nonpower-limited transformer or a stored energy source, for example, storage battery, to limit the output current.

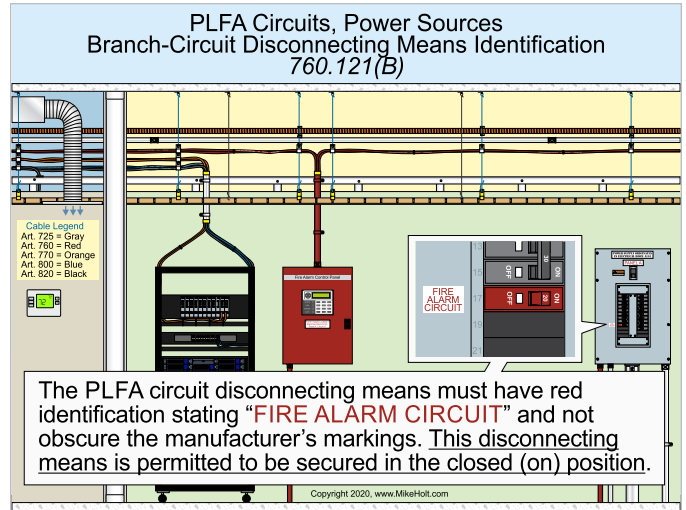
**(B) Branch Circuit.** Power-limited fire alarm equipment must be supplied by a branch circuit that supplies no other load and is not GFCI or AFCI protected. ▶ **Figure 760-18**

▶ **Figure 760-18**

The location of the branch-circuit overcurrent protective device for the power-limited fire alarm equipment must be permanently identified at the fire alarm control unit. ▶ **Figure 760-19**

▶ **Figure 760-19**

The branch-circuit overcurrent protective device must be identified in red, be accessible only to qualified personnel, and be identified as the “FIRE ALARM CIRCUIT.” The red identification must not damage the overcurrent protective device or obscure any manufacturer’s markings. The fire alarm branch-circuit disconnecting means is permitted to be secured in the closed (on) position. ▶ **Figure 760-20**

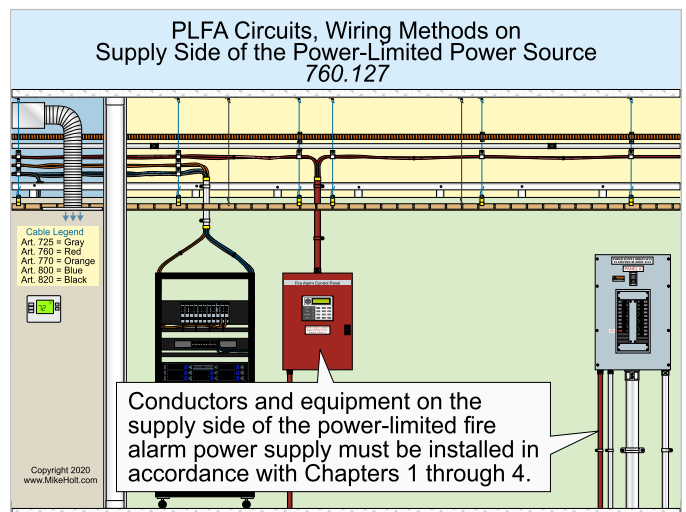
▶ **Figure 760-20**

## 760.124 Marking

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

## 760.127 Wiring Methods on Supply Side of the Power-Limited Fire Alarm Source

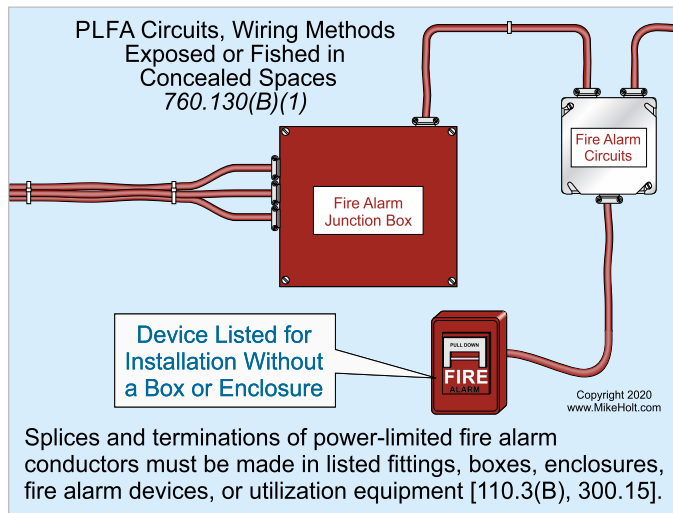
Conductors and equipment on the supply side of the power-limited fire alarm power supply must be installed in accordance with Chapters 1 through 4. ▶ **Figure 760-21**

▶ **Figure 760-21**

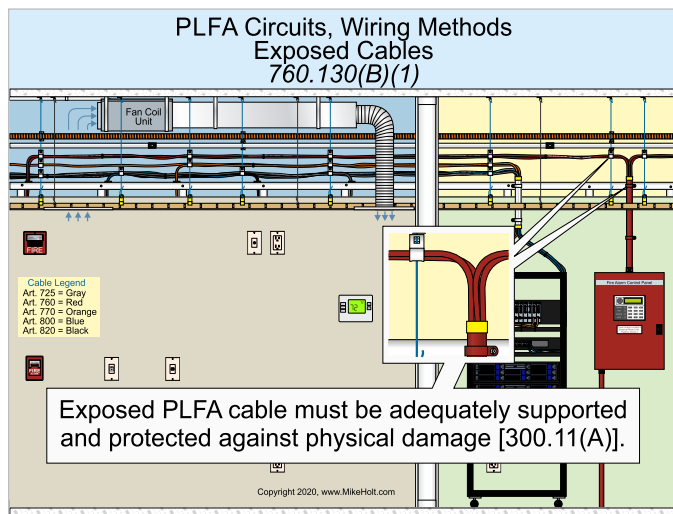
## 760.130 Wiring Methods on Load Side of the Power-Limited Fire Alarm Power Source

### (B) PLFA Wiring Methods and Materials.

- (1) Cable splices and terminations of power-limited fire alarm conductors must be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment [110.3(B) and 300.15]. ▶ **Figure 760-22** Exposed power-limited fire alarm cable(s) must be adequately supported and protected against physical damage [300.11(A)]. ▶ **Figure 760-23**



▶ **Figure 760-22**



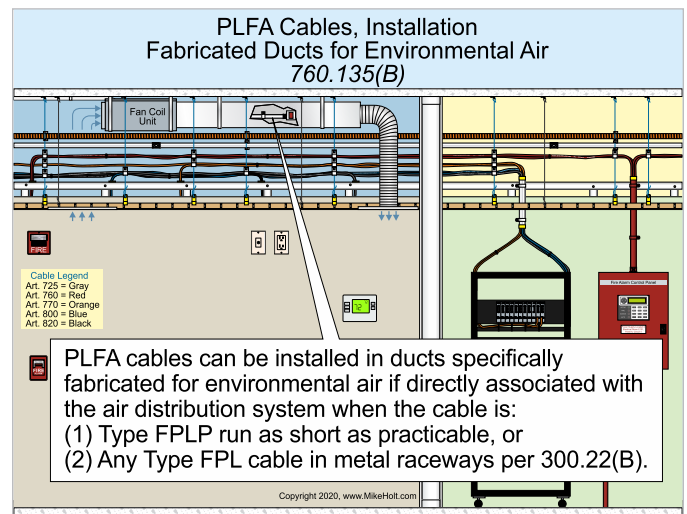
▶ **Figure 760-23**

## 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.** Power-limited fire alarm (PLFA) cables installed in buildings must be listed.

**(B) Ducts Specifically Fabricated for Environmental Air Spaces.** Plenum rated power-limited fire alarm (PLFA) cables are permitted to be installed within ducts specifically fabricated for environmental air spaces in accordance with 760.3(B) Ex 1 if the cable is directly associated with the air distribution system and complies with (1) or (2): ▶ **Figure 760-24**

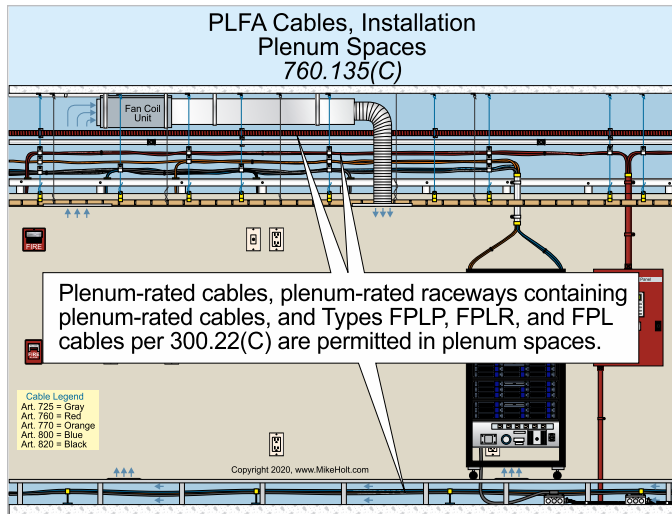


▶ **Figure 760-24**

- (1) Type FPLP cables are permitted where the length is as short as practicable to perform the required function.
- (2) Any Type FPL cable installed in metal raceways in compliance with 300.22(B).

**(C) Plenum Spaces.** Plenum-rated cables, plenum-rated raceways containing plenum-rated cables, and Types FPLP, FPLR, and FPL cables in accordance with 300.22(C) are permitted in plenum spaces. ▶ **Figure 760-25**





► Figure 760-25

**(H) Other Building Locations.** The following power-limited fire alarm cables are permitted to be installed in building locations:

- (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.
  - e. General-purpose communications raceways.
  - f. General-purpose cable routing assemblies.
- (3) Types FPLP, FPLR, and FPL cables installed within a raceway of a type recognized in Chapter 3.

## 760.136 Separation from Power Conductors

**(A) General.** Power-limited fire alarm conductors are not permitted to be placed in any enclosure, raceway, or cable with power conductors.

**(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.** Power-limited fire alarm conductors are permitted to be installed with power conductors where introduced solely to connect to equipment associated with power circuit conductors, and:

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

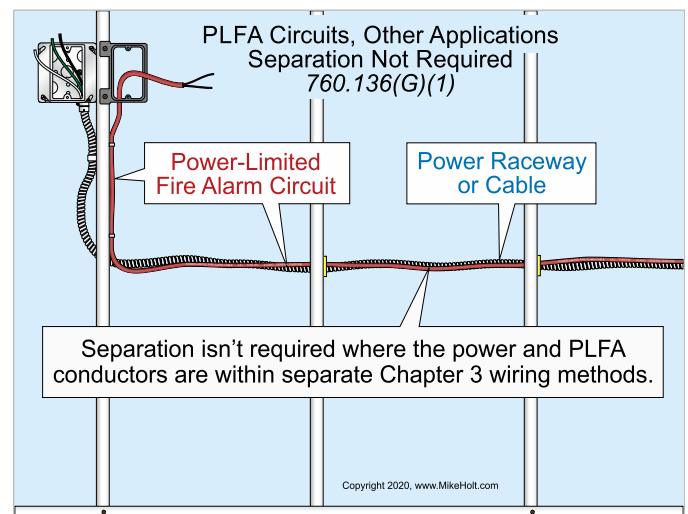
**(G) Other Applications.** In other applications, power-limited fire alarm circuit conductors must be separated by not less than 2 in. from power conductors unless:

- (1) The power and power-limited fire alarm conductors are within separate Chapter 3 wiring methods. ► [Figure 760-26](#)

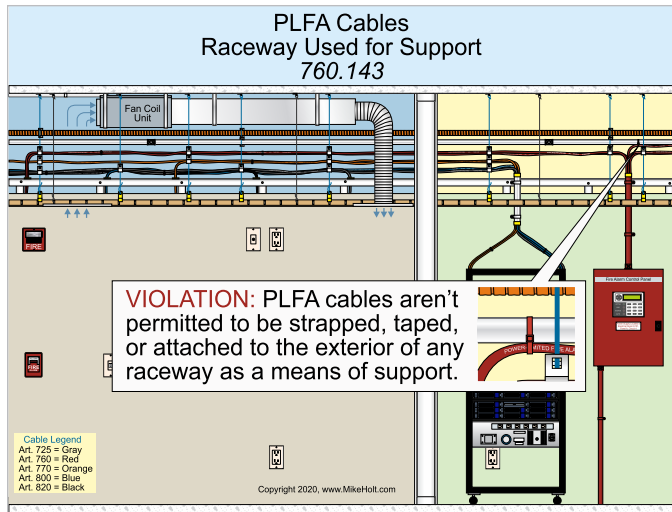
## 760.143 Support of PLFA Cables

Power-limited fire alarm cables are not permitted to be strapped, taped, or attached to the exterior of any raceway as a means of support.

► Figure 760-27



► Figure 760-26

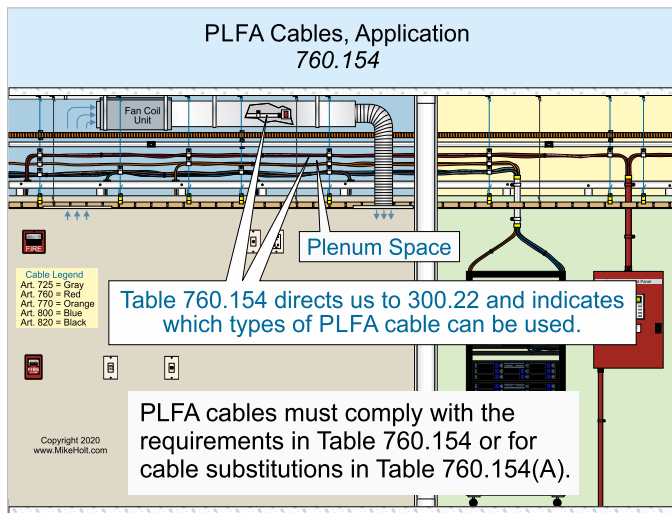


► Figure 760-27

### 760.154 Applications of Power-Limited Fire Alarm Cables (PLFA)

PLFA cables must comply with the requirements in Table 760.154 or for cable substitutions in Table 760.154(A). ►Figure 760-28

**(A) Fire Alarm Cable Substitutions.** Cable substitutions shown in Table 760.154(A) and in *NEC* Figure 760.154(A) Cable Substitution Hierarchy are permitted.



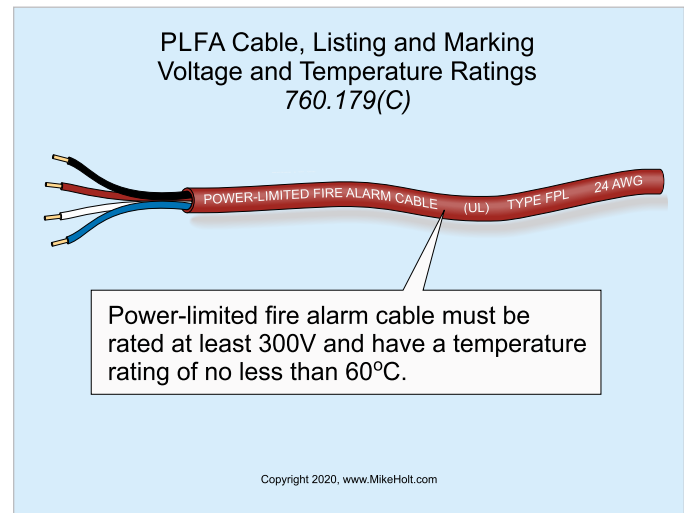
► Figure 760-28

## Part IV. Listing Requirements

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

PLFA cables installed as wiring within buildings must be listed in accordance with 760.179(A) through (H) and be marked in accordance with 760.179(I). Cable in a wet location must be listed for use in wet locations or have a moisture-impervious metal sheath.

**(C) Voltage and Temperature Ratings.** Fire alarm cable must have a voltage rating of not less than 300V and have a temperature rating of not less than 60°C ►Figure 760-29



► Figure 760-29

**(I) Marking.** Cables must be marked in accordance with Table 760.179(I) and are listed in order of fire performance starting with best cable type.

**Table 760.179(I) Cable Markings**

Cable Marking	Type
FPLP	Power-limited fire alarm plenum cable
FPLR	Power-limited fire alarm riser cable
FPL	Power-limited fire alarm cable

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