

## Maintaining Circuit Integrity

by Dean K. Wilson, P.E.

**I noticed in the public proposals and public comments for the 1999 edition of NFPA 70, *National Electrical Code*, that a new reference has been added for a cable type suffix, “CI.”**

**Where would an installer of fire alarm systems use such a cable?**

You are correct. Code Making Panel 16 of the National Fire Protection Association Technical Committee on the *National Electrical Code* has incorporated permissive language into Article 760 of NFPA 70-1999 to permit the marking of cable as “-CI” following the other primary marking such as NFPLF or FPL. Cables that pass circuit integrity requirements at Underwriters Laboratories Inc. will be permitted to be marked with the new suffix. For example, if a particular cable construction passed all the regular tests to earn the marking “FPL” and also passed the circuit integrity tests, the manufacturer can now mark that cable “FPL-CI.”

As to where an installer may choose to use this particular type of cable, refer to sections 3-2.4 and A-3-2.4, as well as sections 3-4.4 and A-3-4.4 of NFPA 72-1996, *National Fire Alarm Code*. These sections read as follows:

3-2.4\* The system shall be so designed and installed that attack by fire:

- (a) In an evacuation zone, causing loss of communications to this evacuation zone, shall not result in loss of communications to any other evacuation zone.
- (b) Causing failure of equipment or a fault on one or more installation wiring conductors of one communications path shall not result in total loss of communications to any evacuation zone.

*Exception No. 1 to (a) and (b): Systems that, on alarm, automatically sound evacuation signals throughout the protected premises.*

*Exception No. 2 to (a) and (b): Where there is a separate means acceptable to the authority having jurisdiction for voice communications to each floor or evacuation zone.*

*Exception No. 3 to (b): The fire command center and the central control equipment.*

*Exception No. 4 to (b): Where the installation wiring is enclosed in a **2-hour rated cable assembly** or enclosed in a 2-hour rated enclosure, other than a stairwell.*

*Exception No. 5 to (b): Where the installation wiring is enclosed within a 2-hour rated stairwell in a fully sprinklered building in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.*

*Exception No. 6 to (b): When the evacuation zone is directly attacked by fire within the zone.*

A-3-2.4 This requirement is intended to limit damage to a fire alarm system, resulting from a fire, to the area in which the fire occurs. The concern is maintaining the operability of the system in areas beyond, but threatened by, the fire.

Conformance to this requirement could entail that:

- (a) Where common risers or trunk circuits are used:
  - 1. Separately routed, redundant risers or trunk circuits be provided, arranged so that one or more circuit faults on one riser or trunk circuit cause the system to switch over automatically to its associated, alternate circuit without loss of function. This capability should allow full system operation with a damaged or severed riser or trunk circuit.
  - 2. Primary and alternate conductors for redundant circuits be separated by 2-hour fire-resistive construction.

- (b) Where multiple individual circuits are routed in a common riser, conduit, raceway, cable, bundle of conductors, or other arrangement resulting in close physical proximity and resultant susceptibility to common misfortune, such circuits be Class A, capable of full operation over a single open or single ground fault.
- (c) Where Class A circuits are required, they be installed so that the supply and return conductors are routed separately. Supply and return risers should be separated by at least 2-hour rated fire construction.

3-4.4\* All styles of Class A circuits using physical conductors (e.g., metallic, optical fiber) shall be installed such that the outgoing and return conductors, exiting from and returning to the control unit, respectively, are routed separately. The outgoing and return (redundant) circuit conductors shall not be run in the same cable assembly (i.e., multiconductor cable), enclosure, or raceway.

*Exception No. 1: For a distance not to exceed 10 ft (3 m) where the outgoing and return conductors enter or exit the initiating device, notification appliance, or control unit enclosures;*

*or*

*Exception No. 2: Where the vertically run conductors are contained in a **2-hour rated cable assembly** or enclosed (installed) in a 2-hour rated enclosure other than a stairwell; or*

*Exception No. 3: Where permitted and where the vertically run conductors are enclosed (installed) in a 2-hour rated stairwell in a building fully sprinklered in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.*

*Exception No. 4: Where looped conduit/raceway systems are provided, single conduit/raceway drops to individual devices or appliances shall be permitted.*  
*Exception No. 5: Where looped conduit/raceway systems are provided, single conduit/raceway drops to multiple devices or appliances installed within a single room not exceeding 1000 ft<sup>2</sup> (92.9 m<sup>2</sup>) in area shall be permitted.*

A-3-4.4 A goal of 3-4.4 is to provide adequate separation between the outgoing and return cables. This separation is required to help ensure protection of the cables from physical damage. The recommended minimum separation to prevent physical damage is 1 ft (305 mm) where the cable is installed vertically and 4 ft (1.22 m) where the cable is installed horizontally.

As you can see from the boldface text which I added for emphasis, cable that can maintain its circuit integrity during the Underwriters Laboratories test to earn a 2-hour rating can provide an economical alternative to other installation methods.

At the present time, a careful reading will also disclose that only those fire alarm systems that selectively evacuate occupants of a building or relocate them to areas of refuge within a building need to meet the requirements of section 3-2.4. And, only those circuits that the designer, authority having jurisdiction, or building owner require the installer to install as Class A circuits needs to meet the requirements of section 3-4.4.

In any case, it is nice to know that NFPA 70-1999 and NFPA 72-1996 offer some alternative installation methods using UL Listed cable with the Circuit Integrity (-CI) suffix.

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