



## IFC/NFPA/NEC Guide to Fire Alarm Wiring & Box Installations

There are many factors to consider when installing fire alarm wire, raceways, boxes & cabinets comprising a fire alarm system.

### Construction type

- Type IA
- Type IB
- Type IIA
- Type IIB
- Type III
- Type IV
- Type V

### Environments

- Environments are wide ranging and too numerous to identify. Please consult the International Building Code.

### The basic principles enforced as prescribed in the national codes & standards to consider

- a) IFC-2015, 104.1 – General Authority and Responsibilities
- b) Texas Insurance Code Chapter 6002 (formerly Article 5.43-2) Fire Detection and Alarm Device Installation and 28 TAC §§ 34.600 The Fire Alarm Rules
- c) The NEC, Chapter 1, Article 100 – Definitions
- d) The NEC, Chapter 3, Section 300.4 – Protection from Physical Damage
- e) The NEC, Chapter 3, Section 314 – Device, Pull & Junction Boxes
- f) The NEC, Chapter 7, Section 760.24 – Mechanical Execution of Work
- g) The NEC, Chapter 7, Section 760.130 - Wiring Methods and Materials on the Load Side of the PLFA Power Source

The following are specific items that an installer may encounter when installing fire alarm wire, raceways, boxes & cabinets comprising a fire alarm system.

### I. Requirements for Electrical Installations

**110.26 Spaces about Electrical Equipment.** Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment.

(1) **Depth of Working Space.** The depth of the working space in the direction of live parts shall not be less than that specified in Table 110.26(A) (1) unless the requirements of 110.26 (A) (1)(a), (A) (1)(b), or (A) (1)(c) are met. Distances shall be measured from the exposed live parts or from the enclosure or opening if the live parts are enclosed.

(2) **Width of Working Space.** The width of the working space in front of the electrical equipment shall be the width of the equipment or 762 mm (30 in.), whichever is greater. In all cases, the workspace shall permit at least a 90-degree opening of equipment doors or hinged panels.

(3) **Height of Working Space.** The work space shall be clear and extend from the grade, floor, or platform to a height of 2.0 m (6 1/2 ft.) or the height of the equipment, whichever is greater. Within the height requirements of this section, other equipment that is associated with the electrical installation and is located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment.

## NFPA 72 Chapter 10 Fundamentals

10.3.5 Equipment shall be designed so that it is capable of performing its intended functions under the following conditions:

- (1)\* At 85 percent and at 110 percent of the nameplate primary (main) and secondary (standby) input voltage(s)
- (2) At ambient temperatures of 0°C (32°F) and 49°C (120°F)
- (3) At a relative humidity of 85 percent and an ambient temperature of 30°C (86°F)

### 10.4 Installation and Design.

10.4.1\* All systems shall be installed in accordance with the specifications and standards approved by the authority having jurisdiction.

10.4.3 Equipment shall be installed in locations where conditions do not exceed the voltage, temperature, and humidity limits specified in the manufacturer's published instructions.

### 10.5 Personnel Qualifications.

#### 10.5.1 System Designer.

10.5.1.1 Plans and specifications shall be developed in accordance with this Code by persons who are experienced in the design, application, installation, and testing of the systems.

10.5.1.2 State or local licensure regulations shall be followed to determine qualified personnel.

10.5.1.3 Personnel shall provide documentation of their qualification by one or more of the following:

- (1) Registration, licensing, or certification by a state or local authority

#### 10.5.2 System Installer.

10.5.2.1 Installation personnel shall be qualified or shall be supervised by persons who are qualified in the installation, inspection, and testing of the systems.

10.5.2.2 State or local licensure regulations shall be followed to determine qualified personnel.

10.5.2.3 Personnel shall provide documentation of their qualification by one or more of the following:

- (1) Registration, licensing, or certification by a state or local authority
- (2) Certification by an organization acceptable to the authority having jurisdiction
- (3) Manufacturer's certification for the specific type and brand of system provided

### §34.616. Sales, Installation, and Service.

(1) The installation of all fire detection and fire alarm devices or systems, including monitoring equipment, subject to Insurance Code Chapter 6002 must be performed by or under the direct on-site supervision of a licensed fire alarm technician, residential fire alarm technician, residential fire alarm superintendent, or a fire alarm planning superintendent for the work permitted by the license. The licensee responsible for the planning of all fire detection and fire alarm devices or systems, including monitoring equipment subject to Insurance Code Chapter 6002, must be licensed under the ACR number of the primary licensed firm. The certifying licensee must be licensed under the ACR number of the primary registered firm and must be present for the final acceptance test prior to certification.

## II. Protection against Physical Damage

NFPA 70 section 300.4 - Where subject to physical damage, conductors, raceways, and cables shall be protected.

### 300.5 Underground Installations.

(A) **Minimum Cover Requirements.** Direct-buried cable or conduit or other raceways shall be installed to meet the minimum cover requirements of Table 300.5.

(B) **Wet Locations.** The interior of enclosures or raceways installed underground shall be considered a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall comply with 310.10(C). Any connections or splices in an underground installation shall be approved for wet locations.

### 300.11 Securing and Supporting

(A) **Secured in Place.** Raceways, cable assemblies, boxes, cabinets, and fittings shall be securely fastened in place. Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids.

(1) **Fire-Rated Assemblies.** Wiring located within the cavity of a fire-rated floor-ceiling or roof-ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

(2) **Non-Fire-Rated Assemblies.** Wiring located within the cavity of a non-fire-rated floor-ceiling or roof-ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means.

### 760.24 Mechanical Execution of Work.

(A) **General.** Fire alarm circuits shall be installed in a neat 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 straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

760.130 **Wiring Methods and Materials on Load Side of the PLFA Power Source.** Fire alarm circuits on the load side of the power source shall be permitted to be installed using wiring methods and materials in accordance with 760.130(A), (B), or a combination of (A) and (B).

(B) **PLFA Wiring Methods and Materials.** Power-limited fire alarm conductors and cables described in 760.179 shall be installed as detailed in 760.130(B)(1), (B)(2), or (B)(3) of this section and 300.7. Devices shall be installed in accordance with 110.3(B), 300.11(A), and 300.15.

(1) **In Raceways, Exposed on Ceilings or Sidewalls, or Fished in Concealed Spaces.** Cable splices or terminations shall be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment. Where installed exposed, cables shall be adequately supported and installed in such a way that maximum protection against physical damage is afforded by building construction such as baseboards, door frames, ledges, and so forth. Where located within 2.1 m (7 ft.) of the floor, cables shall be securely fastened in an approved manner at intervals of not more than 450 mm (18 in.).

(2) **Passing through a Floor or Wall.** Cables shall be installed in metal raceways or rigid nonmetallic conduit where passing through a floor or wall to a height of 2.1 m (7 ft.) above the floor, unless adequate protection can be afforded by building construction such as detailed in 760.130(B)(1), or unless an equivalent solid guard is provided.

(3) **In Hoistway's.** Cables shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, or electrical metallic tubing where installed in hoistway's.

**760.143 Support of Conductors.** Power-limited fire alarm circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support.

### **III. Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings and Manholes**

**314.16 Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies.** Boxes and conduit bodies shall be of an approved size to provide free space for all enclosed conductors. In no case shall the volume of the box, as calculated in 314.16(A), be less than the fill calculation as calculated in 314.16(B). The minimum volume for conduit bodies shall be as calculated in 314.16(C).

**314.17 Conductors Entering Boxes, Conduit Bodies, or Fittings.** Conductors entering boxes, conduit bodies, or fittings shall be protected from abrasion and shall comply with 314.17(A) through (D).

(C) **Nonmetallic Boxes and Conduit Bodies.** Nonmetallic boxes and conduit bodies shall be suitable for the lowest temperature-rated conductor entering the box. Where nonmetallic sheathed cable or multi-conductor Type UF cable is used, the sheath shall extend not less than 6 mm (1/4 in.) inside the box and beyond any cable clamp. In all instances, all permitted wiring methods shall be secured to the boxes.

*Exception:* Where nonmetallic-sheathed cable or multi-conductor Type UF cable is used with single gang boxes not larger than a nominal size 57 mm × 100 mm (2 1/4 in. × 4 in.) mounted in walls or ceilings, and where the cable is fastened within 200 mm (8 in.) of the box measured along the sheath and where the sheath extends through a cable knockout not less than 6 mm (1/4 in.), securing the cable to the box shall not be required. Multiple cable entries shall be permitted in a single cable knockout opening.

**314.19 Boxes Enclosing Flush Devices.** Boxes used to enclose flush devices shall be of such design that the devices will be completely enclosed on back and sides and substantial support for the devices will be provided. Screws for supporting the box shall not be used in attachment of the device contained therein.

**314.23 Supports.** Enclosures within the scope of this article shall be supported in accordance with one or more of the provisions in 314.23(A) through (H).

(A) **Surface Mounting.** An enclosure mounted on a building or other surface shall be rigidly and securely fastened in place. If the surface does not provide rigid and secure support, additional support in accordance with other provisions of this section shall be provided.

(B) **Structural Mounting.** An enclosure supported from a structural member or from grade shall be rigidly supported either directly or by using a metal, polymeric, or wood brace.

(1) **Nails and Screws.** Nails and screws, where used as a fastening means, shall be attached by using brackets on the outside of the enclosure, or they shall pass through the interior within 6 mm (1/4 in.) of the back or ends of the enclosure. Screws shall not be permitted to pass through the box unless exposed threads in the box are protected using approved means to avoid abrasion of conductor insulation.

(2) **Braces.** Metal braces shall be protected against corrosion and formed from metal that is not less than 0.51 mm (0.020 in.) thick uncoated. Wood braces shall have a cross section not less than nominal 25 mm × 50 mm (1 in. × 2 in.). Wood braces in wet locations shall be treated for the conditions. Polymeric braces shall be identified as being suitable for the use.

(C) **Mounting in Finished Surfaces.** An enclosure mounted in a finished surface shall be rigidly secured thereto by clamps, anchors, or fittings identified for the application.

(D) **Suspended Ceilings.** An enclosure mounted to structural or supporting elements of a suspended ceiling shall be not more than 1650 cm<sup>3</sup> (100 in.<sup>3</sup>) in size and shall be securely fastened in place in accordance with either (D) (1) or (D) (2).

(1) **Framing Members.** An enclosure shall be fastened to the framing members by mechanical means such as bolts, screws, or rivets, or by the use of clips or other securing means identified for use with the type of ceiling framing member(s) and enclosure(s) employed. The framing members shall be supported in an approved manner and securely fastened to each other and to the building structure.

(2) **Support Wires.** The installation shall comply with the provisions of 300.11(A). The enclosure shall be secured, using identified methods, to ceiling support wire(s), including any additional support wire(s) installed for ceiling support. Support wire(s) used for enclosure support shall be fastened at each end so as to be taut within the ceiling cavity.

#### Onsite Requirements:

- Permit holder is responsible for all required accommodations needed to perform the inspection
- Approved and stamped drawings shall be available at time of inspection
- Ceiling tile shall not be installed prior to inspection. This includes “borders” unless given specific approval in writing
- Contractor to provide OSHA approved ladders for access above the finished floor
- After hours inspections and tests are available for an additional fee

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