



## Electrical Circuit Protective Systems

### [Guide Information for Fire Resistance Ratings](#)

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### **GENERAL**

This category covers electrical circuit protective systems consisting of components and materials intended for installation as protection for specific electrical wiring systems, with respect to the disruption of electrical circuit integrity upon exterior fire exposure.

Ratings apply only to the entire protective system assembly, constructed using the combination of components and materials specified in the individual system. Components and materials are designated for use in a specific individual system for which corresponding ratings have been developed, and are not intended to be interchanged between systems. Ratings are not assigned to individual system components or materials. For example, caulk or putty used from one system cannot be interchanged with the caulk or putty specified in another system.

Electrical circuit protective systems are intended to be fastened to a concrete or masonry wall or a concrete floor-ceiling assembly. The fire rating of the wall or floor-ceiling assembly is intended to be equal to or greater than the rating of the electrical circuit protective system. This is to ensure that the complete electrical circuit protective system will survive during fire and hose stream exposure.

### **SYSTEMS INCORPORATING CABLE PROTECTED WITH ELECTRICAL CIRCUIT PROTECTIVE MATERIALS**

These protective systems are investigated with respect to fire exposure and water hose stream performance. Performance criteria are based on temperatures within the enclosure and visual examination after the water hose stream.

These protective systems are intended to be installed in interior environments with representative heating and air conditioning, unless stated otherwise in the individual system.

Where indicated in the system, the ampacity reduction due to the electrical circuit protection system has been determined for normal ambient temperature operating conditions in accordance with IEEE 848-1996, "IEEE Standard Procedure for the Determination of the Ampacity Derating of Fire-Protected Cables." If not specified in the system, the effect of the electrical circuit protection system on the ampacity of the electrical conductors has not been investigated. The specifications for the protective system and its assembly are important details in the development of the ratings. Information concerning these details is described in each system.

The products used in these systems are intended to be installed in accordance with the applicable accompanying instructions.

### **SYSTEMS CONSTRUCTED WITH FIRE-RESISTIVE CABLE**

These protective systems are investigated with respect to fire exposure and water hose stream performance. Performance criteria are based on functionality of the cable during the fire and after the water hose stream. [ANSI/UL 2196](#), "Tests for Fire Resistive Cables," describes two fire exposure conditions. The normal temperature rise (to [ANSI/UL 263](#), "Fire Tests of Building Construction and Materials") is intended to represent a fully developed interior building fire. The rapid temperature rise (to [ANSI/UL 1709](#), "Rapid Rise Fire Tests of Protection Materials for Structural Steel") is intended to represent a hydrocarbon pool fire. If not stated otherwise in the individual system, the normal temperature rise exposure was used. There are two hose stream levels: low impact and normal impact. The low-impact fog nozzle hose stream is applied only to cable marked with the "-CI" suffix. The normal-impact hose stream, applied with a standard-taper, smooth-bore playpipe, is applied to all other types of cable.

CI cable is tested on steel rings to simulate installation in free air. If CI cable is intended to be installed in a raceway it is so tested. CI cable that has been tested in a raceway will be specified in the system.

Each design of fire-resistive cable is tested per [ANSI/UL 2196](#). One-conductor and multi-conductor constructions are tested separately, as well as shielded or unshielded, and stranded or solid conductors. The system contains the construction details of the tested configuration. The minimum conductor size, minimum number of conductors, UL Type, voltage rating, etc., are construction details that are also provided. Cable is UL Listed to a National Electrical Code Type and constructed to a UL Standard for the cable (such as Type MC per [ANSI/UL 1569](#), "Metal-Clad Cables"; Type RHH/RHW to [ANSI/UL 44](#), "Thermoset-Insulated Wires and Cables"; Type FPL per [ANSI/UL 1424](#), "Cables for Power-Limited Fire-Alarm Circuits"; Type NPLF per [ANSI/UL 1425](#), "Cables for Non-Power-Limited Fire-Alarm Circuits"; and Type TC per [ANSI/UL 1277](#), "Electrical Power and Control Tray Cables with Optional Optical-Fiber Members").

Cable is tested as a complete system. The system includes the cable and/or raceway support, couplings, boxes/conduit bodies, optional splices, vertical supports, grounds, pulling lubricants,

cable tray, etc. Cable or raceway supports need to hold the cable in place during the fire and hose stream. The hardware, clamps, strut, etc., are generally stated to be made of steel.

Systems that require a raceway are tested with the minimum raceway diameter and the minimum raceway type with their respective coupling(s). Raceways having larger diameters are acceptable. Raceways with greater wall thickness are also acceptable. Intermediate metal conduit (IMC) or rigid metal conduit (RMC) are acceptable for use in systems where electrical metallic tubing (EMT) is specified.

The raceway is intended to be connected together using the coupling type referenced in the system, such as steel setscrew type for EMT or threaded types of coupling for IMC and RMC. No other couplings are intended to be used unless noted in the specific system. For example, a compression coupling is not intended to be used in place of a steel setscrew coupling for EMT unless otherwise specified in the system. If IMC or RMC is substituted where EMT is specified, the raceway should be connected together with threaded types of couplings.

If a box, conduit body, supports (such as a grip), splice or other components are tested, it is noted in the system. Otherwise, the hourly fire rating applies only to continuous lengths of cable and/or raceway with couplings passing completely through a fire zone and terminating a minimum of 12 inches beyond the fire-rated wall or floor bounding the fire zone. For systems installed in a raceway, ANSI/NFPA 70, "National Electrical Code" (NEC), requires not more than 360 degrees of bends without a pull point (such as conduit bodies or boxes). Therefore, for most practical installations, a conduit body or a box will be required. Items such as conduit bodies and boxes, if found acceptable, are described in the system. Since boxes are tested with a single raceway, each individual raceway should have an independent box used for pull points or splices. If a splice is tested, it is also described in the system. Boxes should be sized per the method described in the NEC.

Unless specifically stated in the design, all electrical circuit protective system components that come into contact with fire-resistive cables shall have an interior coating free of zinc. This includes raceways, couplings, connectors, boxes, conduit bodies, and the like.

The supports are an important part of the systems and each individual system has specific support requirements. The maximum distance between the supports is described in the individual systems and are not intended to be exceeded even if an alternate raceway is used. For example, if 5-foot spacing between supports is specified for EMT, this same support distance should be used with any other raceway (IMC, RMC, etc.), unless stated otherwise in the system or a lesser support spacing is specified in the NEC. The type of support and the distance between the steel supports is unique to that specific system and is for all sizes/types of cable and/or conduit/raceway unless otherwise noted in a specific system. Spacing of the tray support should also be the same as the raceway support spacing unless otherwise noted.

The support requirements are for both the horizontal and vertical configuration unless otherwise noted in a specific system. The supports for both the vertical or horizontal configuration are intended to be the support to the cable/conductor. Cable installed in a vertical raceway is not supported by the raceway. This is in contrast to MI or MC cable, where a support on the outside

of the cable also supports the conductors. The ability of cable to support the equivalent cable weight of the maximum distance between cable supports without breaking the conductor, and compatibility/mechanical considerations of the cable support mechanism may be investigated in the test by simulating the weight of the vertical cable run. When so investigated, the maximum vertical distance tested and the cable support mechanism(s) are detailed in the system.

Compatibility of materials used in fire-rated systems is also a concern. Some materials can provide carbon residue that is conductive, or conductive gases that can cause premature failure. A dedicated raceway is the required configuration unless otherwise noted in the system (such as the option of bare ground wires or insulated ground wires). The bare or insulated ground wire may be of special manufacture to be compatible with the system. The system will specify the manufacturer of an allowable ground wire. If not specified, the ground should be the same as the fire-rated wire described in the system. Use of any other ground wire violates the system fire rating. For example, THHN ground wire is not intended to be used with a fire-rated system unless specified in the system. If a pulling lubricant has been tested with the system, it will be so noted in the system.

These systems are intended to be installed in accordance with all provisions of the NEC and as amended by the details of each individual system (such as type of supports and distance between supports).

Authorities Having Jurisdiction should be consulted as to the specific requirements covering the installation and use of these systems.

### **RELATED PRODUCTS**

Fire-resistive cable with the "-CI" marking is also investigated to [ANSI/UL 2196](#) and is covered under Power-limited Fire Alarm Cable ([HNIR](#)) and Nonpower-limited Fire Alarm Cable ([HNHT](#)).

### **ADDITIONAL INFORMATION**

For additional information, see Fire Resistance Ratings ([BXRH](#)).

### **REQUIREMENTS**

The basic requirements used to investigate systems incorporating cable protected with electrical circuit protective materials in this category are contained in [UL Subject 1724](#), "Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems."

The basic standard used to investigate systems constructed with fire-resistive cable in this category is [ANSI/UL 2196](#), "Tests for Fire Resistive Cables."

### **UL MARK**

System components identified by an (\*) in the description text are Classified under the Classification and Follow-Up Service of UL. Such components and names of manufacturers who are authorized to apply the Classification Mark are identified under the specific product category.

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