

NEC<sup>®</sup> 2005

National Electrical Code<sup>®</sup> Update

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800-TEC-FUSE

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# 2005 National Electrical Code® Overview

## NFPA 70 (NEC®) FOR FUSES AND RELATED OVERCURRENT PROTECTION

### Introduction

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#### ■ **WHAT**

##### What is this?

*This technical paper is a compilation and discussion of important changes to the 2005 National Electrical Code (NEC®) that involve fuses and overcurrent protection.*

##### What changes were made?

*The pages that follow detail the most important changes and discuss the new requirements, options, and/or exceptions. In some cases, entirely new Articles or portions of Articles have been added; in other cases, the change just involves a word or two. Either way, it is equally important that all portions of the Code are followed to be in full compliance.*

**Throughout this paper, all changes to the Code text will be illustrated in green color.**

##### What is the significance of the changes?

*These changes involve many key concepts that might otherwise be taken for granted in terms of fuse and overcurrent protection applications. The Code is a continually evolving document, so it is imperative to continue recognizing and adhering to any and all changes that occur during its three-year cycle of revised editions.*

##### What affect do they have to users?

*As with every new Code edition, it is imperative that users become familiar with these and all Code changes as quickly as possible, and adopt the new standards, practices, and requirements immediately.*

#### ■ **WHY**

##### Why were these changes made?

*Changes were made for a variety of reasons. Where possible, we have tried to provide some background or supporting information as to why.*

##### Why do we need to know?

*It is our responsibility as members of the electrical industry to continue practicing safe work procedures while following the standards, recommended practices, and guides set forth and issued by NFPA and its documents. The Code is made available as an advisory document for both public and private uses, with the purpose of protecting life and property.*



# 2005 National Electrical Code® Continued

## Introduction Continued

### ■ **Who**

#### Who does this affect?

These changes affect any and all users of electrical equipment or services – particularly those involved in any way with fuses and other overcurrent protection devices.

### ■ **How**

#### How do these changes affect Littelfuse and our products?

After each Code change, we have listed the Littelfuse product(s) and/or product groups that are affected by each change. In some instances, the changes discussed involve products not yet developed by the industry.

## 2005 CODE CHANGES SUMMARY

# New Definitions

### Article 100 – NEW Definition!

#### • **Coordination (Selective).**

Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protective device and their rating or settings.

**Explanation:** The definition of “coordination” in Article 240.2 of the 2002 NEC has been revised and relocated to Article 100 since the term is now used in more than just one Article. The basic meaning of the word remains the same, but the wording was changed to make it more easily understood for all applications throughout the NEC. The word “selective” was added to further specify the meaning of “coordinated,” which has broader applications than described and listed in the NEC.

#### ■ **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS

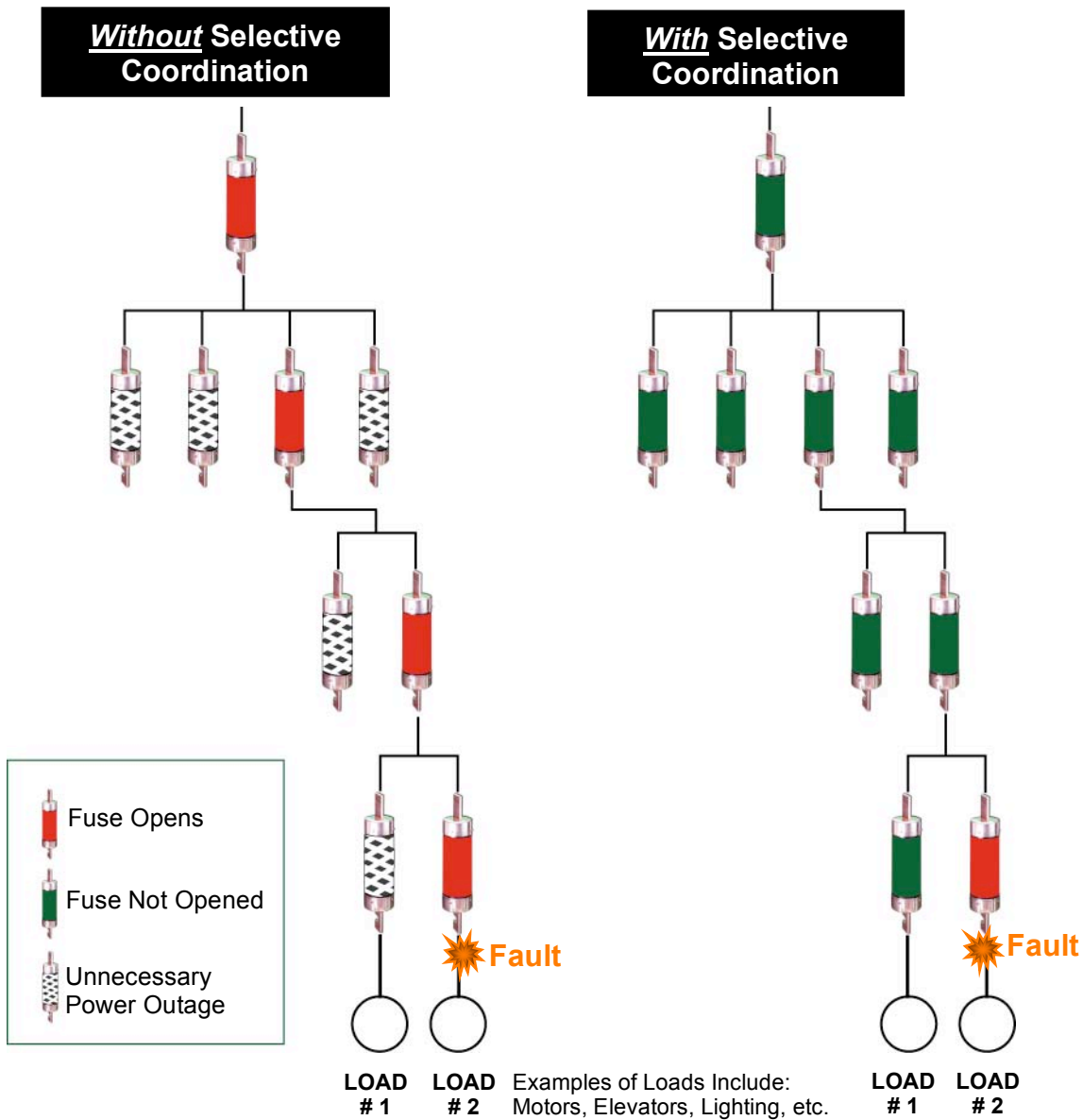


# New Definitions *Continued*

## Article 100 – NEW Definition! *Continued*

### SELECTIVE COORDINATION

In a selectively coordinated system, only the protective device immediately on the line side of an overcurrent opens. Upstream protective devices remain closed.



## New Definitions *Continued*

### Article 100 – NEW Definition!

- **Qualified Person.**

One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved.

FPN: Refer to NFPA 70E-2004, *Standard for Electrical Safety in the Workplace*, for electrical safety training requirements.

**Explanation:** The fine print note (FPN) has been added to this definition to clarify the term, and refer users to the 2004 Edition of NFPA 70E, Standard for Electrical Safety in the Workplace which provides new information and stresses the importance of proper safety training and knowledge for those individuals directly involved and/or exposed to possible electrical hazards.

Examples of these electrical hazards include, but are not limited to, Arc-Flash Hazards. Examples of this safety training include, but are not limited to, training in the use of: special precautionary techniques; personal protective equipment (PPE); insulating and shielding materials; and insulated tools and test equipment used when working on or near exposed conductors and/or circuit parts that are, or can become, energized.

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS

### Article 100 – NEW Definition!

- **Supplementary Overcurrent Protective Device.**

A device intended to provide limited overcurrent protection for specific applications and utilization equipment such as luminaires (lighting fixtures) and appliances. This limited protection is in addition to the protection provided in the required branch circuit by the branch circuit overcurrent protective device.

**Explanation:** This new definition helps clarify the difference between the protection provided by branch-circuit overcurrent protective devices and the supplementary protection included with some pieces of equipment. Both types perform similar functions but serve different purposes.

- **LITTELFUSE PRODUCTS AFFECTED:** MIDGET FUSES (BLF, BLN, BLS, FLA, FLM, FLQ, KLK, AND KLKD SERIES) AND ELECTRONIC FUSES (VARIOUS SERIES)



# Industrial Control Panels

## Articles 409.21 and 409.110 – NEW!

- **Article 409.21 Installation - Overcurrent Protection.**

(A) **General.** Industrial control panels shall be provided with overcurrent protection in accordance with Parts I, II, and IX of Article 240.

*Consult the 2005 NEC for complete text of Article 409.21.*

- **Article 409.110 Marking.**

An industrial control panel shall be marked with the following information that is plainly visible after installation:

- (1) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified.
- (2) Supply voltage, phase, frequency, and full-load current.
- (3) Short-circuit current rating of the industrial control panel based on one of the following:
  - a. Short-circuit current rating of a listed and labeled assembly
  - b. Short-circuit current rating established utilizing an approved method.

**Explanation:** Article 409 is an entirely new article containing general requirements for industrial control panels. Included in these requirements are the needs to provide proper overcurrent protection as stated in Article 240, as well as markings listing the industrial control panel's short-circuit current rating and full-load current. **These changes are intended for not only panel builders and OEMs for initial installations, but also for relocated and retrofitted equipment.** With this new Article, inspectors will be closely examining industrial control panels for the information necessary to simplify and expedite their inspections and approvals.

*Consult the 2005 NEC for complete text of Article 409.110.*

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS



# Motor Controllers

## Article 430.8 – NEW!

- **Article 430.8 Marking on (Motor) Controllers.**

A controller shall be marked with the manufacturer's name or identification, the voltage, the current or horsepower rating, **the short-circuit current rating**, and such other necessary data to properly indicate the applications for which it is suitable.

**Exceptions No. 1-4:** Consult the 2005 NEC for complete text of Exceptions for Article 430.8.

**Explanation:** Article 430.8 now specifically lists the "short-circuit current rating" as one of the required markings for motor controllers. However, there are also four new Exceptions listing situations where the marking of the short-circuit current rating is not required.

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS

# Hermetic Refrigerant – Motor Compressors

## Article 440.4(B) – NEW!

- **Article 440.4 Marking on Hermetic Refrigerant Motor-Compressors and Equipment.**

Consult the 2005 NEC for complete text of this Article.

- **Article 440.4(B) Multimotor and Combination-Load Equipment.**

See below for explanation of this change.

**Exception No. 3** Multimotor and combination-load equipment used in one- and two-family dwellings, cord-and-attachment-plug-connected equipment, or equipment supplied from a branch circuit protected at 60 A or less shall not be required to be marked with a short-circuit current rating.

**Explanation:** Among other pieces of information, the text "and the short-circuit current rating of the motor controllers or industrial control panels" has been added to the list of requirements that must be included when marking the nameplate of various types of refrigeration equipment containing hermetic motor-compressors.

The new Exception lists a few scenarios where this new change does not apply, but in general, most air compressor and refrigeration equipment with multimotor and combination loads will require this marking on the nameplate.

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS



## Industrial Machinery

### Article 670.3(A) – NEW!

- **Article 670.3 Machine Nameplate Data.**
- **Article 670.3(A) Permanent Nameplate.**

*Consult the 2005 NEC for complete text of this Article.*

**Explanation:** Among other pieces of information, this Article requires the short-circuit current rating to be included on the industrial control panel nameplate for industrial machinery. Primarily, this Article was re-worded to clarify previous potential confusion. **Now, the short-circuit current rating must be stated on the nameplate for the entire machine, not just the machine's overcurrent protective device.**

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS

## Fire Pumps

### Article 695.4(B)(1) – NEW!

- **Article 695.4 Continuity of Power.**
- **Article 695.4(B) Supervised Connection.**
- **Article 695.4(B)(1) Overcurrent Device Selection.**

The overcurrent protective device(s) shall be selected or set to carry indefinitely the sum of the locked-rotor current of the fire pump motor(s) and the pressure maintenance pump motor(s) and the full-load current of the associated fire pump accessory equipment when connected to this power supply. The requirement to carry the locked-rotor currents indefinitely shall not apply to conductors or devices other than overcurrent devices in the fire pump motor circuit(s).

**Explanation:** The last sentence of this Article has been added to provide additional clarification that this requirement only applies to the overcurrent device involved, and not to conductor sizing. Conductor sizing rules can be found in Article 695.6, but apparently there has been confusion and incorrect requirements in the field regarding the sizing of other equipment associated with fire pumps.

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS – PRIMARILY UL CLASSES J, R, CC AND CD



## Fire Pumps *Continued*

### Article 695.5(B) – NEW!

- **Article 695.5 Transformers**
- **Article 695.5(B) Overcurrent Protection.**

The primary overcurrent protective device(s) shall be selected or set to carry indefinitely the sum of the locked-rotor current of the fire pump motor(s) and the pressure maintenance pump motor(s) and the full-load current of the associated fire pump accessory equipment when connected to this power supply. Secondary overcurrent protection shall not be permitted. The requirement to carry the locked-rotor currents indefinitely shall not apply to conductors or devices other than overcurrent devices in the fire pump motor circuit(s).

*Explanation:* The last sentence of this Article has been added to provide additional clarification that this requirement only applies to the overcurrent device involved, and not to conductor sizing.

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS – PRIMARILY UL CLASSES J, R, CC AND CD

### Article 695.5(C)(2) – NEW!

- **Article 695.5(C) Feeder Source**
- **Article 695.5(C)(2) Overcurrent Protection.**

The transformer size, the feeder size, and the overcurrent protection device(s) shall be coordinated such that overcurrent protection is provided for the transformer in accordance with 450.3 and for the feeder in accordance with 215.3, and such that the overcurrent protective device(s) is selected or set to carry indefinitely the sum of the locked-rotor current of the fire pump motor(s), the pressure maintenance pump motor(s), the full-load current of the associated fire pump accessory equipment, and 100 percent of the remaining loads supplied by the transformer. The requirement to carry the locked-rotor currents indefinitely shall not apply to conductors or devices other than overcurrent devices in the fire pump motor circuit(s).

*Explanations:* The last sentence of this Article has been added to provide additional clarification that this requirement only applies to the overcurrent device involved, and not to conductor sizing nor to the selection of other equipment.

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS – PRIMARILY UL CLASSES J, R, CC AND CD



## Fire Pumps *Continued*

### Article 695.6(D) – NEW!

- **Article 695.6 Power Wiring**
- **Article 695.6(D) Overload Protection.**

Power circuits shall not have automatic protection against overloads. Branch-circuit and feeder conductors shall be protected against short circuit only. Where a tap is made to supply a fire pump, the wiring shall be treated as service conductors in accordance with 230.6. The applicable distance and size restrictions in 240.21 shall not apply.

**Exception No. 2:** *For on-site standby generator(s) rated to produce continuous current in excess of 225 percent of the full-load amperes of the fire pump motor, the conductors between the on-site generator(s) and the combination fire pump transfer switch controller or separately mounted transfer switch shall be installed in accordance with 695.6(B) or protected in accordance with 430.52.*

*The protection provided shall be in accordance with the short-circuit current rating of the combination fire pump transfer switch controller or separately mounted transfer switch.*

**Explanation:** *The purpose of the changes in this Article was to clear up some confusion regarding the rules of when short-circuit, overload, and ground-fault protection of circuits is, and is not, required. Wording in both the main article and Exception No. 2 were changed to minimize any previous confusion between the 2002 version of this Article and that of Article 695.5(C)(2) – as described above. With this change, the rules should now be clearer that feeders and branch circuits that supply fire pumps are not allowed to be placed in series with overload protection devices only.*

- **LITTELFUSE PRODUCTS AFFECTED:** VARIOUS – PRIMARILY UL CLASSES J, R, CC AND CD



# Series Ratings of Fuses and Breakers

## Article 240.86(A) – NEW!

- **Article 240.86(A) Series Ratings.**

Where a circuit breaker is used on a circuit having an available fault current higher than the marked interrupting rating by being connected on the load side of an acceptable overcurrent protective device having a higher rating, the circuit breaker shall meet the requirements specified in (A) or (B), and (C).

**(A) Selected Under Engineering Supervision in Existing Installations.** The series rated combination devices shall be selected by a licensed professional engineer, who is engaged primarily in the design or maintenance of electrical installations. The selection shall be documented and stamped by the professional engineer. This documentation shall be available to those authorized to design, install, inspect, maintain, and operate the system. This series combination rating, including identification of the upstream device, shall be field marked on the end use equipment.

**(B) Tested Combinations.** The combination of line-side overcurrent device and load-side circuit breaker(s) is tested and marked on the end use equipment, such as switchboards and panelboards.

**(C) Motor Contribution.** Series rating shall not be used where:

- (1) Motors are connected on the load side of the higher-rated overcurrent device and on the line side of the lower-rated overcurrent device, and
- (2) The sum of the motor full-load currents exceeds 1 percent of the interrupting rating of the lower-rated circuit breaker.

**Explanation:** This Article details the new method of determining the combination series rating of overcurrent devices in existing installations where devices have not yet been tested specifically for that application. This applies primarily in older applications where equipment and devices have not, or due to costs involved, cannot be tested together for series rating.

In general, and as required in Article 110.9, circuit breakers should not be used in applications where the available short-circuit current found on the line side of the breaker is greater than the interrupting rating of that circuit breaker. With these revisions, Article 240.86 now includes situations where it is acceptable for “upstream” fuses or circuit breakers to adequately protect “downstream” circuit breakers that have otherwise insufficient interrupting ratings. This scenario is what is referred to as a “series rating”.

Prior to the 2005 NEC, the only real option in situations where equipment needed to be changed to be considered a 'combination series rated system' was to replace the existing equipment - often a costly or unrealistic option. As a result of this Code change, the additional option now exists to permit “a licensed professional engineer engaged primarily in the design or maintenance of electrical installations” to select, document, and stamp (field mark) series combination rated devices for use in existing systems or installations.



## Series Ratings *Continued*

### Article 240.86(A) – **NEW!** *Continued*

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**Explanation (Continued):** Therefore, two different scenarios now exist for the user to meet the requirements for providing the protection necessary for series-rated combination applications. Compliance with 240.86(A) and (C) ...or... 240.86(B) and (C) will allow the user to achieve the proper series-rated combination protection, while also meeting the interrupting rating requirements stated in Article 110.9.

For additional information on this topic, please refer to Littelfuse POWR-GARD Products' Tech Brief on Series Ratings.

- **LITTELFUSE PRODUCTS AFFECTED:** UL LISTED CLASSES: L, RK1, RK5, J, T, CC, AND CD



# Lighting Fixtures

## Article 410.73(G) – NEW!

- **Article 410.73(G) Disconnect Means.**

In indoor locations, other than dwellings and associated accessory structures, fluorescent luminaires (fixtures) that utilize double-ended lamps and contain ballast(s) that can be serviced in place or ballasted luminaires that are supplied from multiwire branch circuits and contain ballast(s) that can be serviced in place shall have a disconnecting means either internal or external to each luminaire (fixture), to disconnect simultaneously from the source of supply all conductors of the ballast, including the grounded conductor if any. The line side terminals of the disconnecting means shall be guarded. The disconnecting means shall be located so as to be accessible to qualified persons before servicing or maintaining the ballast. This requirement shall become effective January 1, 2008.

**Exception No. 1:** A disconnecting means shall not be required for luminaires (fixtures) installed in hazardous (classified) location(s).

**Exception No. 2:** A disconnecting means shall not be required for emergency illumination required in 700.16.

**Exception No. 3:** For cord-and-plug-connected luminaires, an accessible separable connector or an accessible plug and receptacle shall be permitted to serve as the disconnecting means.

**Exception No. 4:** A disconnecting means shall not be required in industrial establishments with restricted public access where conditions of maintenance and supervision ensure that only qualified persons service the installation by written procedures.

**Exception No. 5:** Where more than one luminaire is installed and supplied by other than a multiwire branch circuit, a disconnecting means shall not be required for every luminaire when the design of the installation includes locally accessible disconnects, such that the illuminated space cannot be left in total darkness.

**Explanation:** This section is included under Article 410 Part XIII covering “Special Provisions for Electric-Discharge Lighting Systems of 1000 Volts or Less”. This new addition to Article 410.73 involves a new requirement (as of Jan 1, 2008) for individual disconnecting means for the conductors of ballasts in certain types of fluorescent luminaires (fixtures). More and more of these fixtures are being serviced while energized, which has increased the potential of workers coming in accidental contact with energized parts. To provide a higher level of safety for all workers involved with these services, Article 410.73(G) has been added to require some type of disconnecting means (inside or outside the fixture) that will disconnect conductors of the ballasts during repair and/or replacement. This article specifically addresses those fluorescent luminaires (fixtures) that contain ballasts and use double-ended lamps.

The Exceptions to the rule address conditions and installations where such a requirement is considered impractical or where variations to the rule are necessary.

The effective date of January 1, 2008 has been set to allow manufacturers and the industry enough time to develop products and modifications for these types of lighting applications.

- **LITTELFUSE PRODUCTS AFFECTED:** NONE YET – PRODUCTS STILL “TO BE DEVELOPED”.



# Power Distribution Blocks

## Article 376.56(B) – NEW!

- **Article 376.56(B) Power Distribution Blocks.**
  - (1) **Installation.** Power distribution blocks installed in metal wireways shall be listed.
  - (2) **Size of Enclosure.** In addition to the wiring space requirement in 376.56(A), the power distribution block shall be installed in a wireway with dimensions not smaller than that specified in the installation instructions of the power distribution blocks.
  - (3) **Wire Bending Space.** Wire bending space at the terminals of power distribution blocks shall comply with 312.6(B).
  - (4) **Live Parts.** Power distribution blocks shall not have exposed live parts in the wireway after installation.

**Explanation:** Prior to this edition, Article 376.56 of the Code covered only splices and taps. In the 2005 NEC, the Article was revised to also include power distribution blocks as a listed device suitable for use in a wireway. Previously, power distribution blocks were not included in the Code, but now are covered by such specifics as how to install, size, and provide proper wire bending spacing. This change should also increase the level of awareness for the intended use and applications of this product.

- **LITTELFUSE PRODUCTS AFFECTED:** LD SERIES OF POWER DISTRIBUTION BLOCKS AND COVERS



# Renewable Fuses

**Article 240.60(D) – NEW!**

- **Article 240.60(D) Renewable Fuses.**

Class H cartridge fuses of the renewable type shall only be permitted to be used for replacement in existing installations where there is no evidence of overfusing or tampering.

***Explanation:** This article has been added to clarify that “renewable-type” Class H cartridge fuses shall only be used as replacements in existing installations. The “Class H” type is specifically identified to differentiate it from any future “renewable” or “resettable” current-limiting fuse designs and applications. For years, Class H renewable link fuses have been misused and misapplied by using multiple replacement links for the purpose of increasing the current-carrying capacity of the fuse above its designed capabilities (Interrupting Rating of Class H fuses is 10,000 amperes). This type of misuse is a direct violation of the NEC and can create safety hazards.*

- **LITTELFUSE PRODUCTS AFFECTED:** RLS (600VAC) AND RLN (250VAC) SERIES OF CLASS H FUSES



**Only Acceptable for Replacement in Existing Installations**



**UL Listed Class R Fuses Recommended for All Applications**



# Special Conditions

## Article 517.26 – NEW!

- **Article 517 Health Care Facilities**
- **Article 517.26 Essential Electrical Systems — Application of Other Articles.**

The essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.

**Explanation:** This portion of Article 517 requires “Essential Electrical Systems” to meet all the requirements of Article 700 (“Emergency Systems”), except as amended by Article 517. See below for the new Article 700.27 that requires all emergency system(s) overcurrent devices to be selectively coordinated with all supply side overcurrent protective devices. There are no amendments in Article 517 regarding selective coordination, so bottom line – in a rather circular fashion: selective coordination is required not only in normal electrical systems, but also in essential electrical systems within health care facilities.

- **LITTELFUSE PRODUCTS AFFECTED:** UL LISTED CLASSES: L, RK1, RK5, J, T, AND G

## Article 700.27 – NEW!

- **Article 700 Emergency Systems**
  - **Article 700.27 Coordination.**
- Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.

**Explanation:** Selective Coordination is now mandated for all emergency system applications. Both fuses and circuit breakers can be used to achieve this coordination if the appropriate overcurrent protective devices are properly designed and selected. The focus here is to provide a reliable emergency system that will still be operational when called upon, when used per the “Tests and Maintenance” requirements found in Article 700.4. The Article was previously found as the FPN following 700.25 in the 2002 Code.

- **LITTELFUSE PRODUCTS AFFECTED:** UL LISTED CLASSES: L, RK1, RK5, J, T, AND G



## Special Conditions *Continued*

### Article 701.18 – NEW!

- **Article 701 Legally Required Standby Systems**
- **Article 701.18 Coordination.**

Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protection devices.

***Explanation:** This Article has been added as a new requirement designed to improve the reliability of all standby systems required by law. This standard applies to any and all fuses or circuit breakers used to protect both the standby system itself, and the system's corresponding supply side overcurrent devices. If all overcurrent protective devices (OCPDs) have been properly selected, then a fault in the standby system will be isolated to the OCPD closest to the fault – thus keeping the rest of the system operational. This article also makes a direct reference to the new definition of "Selective Coordination" found in Article 100 (see pages 4-5 of this document).*

- **LITTELFUSE PRODUCTS AFFECTED:** UL LISTED CLASSES: L, RK1, RK5, J, T, AND G



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