2011 NEC Code

Changes in Overcurrent and Surge Protection

REFERENCE GUIDE

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2011 NEC Code Changes in Overcurrent and Surge Protection

Contents

The recommendations by Mersen in this publication are intended to be in compliance with the 2011 NEC, however jurisdictions that adopt the code are solely responsible for any modifications and interpretations to be enforced by their jurisdictions.

The user of the code should identify what regulatory authority has responsibility for the installation approval and always comply with any regulatory authority modifications to the N.E.C. Mersen cannot be responsible for errors and omissions.

1. Required Short Circuit Current Ratings

Previous Code Requirements

For the first time in the 2005 code, industrial control machinery and panels, air conditioning equipment, refrigeration equipment, meter disconnect switches, and motor controllers had to be marked with their SCCR (Short-Circuit Current Rating).

The 2008 code defined SCCR as, “The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.” Several code sections have specific labeling requirements such as in Section 409 for Industrial Control Panels and Section 670 for Industrial Machinery.

Prior editions of code paragraph 110.10 had no mention of Short-Circuit Current Rating (SCCR). It generally required equipment to be protected by overcurrent protection enough to prevent extensive damage.

Sections 409 and 670 had no explanation of how to use the SCCR label requirements.

New Code

110.10 Circuit Impedance, Short-Circuit Current Ratings, and Other Characteristics.
The overcurrent protective devices, the total impedance, the equipment short-circuit current ratings, and other characteristics of the circuit to be protected shall be selected and coordinated to permit the circuit protective devices used to clear a fault to do so without extensive damage to the electrical equipment of the circuit.

409.22 Short-Circuit Current Rating.
An industrial panel shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 670.3(A)(4).

670.5 Short-Circuit Current Rating.
Industrial machinery shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 670.3(A)(4).

1. Required Short Circuit Current Ratings, *Continued*

Reasons for Changes

Manufacturers began labeling electrical equipment with the SCCR, but many people failed to realize the significance. Some people just assumed it was unimportant labeling. The code mandated the labeling, but the prior code was unclear how to use this information.

Some panel buyers only checked for the label, and what the manufacturers provided. But the equipment could be at dangerously low SCCR levels for the application. The panel users needed more description on how to use the SCCR label information.

How to Comply

Industrial control and machine panels have to be marked with their SCCR. The manufacturers or designers of the panel must do an analysis as described in UL 508A, even if the panel is not built to the UL 508A Standard specifications.

Then the installer must insure that the panel's SCCR is not less than the available fault at the supply terminals of the panel. The electrical inspector has to verify that the SCCR is on the nameplate and have some evidence that the SCCR is not exceeded. The 2011 code has a new requirement for labeling service entrance equipment with the maximum available fault current to make this comparison easier.

Compliance can be costly if the installer who is responsible for code compliance ignores this code issue until the equipment is installed. Much time can be consumed in negotiating who should pay for the problem resolution. The installation fix often requires return of the panel to the manufacturer for upgrading.

Helpful Products

The Amp-Trap® Family delivers current limiting fuses that can increase the SCCR of industrial control panels. Products such as the UltraSafe™ USFM fuse holder directly replace circuit breakers having the same width as type IEC starters. The Surge-Trap® products protect against voltage spikes and have a built-in rating of 200kA SCCR. The finger-safe power distribution blocks can also have a 100kA rating with fuses.

2. New Markings for Available Fault Currents

Previous Code Requirements

Installers and inspectors were required to have electrical equipment interrupting ratings sufficient for the connected available fault current. Examples are 110.9 and 110.10. They had to compare the available short circuit current with the appropriate ratings on the equipment. Prior code only dictated the labeling of equipment ratings on the equipment, not labeling of the available fault current.

If equipment were applied in excess of its rating, it could cause personal injury, fire or damage. Adequate interrupting rating and SCCR are vital for a safe installation.

In the normal design of a new system or only adding an industrial control panel, the code required determining the available fault current to check against the equipment ratings. The code did not require any documentation of this available fault current.

New Code

110.24 Available Fault Current.

(A) Field Marking.
Service equipment in other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault current calculation was performed and be of sufficient durability to withstand the environment involved.

(B) Modifications.
When modifications to the electrical installation occur that affect the maximum available fault current at the service, the maximum available fault current shall be verified or recalculated as necessary to ensure the service equipment ratings are sufficient for the maximum available fault current at the line terminals of the equipment. The required field marking(s) in 110.24(A) shall be adjusted to reflect the new level of maximum available fault current.

Exception: The field marking requirements in 110.24(A) and 110.24(B) shall not be required in industrial installations where conditions of maintenance and supervision ensure that only qualified persons service the equipment.

2. New Markings for Available Fault Currents, *Continued*

Reasons for Changes

Inspectors and customers often had problems in easily obtaining the available fault current value. In order to evaluate the suitability of the equipment they needed to verify the rating of the equipment was more than the available fault current.

With this code change, the inspector and others can use the new markings to simplify the comparison. This should ensure more equipment being properly applied.

How to Comply

The maximum available fault current can be obtained from multiple methods. If it is an engineered project, the engineer will provide it. Most utilities will provide it as a free service for their connection point. Mersen has a software tool to easily calculate the available fault current.

But there are some potential misunderstandings with the new exception. The phrase “Industrial Installations” is neither explained in this section nor listed in Section 100 as a definition. So what is the code intent by using the phrase “Industrial Installation”? Chapter two has an equivalent phrase that is defined in detail.

240.2 Definitions.

> *“Supervised Industrial Installation. For the purposes of Part VIII, the industrial portions of a facility where all of the following conditions are met:*
>
> *(1) Conditions of maintenance and engineering supervision ensure that only qualified persons monitor and service the system.*
>
> *(2) The premises wiring system has 2500 kVA or greater of load used in industrial process(es), manufacturing activities, or both, as calculated in accordance with Article 220.*
>
> *(3) The premises has at least one service or feeder that is more than 150 volts to ground and more than 300 volts phase-to-phase.*
>
> *This definition excludes installations in buildings used by the industrial facility for offices, warehouses, garages, machine shops, and recreational facilities that are not an integral part of the industrial plant, substation, or control center.“*

Helpful Products

Mersen has a free software program that can easily calculate the maximum available fault current. It’s part of the free Select-A-Fuse® software program. It’s available upon request from our website.

Access Select-A-Fuse software at:
ep-us.mersen.com,
click “Resources > Select-a-Fuse Software“

3. Short Circuit Protection of Conductors

Previous Code Requirements

The code required overload protection in accordance with cable ampacity and environmental conditions. This prevented the conductor part of the wire from overheating the outer insulation to a degree that it would be damaged.

Section 310 requires conductors for general wiring to be sized to prevent overheating due to an overload. This assumes that the conductors can release their heat over time to the environment. This assumption is true for an overload.

Section 240.92 gives a method for more detailed analysis, including Short-Circuit Current analysis in Table 240.92(B). This section introduces the short-circuit formulas for conductors.

Conductor heating under short-circuit conditions is determined by (1) or (2):

(1) Short-Circuit Formula for Copper Conductors

$(I^2/A^2)t = 0.0297 \log_{10} [(T_2 + 234)(T_1 + 234)]$

(2) Short-Circuit Formula for Aluminum Conductors

$(I^2/A^2)t = 0.0125 \log_{10} [(T_2 + 228)/(T_1 + 228)]$

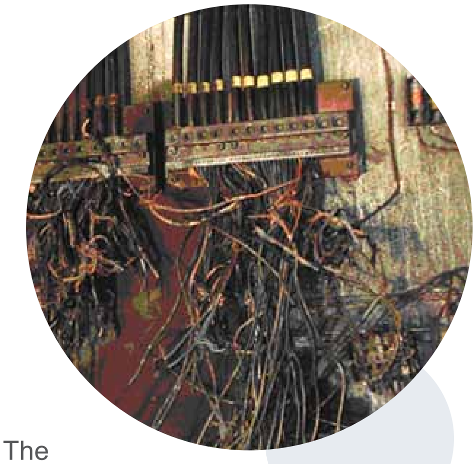
New Code

240.4 Protection of Conductors.
Conductors, other than flexible cords, flexible cables, and fixture wires, shall be protected against overcurrent in accordance with their ampacities specified in 310.15, unless otherwise permitted or required in 240.4(A) through (G).

Informational Note: See ICEA P-32-382-2007 for information on allowable short-circuit currents for insulated copper and aluminum conductors.

3. Short Circuit Protection of Conductors, *Continued*

Reasons for Changes



Only the informational note was added. Some applications can meet the general requirements of Section 310, but not prevent damage to wire insulation when undergoing high short circuits. This damaged insulation can trigger a major hazard.

The referenced ICEA P-32-382-2007 contains the same formulas as in Table 240.92(B). It also documents the dynamics of overheating of conductors and demonstrates that time is critical in removal of short circuits from a conductor.

When a short circuit occurs, high currents flow for a short time duration. The heat generated in the cable doesn't have enough time to dissipate. The temperature caused by a high short circuit current can damage the insulation in a fraction of a second. If an overcurrent device operates quickly enough under a short circuit condition, it will protect the cable from the heat build-up.

How to Comply

Obtain the available fault current and the overcurrent protective device operating time at that current. For example, fuses in their current limiting range have a maximum opening duration of 0.0083 seconds. Circuit breakers typically have many times that duration depending upon the model. These formulas can be used to verify the chosen conductor size to prevent overheating from short-circuits.

Typically current limiting fuses sized to provide overload protection are sufficient. When using circuit breakers or slow acting devices, an analysis should be considered if the system could have high magnitude fault currents.

Helpful Products

All branch circuit rated current limiting fuses can substantially reduce the heating effects. For instance, the Amp-Trap 2000® Class J 200 Amp AJT200 fuse opens in 0.01 seconds at less than 3,000 amps fault current. The data for the Mersen fuses is available from our website or by calling our technical services group.

4. Arc Flash Danger from Some Circuit Breakers

Previous Code Requirements

The Overcurrent Protection Article 240 generally contains the code requirements for overcurrent protection. The prior code in section VII dictated the general circuit breaker requirements for overcurrent protection in paragraphs 240.80 through 240.86.

The code had no restrictions against using circuit breakers when they increased arc flash dangers by having no instantaneous trip.

New Code

240.87 Non-instantaneous Trip.
Where a circuit breaker is used without an instantaneous trip, documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).

Where a circuit breaker is utilized without an instantaneous trip, one of the following or approved equivalent means shall be provided:

(1) Zone-selective interlocking

(2) Differential relaying

(3) Energy-reducing maintenance switching with local status indicator

Informational Note: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to "no intentional delay" to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2009, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.

Reasons for Changes

The electrical community has become more aware of Arc Flash Hazards. NFPA 70E and IEEE 1584 detail how the severity of the hazards can be calculated.

Some installations have the main circuit breaker at the service entrance with the instantaneous trip disabled. At the time of their design and installation, little was known about predicting arc flash hazards.

Disabling the instantaneous trip was very effective in achieving selective coordination without fuses or complicated electronic control schemes. Selective coordination allowed for a feeder breaker to clear a fault without nuisance opening the main. The intent was good, but it had unintentional consequences.

With the instantaneous trip of the main disabled, the main will need substantially more time to react to an arc flash current between the main and feeder breakers. This can increase the arc flash hazard from Category 0 to Category 4. With a higher hazard level, the chances of an electrical worker being severely injured increase.

4. Arc Flash Danger from Some Circuit Breakers, *Continued*

How to Comply

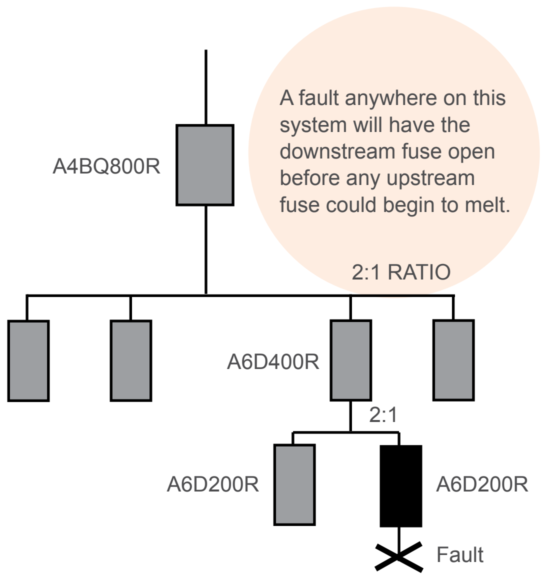
When designing a new electrical system use the simple fuse approach. Within the Amp-Trap 2000 family of fuses maintain at least a 2:1 ratio of the fuse sizes to ensure selective coordination without increasing the arc flash hazard level. This is due to the current limiting action of the fuses, which are much faster acting than circuit breakers. The reduction of time and complexity from using circuit breaker systems can reduce the engineering effort to comply with the selective coordination requirements.

Another solution is electronic trip communications between the circuit breakers such as Zone Selective Interlocking (ZSI). This communication package permits significant time delay of the upstream trip only when the downstream feeder is attempting to trip. This introduces some unintentional time delay, but it still can reduce the arc flash hazard.

The other two methods are “Differential relaying” and “Energy-reducing maintenance switching with local status indicator”. Differential relaying is explained in the informational note to paragraph 240.92(C)(1)(2).

Helpful Products

A selective coordination requirement can be easily met in new systems design using the Amp-Trap 2000 family of fuses. This family easily enables meeting the requirements despite future electrical system modifications. This family can also reduce the arc flash hazard exposure because of its exceptional current limitation.



5. Overvoltage Protection - SPDs

Previous Code Requirements

Section 285 was modified in the 2005 and 2008 revisions to harmonize with the UL 1449 Revision Three Standard for Surge Protection Devices (SPDs). This standard changed so much that the overvoltage device names were changed to emphasize the significance. The former TVSS units were renamed SPDs.

Paragraph 285.5 requires the use of a listed device and paragraph 285.6 a marking of an SCCR value. The prior major revisions to UL 1449 and the code were to upgrade the safety of surge protection devices.

Later paragraphs detail the new application requirements concerning Type 1, 2 and 3 SPDs. These requirements directly impact existing construction specifications. Such terms as TVSS, SVR, and Joule ratings are obsolete terms and make a specification obsolete.

As with any change of this significance, the phrasing is often improved in later revisions.

New Code

285.23 Type 1 SPDs (Surge Arresters).
Type 1 SPDs shall be installed in accordance with 285.23(A) and (B).

(A) Installation. Type 1 SPDs (surge arresters) shall be installed as follows:

(1) Type 1 SPDs (surge arresters) shall be permitted to be connected to the supply side of the service disconnect as permitted in 230.82(4) or

(2) Type 1 SPDs (surge arresters) shall be permitted to be connected as specified in 285.24.

(B) At the Service. When installed at services, Type 1 SPDs shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

5. Overvoltage Protection - SPDs, *Continued*

Reasons for Changes

The prior text of 285.23(B) emphasized the connection of the grounding conductor of the SPD. The new text more directly requires Type 1 SPDs to be connected to one of the designated items. This is more editorial in nature but it serves to emphasize the enormity of the revisions in the last two code changes.

How to Comply

Use UL listed SPD products. Listed products are marked with a UL hologram and the SCCR. The device SCCR must equal or exceed the available fault current at the point of application. It will also be marked with an application type, such as Type 1, 2, 3, or 4. As always, install the listed devices in accordance with any manufacturer's instructions.

Helpful Products

Mersen has a full line of SPDs that comply with UL 1449 Third Edition and the NEC. The STX products are frequently specified by engineering firms for building distribution protection in new construction. The STT2 products are general purpose SPDs used for many existing installations. The ST Modular and STP Pluggable are used by OEMs in applications from Solar PV to traditional motor controls.

6. Changes in Group Motor Protection

Previous Code Requirements

Section 430.53 permits several motors to have combined short-circuit protection instead of having it in each motor circuit. This saves cost and is frequently preferred by OEMs and control panel manufacturers. Generally the motor controllers and wires are required to be sized the same as if the individual motors had their own individual short-circuit protection.

New Code

430.53 Several Motors or Loads on One Branch Circuit.
Two or more motors or one or more motors and other loads shall be permitted to be connected to the same branch circuit under conditions specified in **430.53(D)** and in **430.53(A)**, **(B)**, or **(C)**. The branch-circuit protective device shall be fuses or inverse time circuit breakers.

Reasons for Changes

It was not clear if the short-circuit protection was allowed to be an instantaneous trip circuit breaker or a supplemental protector. The code now clearly requires short-circuit protection to be a fuse or inverse circuit breaker that is listed for branch protection.

Supplementary protectors such as those listed to UL 1077 are not adequate. They are not listed branch rated devices. The code defines a supplementary overcurrent device as one intended for limited overcurrent protection in specific applications. This limited protection is in addition to the protection provided in the required branch circuit by the branch-circuit overcurrent protective device.

How to Comply

Whenever using motor group installations provide short-circuit protection that is listed as branch overcurrent protection in the form of fuses or inverse circuit breakers.

Helpful Products

The Mersen AJT, ATDR, and ATQR fuses are commonly used to give full branch rated overcurrent protection. The AJT, which is a Class J time delay fuse, is often used with our FBJ disconnect switch. The ATDR and ATQR are both Class CC fuses with the advantage of extremely small size.

The USFM is a three pole Class CC fuse holder with the same width as an IEC starter. Many times it can be directly substituted in the same space as a non-code compliant supplementary protector to provide a simple solution.

7. MV Motor Protection Settings Require Engineering Supervision

Previous Code Requirements

Previously the NEC allowed anyone to determine the protection of medium voltage motors similar to that of low voltage motors as long as the resulting selection protected against dangerous conditions. This selection process could be performed by an electrician, engineer, or perhaps a non-qualified person.

New Code

430.225 Motor-Circuit Overcurrent Protection. (Over 600 Volts, Nominal)
(A) General. Each motor circuit shall include coordinated protection to automatically interrupt overload and fault currents in the motor, the motor-circuit conductors, and the motor control apparatus.
Exception: Where a motor is critical to an operation and the motor should operate to failure if necessary to prevent a greater hazard to persons, the sensing device(s) shall be permitted to be connected to a supervised annunciator or alarm instead of interrupting the motor circuit.

(B) Overload Protection.
(1) Type of Overload Device. Each motor shall be protected against dangerous heating due to motor overloads and failure to start by a thermal protector integral with the motor or external current-sensing devices, or both. *Protective device settings for each motor circuit shall be determined under engineering supervision.*

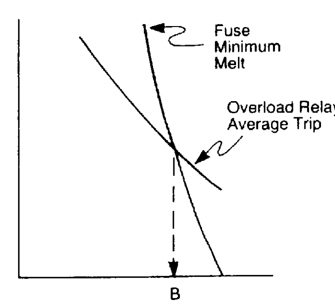
Reasons for Changes

A medium voltage motor controller typically has high power and can create an arc flash if it overheats. The coordination between a Medium Voltage (MV) fuse and an overload is vital for safe operation. Most MV fuses in this application are rated for short-circuit current interrupting only. The overloads are rated for interrupting low level currents only. When a device tries to interrupt MV currents outside its rating, an arc flash or an explosion can occur.

The protective device coordination requires an understanding of the device ratings, device time-current characteristics, and the protection curve of the motor. Without sufficient information and training, it is difficult to properly apply these devices.

How to Comply

Use engineering supervision to coordinate requirements whenever a MV overload setting or MV short-circuit protection is adjusted. It is common practice in lower voltage motor circuits to adjust settings with a trial and error approach. If an overload trips or the fuse opens, sometimes a higher setting or larger fuse is tried. This is a dangerous practice with MV motor circuits.



Instead of adjusting the overload trip to a higher level when a MV motor trips out, consult with an engineer to assure proper new settings.

Helpful Products

Mersen has the widest range of current-limiting medium voltage fuses for motor protection that meet the North American ANSI/IEEE standards. We can supply details of our fuse curves to engineers involved with adjusting MV overload settings or choosing new fuses.

8. Transformers Need Safe Disconnecting Means

Previous Code Requirements

The transformers were required to have sufficient overcurrent protection and supply conductor ampacity. But the code did not require a disconnecting means. Multiple transformers could be supplied from a single overcurrent device from a remote panelboard.

New Code

450.14 Disconnecting Means. Transformers, other than Class 2 or Class 3 transformers, shall have a disconnecting means located either in sight of the transformer or in a remote location. Where located in a remote location, the disconnecting means shall be lockable, and the location shall be field marked on the transformer.

Reasons for Changes

When maintenance work is required for an individual transformer without an obvious disconnect switch, safety versus convenience becomes an issue. If you switched the feeder off, all the transformers on that circuit would be de-energized. This can disrupt the workplace. This disconnect switch might be located in a far off main electrical room with inadequate signage. This layout encourages taking unsafe shortcuts and makes it difficult to encourage Lock-out and Tag-out procedures.

How to Comply

Any new transformer should have a disconnecting means that is either 1) within site of the transformer or 2) it should have lock-out capability and have sufficient signage to clearly indicate the proper disconnect. This signage shall be on the transformer.

Helpful Products

The Enclosed Switch disconnect products are available to comply with many different environments. Using stainless steel, non-metallic or other rated enclosures, the Mersen disconnects can be located within sight of the transformers.

9. PV Systems Require Listed Overcurrent Protection

Previous Code Requirements

Photovoltaic system requirements are changing every code cycle.

Fuses or circuit breakers, used in any DC portion of a photovoltaic power system should be listed for use in DC circuits and have the appropriate voltage, current, and interrupting ratings. As the 2005 code 690.9(D) was written, these devices were not available with the UL 2579 listing. Now they are.

The prior code did not have a requirement for DC Arc Fault Circuit Interrupters (AFCIs). The basic overcurrent protection was responsible for interrupting the circuits. As the 2011 code was being written, no listed devices were available.

New Code

690.9(D) Direct-Current Rating.
Overcurrent devices, either fuses or circuit breakers, used in any DC portion of a photovoltaic power system shall be listed for use in DC circuits and shall have the appropriate voltage, current, and interrupt ratings.

690.11 Arc-Fault Circuit Protection (Direct Current).
Photovoltaic systems with DC source circuits, DC output circuits, or both, on or penetrating a building operating at a PV system maximum system voltage of 80 volts or greater, shall be protected by a listed (DC) arc-fault circuit interrupter, PV type, or other system components listed to provide equivalent protection.

Reasons for Changes

UL determined that the existing DC fuse standards were inadequate for protection of PV systems. PV systems typically undergo extreme temperature changes and cycling of load currents far beyond normal building environments.

In order to justify investment in PV systems, it is important to minimize required maintenance, for example, replacing fuses. Fuses that are listed to UL 2579 are tested to perform under the PV extreme conditions. Some electrical inspectors are using the prior code paragraph 690.9(D) to require fuses complying with UL 2579.

The new code anticipates a similar reaction from the electrical inspectors with paragraph 690.11. At the time this 2011 code change was approved, there were no listed DC AFCI devices available from suppliers. The joint Ad Hoc Working Committee determined that there would soon be listed devices available.

9. PV Systems Require Listed Overcurrent Protection, *Continued*

How to Comply

In paragraph 110.3(B) the code requires listed fuses be used in accordance with any instructions included in the listing. The general fuse listing of UL 248 does not address PV applications, but UL 2579 does.

Using DC fuses that comply with UL 2579 averts electrical inspector rejections, lessens maintenance, and provides a safer PV system.

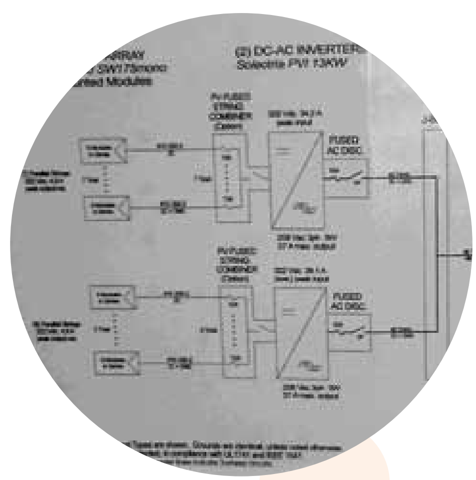
Apply DC AFCIs to systems with 80+ volt DC source circuits or DC output circuits that penetrate a building envelope. When listed DC AFCI become available, use a listed product.

Helpful Products

Mersen has products that support PV systems, however not AFCIs. Mersen has UL listed fuses that are designed for the rigors of PV applications. They are the first fuses listed to UL 2579, which provides the extreme temperature and cycling performance needed for PV.

The HP6J PV fuse series is engineered and designed specifically for the protection of photovoltaic systems. Its new fuse construction makes it ideal for repeated PV temperature and current cycling. This adds to system reliability. They are rated by UL 2579 for up to 600VDC and 400 amps.

The HP6M (600 VDC) and HP10M (1000 VDC) Photovoltaic Fuses are also engineered to protect photovoltaic applications. They have low minimum breaking capacity capabilities of 1.35 times the fuse's rated current value, allowing for safe circuit interruption under typical low fault current conditions produced by PV arrays. Protect your off-grid or grid-tied PV system from unexpected ground faults and line faults using Mersen's HelioProtection® fuse line.



Features include-

- Low fault current interrupting capability
- Durable construction for enhanced system longevity
- Temperature cycle withstand capability
- Guaranteed operation at temperature extremes
- Industry's first UL Listed solution
- Globally accepted

10. Required Selective Coordination Requirements Modified

Previous Code Requirements

The code requirement for selective coordination was inserted in 1993 referencing elevators. In the 2005 Code this selective coordination requirement was expanded to heath care facilities, emergency systems and legally required standby systems. The effects of this expansion were well discussed during the 2008 code cycle, resulting in some clarification. The code making community discussed the basics of selective coordination.

Selective coordination is a description of how an electrical system acts under overcurrents. Most people expect that a single overcurrent in the system would de-energize the local problem and let the rest of the system continue to operate. If the electrical system was not engineered to behave as a selectively coordinated system, a local problem can result in shutting off substantially more of the system than necessary to isolate the problem.

An example of a non-selectively coordinated system is when a branch circuit is shorted out, causing the feeder and maybe even the main to de-energize. This can happen in a typical building that was not designed with selective coordination as a goal. Then why is it uncommon to see entire buildings lose their power due a branch overcurrent?

Overcurrents can be broken into two types—overloads and short circuits. Typically an overload is less than 10 times the rated circuit current and the short circuit is over 10 times. Overloads are the most common electrical problem. These common overloads are very easy to selectively coordinate because most fuses and circuit breakers are designed for this performance. As long as the upstream overcurrent device has a higher trip rating, overloads are almost automatically selectively coordinated.

The less common overcurrent is the short circuit. This is when selective coordination can become an engineering task. Unfortunately, short circuits are more likely to occur during a fire or explosion and that is the same time that elevators and emergency electrical systems are most needed. Short circuits have high currents and the overcurrent protective devices respond very rapidly. The rapid response times have to be coordinated so that the smallest portion of the electrical system is taken out of service. If this is accomplished, the system is selectively coordinated.

The 2005 code change was based on the success of the elevator requirement for selective coordination in section 620.62. That section requires selective coordination where more than one driving device is fed from the same feeder. The intent is to prevent loss of use of multiple elevators when the electrical outage could be confined to one elevator.

In 2005 code sections 700.27 and 701.27 were added requiring selective coordination. These sections affected emergency systems, legally required standby systems and by reference of 517.26, the essential electrical systems of health care facilities. These systems were considered important enough to require selective coordination to prevent unnecessary power outages.

Selectivity also requires consideration of ground fault devices. Section 517.17(C) required a six-cycle separation between ground fault devices regardless of manufacturer to ensure selective coordination.

New Code

517.17(C) Selectivity.
Ground-fault protection for operation of the service and feeder disconnecting means shall be fully selective such that the feeder device, but not the service device, shall open on ground faults on the load side of the feeder device. Separation of ground-fault protection time-current characteristics shall conform to manufacturer's recommendations and shall consider all required tolerances and disconnect operating time to achieve 100 percent selectivity. More...

10. Required Selective Coordination Requirements Modified, *Continued*

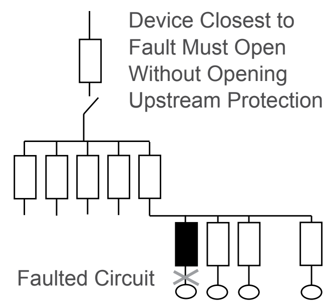
New Code, continued...

700.27 Coordination.
Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices. *Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.*

701.27 Coordination.
Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices. *Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.*

Reasons for Changes

The electrical community discussed the trade-off between reliability and cost. Changes again in this 2011 code cycle are meant to refine the selective coordination requirements.



Paragraph 517.17(C) removed the requirement for six-cycle separation between the first and second level of ground fault protection. Instead, the new code allows manufacturer's recommendations to be used to insure 100% selective coordination.

Paragraphs 700.27 and 701.18 modified the exceptions to address some questions about the required selective coordination. These exceptions don't alter the impact of requiring selective coordination, but give technical assistance to the design engineer.

How to Comply

When designing a new electrical system, the sections for selective coordination should be identified first. Although circuit breakers can be selectively coordinated for a given system, the use of the Amp-Trap 2000 family of fuses is more economical.

Within the Amp-Trap 2000 family of fuses at least a simple 2:1 ratio of the fuse sizes ensures selective coordination. This is due to the current limiting action of the fuses which are much faster-acting than circuit breakers. The reduction of time and complexity from using circuit breaker systems can reduce the engineering effort to comply with the selective coordination requirements.

Helpful Products

The selective coordination requirement can be easily met in new systems design using the Amp-Trap 2000 family of fuses, the Elevator Switch, and the Selective Coordination Panel. This family enables meeting the requirements even if future electrical system modifications vary the available fault currents.

The Elevator Switch, also called the Engineered Fusible Shunt Trip Disconnect, is built for selective coordination of elevator applications. It features a fire safety interface relay with a fire alarm voltage monitoring relay and mechanically interlocked auxiliary contacts. Use of Mersen's Amp-Trap 2000 Class J fuses permits easy selectivity coordination, while providing the panel and its components with reliable current limitation and the ability to withstand high fault conditions.

MERSEN

Expertise, our source of energy

A WORLD LEADER
in safety & reliability
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