2008 NEC Changes
Traffic Signal and Roadway Lighting Related
Is Rigid Non-Metallic Conduit no Longer in the NEC?

Part 1 Articles 100 thru 590
For the 2008 NEC cycle, there were 3,699 code change proposals and 2,349 comments on those proposals. Several changes are very controversial, including 210.12 that will require Arc Fault Circuit Interrupter protection for all dwelling unit branch circuits. It is probable that many local jurisdictions will not adopt this section due to the increased cost it will require.

Some Significant Changes for the 2008 NEC
100 - Ground is now defined as The earth.
250.32 - Regrounding the neutral no longer allowed at separate buildings/structures.
300.12 - Stubbing conduits into traffic signal cabinets now allowed in the NEC.
300.5B - Raceways above ground in wet locations requires wet location conductors/cables.
314.30 - Handhole Enclosures must be identified for that use.
Article 352 - Rigid Nonmetallic Conduit is no longer recognized by NEC.
406.9 - Weather resistant receptacles are required for any outdoor location.
408.54 - The limit of 42 overcurrent devices has been removed.

When Will the 2008 Be Adopted?
Adoption of the 2008 NEC, and any edition of the NEC, is done by local or state law. Many locations won’t adopt the NEC until after public hearings and comments are made, including local amendments.

How to Understand the Changes
This brief article does not list the text of the NEC changes, but rather summarizes it, with comments. You’ll want a copy of the 2008 NEC to review the complete text. For a complete understanding of the changes, refer to a code change text, such as Mike Holt’s Illustrated 2008 NEC Changes (www.mikeholt.com), the IAEG Analysis of Changes (www.iaei.org), or Stallcup’s Illustrated Code Changes (www.nfpa.org).

New Features of the 2008 NEC Make it Easier to Use
The 2008 NEC has the changes other than editorial text shown with gray shading, making the changed text easy to see. Vertical ruling is used for large blocks of changed and new text. Bullets (*) indicate deletion of complete paragraphs.

Articles – New, changed and deleted
4 new articles are added:
- Article 355 - Reinforced Thermosetting Resin Conduit: Type RTRC
- Article 522 - Control Systems for Permanent Amusement Attractions
- Article 626 - Electrified Truck Parking Spaces
- Article 708 - Critical Operations Power Systems

The title of Article 352 changed from Rigid Nonmetallic Conduit: Type RNC to Rigid Polyvinyl Chloride Conduit: Type PVC.

The title of Article 285 changed from Transient Voltage Surge Suppressors to Surge Protective Devices (SPDs), 1kV or Less.

Article 780, Closed Loop and Programmed Power Distribution, was deleted as the manufacturer of the product is no longer in business.

Article 100 - Definitions
Bonded (Bonding). The new definition of bonded is Connected to establish electrical continuity and conductivity.

Ground. Ground is now simply The earth. The previous definition referred to a conducting body that served in place of the earth.

Grounded (grounding). This definition has been clarified by adding extends the ground connection.

Comment: The above definitions are part of a continuing effort to clarify the terms used for grounding and bonding. The NEC is now very clear that “ground” is the earth, and “bond” is used to connect metallic parts together for clearing a fault. The common and incorrect statement “we need run a ground wire” now would mean “we need to run an earth wire”.

Grounding Conductor, Equipment (EGC). This definition was changed to indicate the EGC is a conductive path to connect the normally non-current carrying paths together. Two Fine Print Notes were added, to explain the EGC also performs bonding, and that a list of acceptable EGCs is shown in 250.118. This is to clarify that a raceway, such as RMC or EMT, is suitable as an EGC.

Grounding Electrode. This definition was changed to indicate that a grounding electrode is a conducting object making a direct connection to the earth.

Intersystem Bonding Termination. This device is designed to provide a means for bonding communications system(s) grounding and bonding conductors, and is required at each building or structure, served by a service, feeder or branch circuit.

Comment: The intersystem bonding termination connects the communications grounding and bonding conductors at one point, to establish a single point ground. In the event of a lightning or high voltage surge, referencing all grounding and bonding conductors to one point will help eliminate a difference of potential. A difference of potential (voltage) will cause current flow and possible equipment damage. Every traffic signal and roadway lighting service will require an Intersystem Bonding Termination point. Look for aftermarket terminals and bus bars to simplify this requirement.

Neutral Conductor and Neutral Point. These new definitions will clarify what a neutral is and is not. For example, while the white wire to a traffic signal head, supplied from a 120/240 volt service, under the 2005 NEC was a grounded conductor, but not a neutral; the 2008 NEC considers this conductor a neutral, even though it does not carry neutral current.

Surge Protective Device (SPD). SPD is a term that is used in place of Transient Voltage Surge Suppressor. This new term

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Continued from page 36 correlates between the NEC and UL Standard 1449. The text lists the four types of SPDs.

Comment: Specifications and drawings will need to be updated to show the correct type of SPD.

Article 110 - Requirements for Electrical Installations

110.16 Flash Protection. The requirement for flash protection marking has been expanded to nearly all electrical equipment, by adding the words Electrical equipment, such as…

110.20 Enclosure Types. The requirements for enclosures, such as NEMA 3R, 4, X, were relocated from Article 430 to 110.

Comment: Having the enclosure types in Article 110 will allow application to the entire NEC, not just Article 430 for motor controller enclosures. This requirement indicates that these products have to be tested and evaluated for use. Note that some products, such as indoor or outdoor, don’t have NEMA ratings.

210.5 Identification of Branch Circuits.

(C) Ungrounded Conductors. The requirement to identify conductors of different nominal voltage systems has been

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greatly expanded. Each conductor must be identified at termination, connection, and splice points. The identification means can now be by documentation that is readily available.

Comment: A typical application would be a roadway lighting system with 120/240 volt single phase and 277/480 volt three phase systems. Each system would have a different means of identification, such as color, and the means used would be documented or be posted.

210.7 Branch-Circuit Requirements for Device Connections and Locations (B) Other Than Dwelling Units

GFCI protection is now required for all Outdoor locations.

210.12 Arc-Fault Circuit Interrupter Protection (AFCI)

The requirement for dwelling unit AFCIs has been expanded to all family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreational rooms, closets, hallways or similar rooms or areas.

Comment: While not a traffic signal or roadway lighting NEC change, this section has significantly expanded the requirement for AFCIs and is very controversial. Note that an AFCI could have application for roadway lighting circuits, to clear an arcing fault on a pole knockdown or similar.

Article 225 - Outside Branch Circuits and Feeders

225.39 Rating of Disconnect. When a single main disconnect is not used, and not more than six disconnects are used, combining the ratings of each switch or circuit breaker can be used to determine rating of the disconnecting means.

Article 230 - Services

230.82 Equipment Connected to the Supply Side of Service Disconnect

(3) New text requires a meter disconnect switch to be able to interrupt the load served.

Comment: In some locations, an electrical utility will require a disconnect switch ahead of the meter (zero-sequence metering), to allow meter maintenance to be done with the power off. If an non-fused disconnect is used, this section requires it to be capable of interrupting fault current. Most non-fused disconnects are rated at 10,000 amperes interrupting current. The available short circuit current is available from the electrical utility.

Figure 2 Nominal Voltage Sign

Figure 3 picture of meter disconnect switch

Article 240 – Overcurrent Protection

240.4 Protection of Conductors.

(D) Small Conductors. Ampacity ratings for 18 AWG (7 amperes) and 16 AWG (10 amperes) copper conductors have been added.

Article 250 - Grounding and Bonding

250.8 Connection of Grounding and Bonding Conductors.

(A) Permitted Methods. Revised text allows machine-screw fasteners that engage at least two threads, or secured with a nut, or thread forming machine screws that engage not less than two threads in the enclosure to be used to connect grounding and bonding conductors.

Comment: This rule was changed from what was prohibited (a sheet metal screw), to what is required (specific type of fastener). For a 10-32 fastener to engage two threads, the minimum enclosure thickness would be 1/16", or 14 gage

Figure 4 drywall screw

250.20 Alternating-Current Systems to Be Grounded.

(D) Separately Derived Systems. New language specifies that when an on-site generator is used with a transfer switch that switches the neutral, grounding of the generator is required. A new FPN gives information on when a generator is not required to be grounded.

250.32 Buildings or Structures Supplied by a Feeder or Branch Circuits.

This section has several changes, all related to the new requirement that the grounded neutral conductor is not allowed to be used in place of the EGC, or in common terms “regrounding of the neutral”, is not allowed. There is an exception for existing wiring systems.

Comment: The effect of this rule is that an EGC is required for every building or structure supplied by a feeder or branch circuit. When the neutral is regrounded, neutral current is present on metal enclosures and raceways, fires and electrical shock could occur. Metal raceways are not intended to carry neutral current continuously.

250.35 Permanently Installed Generator. The rules in this new section are for generators that are not separately derived, or do not transfer the neutral. The rules include requirements for sizing the equipment grounding conductor and equipment bonding jumpers.

Comment: There is considerable confusion when a generator requires ground rods and when a system bonding jumper is required. The system bonding jumper connects the generator equipment grounding conductor to the generator neutral and provides the fault current return path. Failure to install the system bonding jumper means a line to case fault won’t clear.

• A generator used with a transfer switch that switches the neutral, or a generator used to supply temporary loads such as carnivals and events are separately derived – ground rods and a system bonding jumper are required.

• For a generator used with a transfer switch that does not switch the neutral, no ground rods are required, and a system bonding jumper must not be installed. A system bonding jumper in this application results in a parallel path for neutral current and dangerous neutral current will be present on all metallic raceways and enclosures.

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250.52 Grounding Electrodes
(A) Electrodes Permitted for Grounding
(2) Metal Frame of a Building or Structure

(3) Concrete-Encased Electrodes. New language allows the reinforcing steel located vertically within a concrete foundation to be used as the grounding electrode. New language also specifies that where there are multiple concrete encased electrodes present, only one is required to be used.

Comment: The concrete-encased electrode, or “Ufer” ground, was first introduced into the 1968 NEC. A change came in 1978 requiring the concrete-encased electrode to be used if available on the premises. However, it was not required to be used if a water pipe or “other available electrode” were used. The NPFA stated in a formal interpretation that “if available” did not require a concrete encased electrode to be used.

The 2005 NEC required the concrete encased electrode to be used when present. This is the first of what can be expected in future codes to refine the requirements for a concrete-encased electrode. The picture shows a concrete slab that has no reinforcing steel, 20 ft of 4 AWG bare copper creates a concrete encased electrode. This could be done for a traffic signal installation, and ground rods are not required (Around the outside are plastic pipes for fence posts).

Figure 5 Concrete slab with 4 AWG ufer ground.

250.94 Bonding for Other Systems. New language requires an intersystem bonding termination at each service. It can be:
(1) Terminals mounted to the meter enclosure
(2) A bonding bar near the service equipment enclosure
(3) A bonding bar near the grounding electrode conductor

Comment: Utilities may not allow modifications to the meter enclosure. The intersystem bonding termination is very important to create a single point ground for all systems.

250.119 Identification of the Equipment Grounding Conductor. A new exception allows the green conductor for power limited circuits (such as thermostat) to be used for other than equipment grounding.

Comment: The use of the green conductor in IMSA 19-1

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Comment: The interior of luminaire poles is considered to be a raceway, see 410.30(B).

300.12 Mechanical Continuity - Raceways and Cables. Exception No. 1: A new exception allows stubbing into open bottom equipment, and now recognizes this common traffic signal cabinet wiring method. The basic rule is that conduits have to be mechanically secured to enclosures.

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314. 30 Handhole Enclosures. New text requires handhole enclosures to be “identified” for use in underground applications.

Comment: The Article 100 Definition of Identified is Identified (as applied to equipment), Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular Code requirement. A FPN explains that Identified equipment can be determined by listing and labeling by a qualified testing laboratory, an inspection agency, or product evaluation organizations.

The title of Section (C) was changed from Handhole Enclosures Without Bottoms to Enclosed Wiring, to clarify that the conductors and splices in any type of handhole, including those with bottoms, are required to be suitable for wet locations.

**Article 342 Intermediate Metal Conduit:** Type IMC

**Article 344 Rigid Metallic Conduit:** Type RMC

342.30 and 344.30 Securing and Supporting

**C** Unsupported Raceways. New rule specifies that supporting IMC and RMC in unbroken lengths not more than 18” is not required between boxes, enclosures or similar. The rule requires support on shorter than 18” lengths where reducing washers are used.

Comment: Many electricians felt that lengths of IMC and RMC under 36” did not require support. The previous language of the NEC was not clear.

**Article 352 - Rigid Polyvinyl Chloride Conduit:** Type PVC

The title of this article was changed from Rigid Non-Metallic Conduit to Rigid Polyvinyl Chloride Conduit.

Comment: The 2005 NEC added a new article for HDPE, even though HDPE was included in the scope of the article 352 - Rigid Non-Metallic Conduit. This left reinforced Thermosetting Resin Conduit (RTRC) in Article 352 with PVC Conduit. The 2008 NEC creates a new article for RTRC, and now the scope of Article 352 is for type PVC conduit only.

(F) Exposed. New text requires PVC conduit exposed to physical damage to be identified for the use.

Comment: A FPN states that PVC conduit, schedule 80, is identified for areas with physical damage. This information has been in the UL Guide Information for Electrical Equipment (White Book), in the category DZYR: Schedule 40 conduit is also suitable for underground use indoors or outdoors exposed to sunlight and weather where not subject to physical damage. The marking “Schedule 80 PVC” identifies conduit suitable for use where exposed to physical damage and for installation on poles in accordance with the NEC.

**Article 355 - Reinforced Thermosetting Resin Conduit:** Type RTRC

This new article covers the use, installation, and construction of type RTRC conduit, commonly known as fiberglass conduit.

**Article 406 – Receptacles, Cord Connectors, and Attachment Plugs (Caps)**

406.9 Receptacles in Damp or Wet Locations. New text requires that all 15 and 20 ampere, 125 and 250 volt, non-locking receptacles must be a listed weather-resistant type.

Comment: Proposals for this section documented deterioration due to exposure to moisture, UV radiation, and temperature extremes.

**Article 408 - Switchboards and Panelboards**

408.4 Circuit Directory or Circuit Identification. Two additional requirements were added for panelboard directories:

- Spare positions that have unused overcurrent devices have to be identified.
- Panelboard directories can not be described in a way that depends on transient conditions of occupancy.

Comment: An example of transient condition of occupancy would be “Street Lighting-East Business Park”, as the name of the business park could change.

408.54 Maximum Number of Overcurrent Devices.

The limit on a maximum of 42 overcurrent devices has been removed.

Comment: The requirement for a limit of 42 overcurrent devices was based on a fire in the 1920s, due to the flammable rubber-insulated conductors in a panelboard.

**Article 410 – Luminaires, Lampholders and Lamps**

410.6 Listing Required. All luminaires and lampholders are required to be listed.

Comment: All remaining references to lighting fixtures or fixtures have been deleted from Article 408.

410.30 Supports

(B) Metal or Nonmetallic Poles Support-
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ing Luminaires. Luminaire pole handholes are required too suitable for wet locations.

Comment: The previous language was raintight. The definition of a wet location is in unprotected locations exposed to the weather, and Raintight is Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions. A luminaire pole is considered to be a raceway per [410.30(B)], and due to the change in section 300.9 that states the interior of a raceway is a wet location, it may be a requirement to use wet location listed splices and wire connectors in luminaire poles.

Figure 8 Raintight Handhole Cover
Figure 9 Wet Location Handhole Cover
Figure 10 wet location splices

Article 590 - Temporary Installations
590.6 Ground-Fault Protection for Personnel. A new requirement was added for GFCI protection for on-site generated power source (portable generators) used for construction, remodeling, maintenance, repair of demolition.

Comment: Generator manufactures may include integral GFCI protection for portable generator receptacles. A GFCI device will trip if the generator is connected to an electrical system where the neutral is not transferred, with either a manual or automatic transfer switch. The GFCI trips due to the imbalanced current from the neutral being bonded at the service main bonding jumper.

IMSA Member Tom Baker is a Master Electrician, and is certified in IMSA Level II Traffic Signal and Roadway Lighting Level I. His business, Puget Sound Electrical Training, provides classes on the NEC, Grounding and Bonding, and other electrical subjects. He is the IMSA representative to the Illumination Engineering Society. Contact him via email by visiting www.psetraining.com.

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