Revisions for the 2023 National Electrical Code – Part 2

An Online Continuing Education Course for Engineers

Course Number: E-3109

Credit: 3 Hours / 3 PDH / 3 CPD

Revisions for the 2023 National Electrical Code – Part 2

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Introduction

This course is intended to familiarize the reader with the major changes contained in the 2023 National Electrical Code®. These are the "need to know" changes. The document is heavily illustrated to enable effective and efficient visual learning. The course addresses Code revisions that apply to all types of occupancies: residential, commercial, and industrial.

The course series is divided into 3 parts. This course covers Part 2.

- Part 1: Code-wide changes through Article 240 (4 PDHs)
- **Part 2: Article 250 through part of Article 500 (3 PDHs)**
- Part 3: Article 500 (cont.) through Annex E (3 PDHs)

The layout and the method of this presentation will enable new Code users to easily navigate through the changes. Those well experienced in the Code will find depth in the coverage. Through the heading(s) at the beginning of each Code change addressed in the document, the reader will readily identify the section affected by the change and the specific subject being discussed. The Significance section sets the stage. An Analysis of the Code change follows, with explanation where necessary to help the student understand the revision, its background, and the logic of the change. Graphics, photographs, examples, or calculations are used to illustrate the change and to enhance learning. The Summary is a brief re-statement of the highlights of the Code change. An Application Question with answer is included at the end of some Code sections studied for exercise in applying the change. Some of the sections analyzed contain a Code Refresher that addresses existing Code requirements related to the change. General Code information and rules are weaved into the writing throughout the document. The author's writing method attempts to provide general Code study and a Code refresher through discussion of the Code changes. NFPA 70E®, *Electrical Safety in the Workplace*, is briefly discussed and referenced several times within the course.

Although there are many references to the 2023 NEC® throughout this document, the course and quiz can be completed without the need to refer to the NEC® itself. However, the learning experience will be enhanced by referring to the NEC® as the course is completed. For further study on any Code section within this course, the full text of the 2023 NEC® should be consulted.

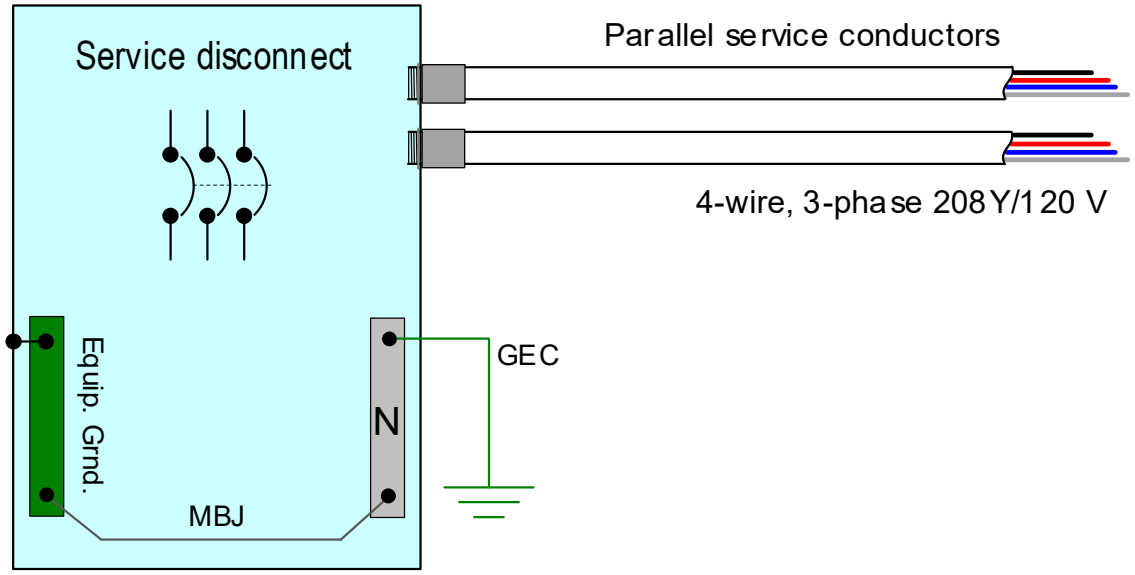
You can read the 2023 NEC® online at the following site, courtesy of NFPA:

https://www.nfpa.org/NEC/electrical-codes-and-standards/NFPA-70?code=70

Grounding of Service-Supplied Alternating-Current Systems – Grounded Conductor Brought to Service Equipment – Conductors Connected in Parallel in Two or More Raceways or Cables

Significance

Installing service conductors in parallel is a common practice. The many rules for paralleling conductors are sometimes misunderstood. This revision seeks to clarify requirements concerning *grounded* parallel service conductors. There are no technical changes.



Analysis: Where ungrounded (hot) service-entrance conductors are installed/connected in parallel in multiple raceways or cables, the grounded conductor also shall be installed in each raceway or cable and shall be connected in parallel. The diagram above illustrates the condition described in 250.24(D)(2)(a). Subsection 250.24(D)(2)(b) describes a situation where two sets (or more) of parallel conductors are installed in each raceway. For the parallel conductors in the diagram above, the size of the grounded conductor installed in each raceway shall be based on the largest ungrounded conductor in the raceway. Use Table 250.102(C)(1) to size the grounded conductor in each raceway. Section 310.10(G) specifies a minimum size of 1/0 for conductors connected in parallel and contains other important rules for parallel conductors.

Summary: Where ungrounded service conductors are installed/connected in parallel in multiple raceways or cables, the grounded conductor shall also be installed in each raceway or cable and shall be connected in parallel. The size of the grounded conductor installed in each raceway shall be determined from Table 250.102(C)(1), based on the largest ungrounded conductor in the raceway.

Types of Equipment Grounding Conductors – Permitted

Significance

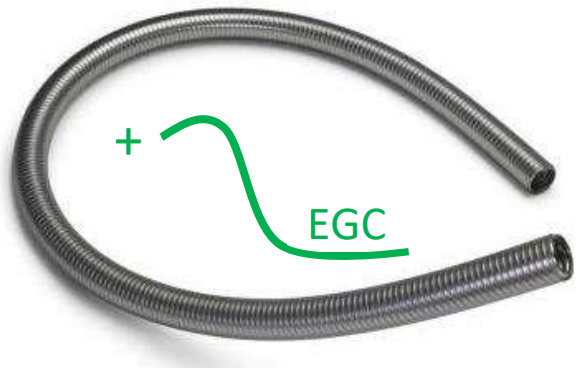
This change adds stainless steel flexible metal conduit and stainless steel liquidtight flexible metal conduit to the list of permitted types of equipment grounding conductors, with conditions.

Analysis

The cores of stainless steel flexible metal conduit and stainless steel liquidtight flexible metal conduit have higher resistivity than the metallic cores of other flexible conduits permitted in the *NEC* for equipment grounding purposes. However, stainless steel has excellent corrosion resistance and other beneficial properties. To enable its use for wiring protection, the 2023 Code requires an internal equipment grounding conductor, or an external bonding jumper, to keep the fault-current path at a low resistance.

Courtesy of Calbrite

Stainless steel flexible metal conduit



Courtesy of Robroy Stainless

Stainless steel liquidtight flexible metal conduit

Where flexible conduits are permitted for equipment grounding, several conditions must be met:

a. The flexible conduit must be terminated in listed fittings.
b. The size of the flexible conduit is limited.
c. The size of the overcurrent protective device is limited.
d. The ground-fault current path created by the flexible conduit cannot exceed 6 ft.
e. Where flexibility is necessary to reduce transmission of vibrations, or for movement of equipment after installation, a wire-type equipment grounding conductor (EGC) or bonding jumper is required.

If the flexible metal conduit or liquidtight flexible metal conduit has a stainless steel core, it must contain an internal equipment grounding conductor, or an external bonding jumper.

Summary: Where stainless steel flexible metal conduit and stainless steel liquidtight flexible metal conduit is used as permitted in the *NEC*, it must contain an internal equipment grounding conductor, or an external bonding jumper, to keep the resistance of the fault-current path low.

Frames of Ranges and Clothes Dryers – Grounded Conductor Connections

Significance

This change involves a new permission that will allow an existing SEU range or dryer cable with an uninsulated neutral to remain when modifications occur, and the service panel becomes a subpanel. A *subpanel* is a term used in the trade for any panel that is downstream from the service panel.

Analysis

For new circuits, the frames of ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and metal outlet or junction boxes that are part of the supply circuit, are not permitted to be grounded to the neutral conductor. For existing branch circuits, the neutral is permitted to ground the appliance frames and metal boxes in the circuit, provided certain conditions are met. One of the conditions is that the neutral is insulated, or uninsulated and part of an SE cable "that originates in the service panel."

There are instances when a service panel becomes a subpanel. This can occur when an emergency outside disconnects or generator transfer equipment that qualifies as the service equipment is installed ahead of an existing service. In this case, the new provision in 250.140(B)(5) permits an uninsulated neutral conductor of an SE cable to be field "covered" (see def.) within the supply enclosure with listed "insulating material," such as tape or sleeving. This will prevent the neutral from making electrical contact with non–current-carrying metal parts within the enclosure. The insulation will maintain neutral and equipment grounding isolation required downstream from a service panel.

Be sure to use a quality listed product. If using vinyl tape, 3M Scotch 33+ and 88 have excellent properties for up to 600-volt applications.

Existing range or clothes dryer supply cable

Electrical tape over bare neutral conductor

Extruded PVC insulating sleeve

Summary

In instances where a service panel becomes a subpanel, existing branch circuits supplying ranges or clothes dryers with SE cable that has an uninsulated neutral are not required to be replaced. The uninsulated neutral conductor is permitted to be field covered within the supply enclosure with listed insulating material, such as tape or sleeving.

210.8(A)(7)
Ground-Fault Circuit-Interrupter Protection for Personnel – Dwelling Units – Areas with sinks…

Subsection 210.8(A) requires GFCI protection for 125-volt through 250-volt receptacles installed in specific locations in dwellings and supplied by single-phase branch circuits rated 150 volts or less to ground.

Subsection 210.8(A)(7) requires GFCI protection for [illegible]acles install[illegible]

"Areas with sinks and permanent [illegible]ion, or cooking."

Revised 210.8(A[illegible]) requires GFCI protection for [illegible]e intended to serve kitchen co[illegible]ops. Subsection [illegible]ot for subsection numbering), requ[illegible]) requires GFCI protection for rec[illegible]where the sink is associated with [illegible]

The "sinks" in both [illegible]dries, since kitchens and laundr[illegible]

220.70

Part III. Feeder and S[illegible]

This is a new section r[illegible]book.

If an energy manageme[illegible]ce with 750.30, a single value e[illegible] be used in load calculations for a[illegible]load.