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## ELECTRICAL CONTINUING EDUCATION

# Connecticut

### 2024 RENEWAL YEAR CONFERENCE WORKBOOK

Licenses E1, E2, E4, E5, E9

### 2020 NEC Chapters 2-3 Connecticut General Statues & Regulations | 2020 Connecticut State Building Code | Safety | Calculations

Continuing Education for Connecticut Electricians for the Renewal of License

Public Act 02-142, pursuant to Section 20-334d of the Connecticut General Statutes, requires that all types of Electrical license holders have to obtain four (4) hours of continuing education of instruction to renew their respective license in the year 2023.

The reader is expressly warned to consider and adopt all safety precautions that might be indicated by the activities herein to avoid all potential hazards. By following the instructions contained herein, the reader willingly assumes all risks in connection with such instructions. The provider or instructor makes no representation or warranties of any kind, including but not limited to, the warranties of fitness for particularly purpose of merchantability nor are any such representations implied with respect to the material set forth herein, and the provider or instructor takes no responsibility with respect to such material. The provider or instructor shall not be liable for any special, consequential, or exemplary damages resulting in whole or part, from the readers' use of, or reliance upon, this material.

**Sec. 20-332b. Hiring ratios re apprentices, journeymen and contractors. Electrical, plumbing, heating, piping and cooling, sprinkler fitter and sheet metal work. Regulations.** The Commissioner of Consumer Protection shall amend existing regulations of Connecticut state agencies adopted pursuant to section 20-332 to specify the following allowable hiring ratios regarding apprentices, journeymen and contractors for the following trades:

TRADE

Electrical, Plumbing, Heating, Piping and Cooling,  
Sprinkler Fitter and Sheet Metal Work

Apprentices	Licensees (Journeymen or Contractors)
1	1
2	2
3	3
4	6
5	9
6	12
7	15
8	18
9	21
10	24

Ratio continues at 3 Journeypersons  
To 1 Apprentice

**Sec. 20-332c. Apprentice, journeymen and contractor working group established. Membership. Report.** (a) There is established a working group to discuss hiring ratios for apprentices, journeymen and contractors and study the hiring ratio relief process. The working group shall meet at least three times annually and shall study and make recommendations related to apprentices, journeymen and contractors.

- The working group shall consist of ten members, and shall be evenly divided between members of the following union and nonunion industry trade groups: The International Brotherhood of Electrical Workers, the Independent Electrical Contractors of New England, the Associated Builders and Contractors of Connecticut, Sheet Metal Local 40, Sprinkler Fitters Local 669, the Connecticut Chapter of American Fire Sprinkler Association, the United Association of Plumbers and Pipefitters Local 777, the Plumbing Heating and Cooling Contractors of Connecticut, the Connecticut Heating and Cooling Contractors and the

Connecticut State Building and Construction Trades Council. Each union industry trade group member shall be either the business manager of such group or such business manager's designee from such group. Each nonunion industry trade group member shall be either the president of such group or such president's designee from such group.

- Such members shall be selected as follows:

(1) Two union members appointed by the speaker of the House of Representatives;

(2) Two union members appointed by the president pro tempore of the Senate;

(3) One nonunion member appointed by the majority leader of the House of Representatives;

- One union member appointed by the majority leader of the Senate;
- Two nonunion members appointed by the minority leader of the House of Representatives; and
- Two nonunion members appointed by the minority leader of the Senate.

(d) All appointing authorities shall consult with the chairpersons and ranking members of the joint standing committee of the General Assembly having cognizance of matters relating to the Department of Consumer Protection prior to making any appointments pursuant to this section.

(e) All appointments to the working group shall be made not later than thirty days after the effective date of this section. Any vacancy shall be filled by the appointing authority.

(f) The members of the working group shall select the chairpersons of the working group from among the members of the group. One chairperson shall be a union member and one chairperson shall be a nonunion member. Such chairpersons shall schedule the first meeting of the working group.

(g) The administrative staff of the joint standing committee of the General Assembly having cognizance of matters relating to the Department of Consumer Protection shall serve as administrative staff of the working group.

(h) Not later than December 1, 2017, and annually thereafter, the working group shall submit a report on its recommendations to the joint standing committee of the General Assembly having cognizance of matters relating to the Department of Consumer Protection, in accordance with the provisions of section 11-4a.

**2022 Connecticut State Building Code:** *(Include in all course handouts to attendees for their future use and review with class.)*

Building and Fire Code Adoption Process

State Building, Fire Safety and Fire Prevention Codes Update

The [Department of Administrative Services](#), [Office of the State Building Inspector](#) and [Office of the State Fire Marshal](#), in conjunction with the [Codes & Standards Committee](#) and the [Fire Prevention Code Advisory Committee](#), intend to adopt the following new codes, effective October 1, 2022:

- 2022 Connecticut State Building Code (CSBC)
- 2022 Connecticut State Fire Safety Code (CSFSC)
- 2022 Connecticut State Fire Prevention Code (CSFPC)

In accordance with the requirements of sections [29-252b](#), [29-292a](#) and [29-291e](#) of the Connecticut General Statutes, the agency accepted comments from the public for a period of forty-five (45) days, beginning January 31, 2022 through the close of business March 17, 2022.

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The comments received are now being considered for incorporation into the draft codes ahead of their submission of legislative review.

Draft 2022 State Codes

- The public comment drafts of the three proposed codes are available under [Documents/Forms](#)
- The legislative approval drafts of the three proposed codes are being prepared.

Proposed Model Codes:

The following codes are proposed to be adopted into the next state codes:

- 2021 International Building Code (IBC) by the ICC
- 2021 International Existing Building Code (IEBC) by the ICC
- 2021 International Energy Conservation Code (IECC) by the ICC
- 2021 International Mechanical Code (IMC) by the ICC
- 2021 International Plumbing Code (IPC) by the ICC
- 2021 International Residential Code (IRC) by the ICC
- 2021 International Swimming Pool & Spa Code (ISPSC) by the ICC
- 2020 NFPA 70 National Electrical Code (NEC) by NFPA
- 2017 ICC A117.1 Accessible and Usable Buildings and Facilities by the ICC
- 2021 International Fire Code (IFC) by the ICC
- 2021 NFPA 101 - Life Safety Code by the NFPA
- 2021 NFPA 1 - Fire Code by the NFPA

The model codes are viewable on their publisher's web sites:

- [International Code Council \(ICC\) Codes](#)
- [National Fire Protection Association \(NFPA\) Codes](#)

**NOTE: Always refer to the State Building Officials website indicated above for all of the most currently adopted codes and “AMENDMENTS” to the codes.**

**PART II – Safety  
(1/2 Hour To Review With Class And Inform Attendees Material in Handout) (Please review with the class the top 10 OSHA Violations for 2021)**

OSHA Standard	FY 2021 Preliminary Data	Previous Year's Data
<p><b>1. Fall Protection – General Requirements (1926.501)</b>  <a href="#">OSHA Fall Protection Defense Guide</a>  <a href="#">Construction Fall Protection Standards</a></p>	5,271 Violations	No. 1 with 5,424 Violations
<p><b>2. Respiratory Protection (1910.134)</b>  <a href="#">Selecting and Using Particulate Respirators</a>  <a href="#">Starting a Respiratory Protection Program</a></p>	2,521 Violations	No. 3 with 2,649 Violations
<p><b>3. Ladders (1926.1053)</b>  <a href="#">Are Your Ladders Compliant?</a>  <a href="#">Ladder Safety Tips</a></p>	2,018 Violations	No. 5 with 2,129 Violations
<p><b>4. Scaffolding (1926.451)</b>  <a href="#">OSHA Scaffolding Requirements for Construction and General Industry</a></p>	1,943 Violations	No. 4 with 2,538 Violations
<p><b>5. Hazard Communication (1910.1200)</b>  <a href="#">OSHA’s Revised Hazard Communication Standard</a></p>	1,939 Violations	No. 2 with 3,199 Violations
<p><b>6. Lockout/Tagout (1910.147)</b>  <a href="#">When Does the Lockout/Tagout Standard Apply?</a></p>	1,670 Violations	No. 6 with 2,065 Violations

<b>7. Fall Protection – Training Requirements (<a href="#">1926.503</a>)</b>	1,660 Violations	No. 8 with 1,621 Violations
<b><u><a href="#">ANSI/ASSP Z359: Fall Protection Standards System</a></u></b>		
<b>8. Personal Protective and Life Saving Equipment – Eye and Face Protection (<a href="#">1926.102</a>) <u>PPE Requirements: Eye and Face Protection</u></b>	<b>1,451 Violations</b>	<b>No. 9 with 1,369 Violations</b>
<b>9. Powered Industrial Trucks (<a href="#">1910.178</a>) <u>Forklift Safety Training Guide</u></b>	<b>1,404 Violations</b>	<b>No. 7 with 1,932 Violations</b>
<b>10. Machine Guarding (<a href="#">1910.212</a>) <u>OSHA Requirements: Machine Guarding</u></b>	<b>1,105 Violations</b>	<b>No. 10 with 1,313 Violations</b>

*The information contained in this article is intended for general information purposes only and is based on information available as of the initial date of publication. No representation is made that the information or references are complete or remain current. This article is not a substitute for review of current applicable government regulations, industry standards, or other standards specific to your business and/or activities and should not be construed as legal advice or opinion. Readers with specific questions should refer to the applicable standards or consult with an attorney.*

## 2020 NEC Chapters 2-3

### Code-Wide Changes

- There were a total of 3730 Public Inputs (PI) and 1930 Public Comments (PC) submitted from interested participants seeking changes to the 2020 *NEC*
- Available Fault Current References. Different terms like “available short-circuit current” and “short-circuit current” were previously used to describe large amounts of current capable of being delivered at a point on the system during a short-circuit condition. For the 2020 *NEC*, these large amounts of current descriptions were changed to “available fault current” throughout the *Code* for improved consistency
- Reconditioned Equipment, Yes or No ? Each Code Making Panel (CMP) was asked to review the equipment they have purview over and determine what equipment could be reconditioned and what equipment could not be reconditioned but rather replaced when necessary

**Definition Statements.** Two distinct statements added at XXX.2 sections of the Code

“The definitions in this section shall apply only within this article.”

“The definitions in this section shall apply within this article and throughout the Code.”

GFCI Requirements Alignment with 210.8. Changes were proposed throughout the Code to align all GFCI requirements with the GFCI requirements of 210.8

“Allowable” Ampacity. Several locations across the NEC where the term “allowable ampacity” was used and should have been simply stated as “ampacity” as it is the intent for those sections to determine the ampacity of a conductor based upon its conditions of use

Grounding Conductor Changed to Equipment Grounding Conductor. The term “grounding conductor” (not a defined term) was replaced with mainly the proper term “equipment grounding conductor,” but in some instances with the terms “grounding electrode conductor” or one of the several types of “bonding jumpers”

### Article 90

#### Introduction

- Revision clarifies that the *NEC* covers installations supplying shore power to ships and watercraft, including monitoring of leakage current
- 90.2(B)(1) reveals that installations in ships and watercraft (*other than floating buildings*) are not covered by the *NEC*
  - This does not include electrical supply system supplying shore power to ships and watercraft
- Change intended for ships, boats, and other watercraft covered by Article 555
- New provision was necessary to address potential hazards created where shore power is supplied to ships and watercraft with a significant number of fatalities from electric shock drowning (ESD) associated with leakage of current from watercraft connected to shore power

A new (6) has been added to 90.2(A) to address installations used to export power from electric vehicles to premises wiring

Bidirectional flow of power is typically accomplished using utility interactive inverters

## Chapter Two Wiring and Protection

### **200.3 Connection to Grounded**

System Grounded conductors of premises wiring systems are required to be electrically connected to the supply system grounded conductor

#### **210.8(A) GFCI Protection for Personnel Dwelling**

- unit GFCI protection has been expanded to all 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground installed in the specified areas of 210.8(A)
  - *Previously was all 125-volt, single-phase, 15- and 20-ampere receptacles installed in (10) specific locations (bathrooms, kitchens, laundry areas, etc.)*

#### **210.8(A)(5) GFCI in Dwelling Unit Basements**

- GFCI protection now required for ALL dwelling unit basements (*not just unfinished portions of basements*)
- GFCI now required for all 125-volt through 250-volt receptacles in both an unfinished basement and a finished basement intended as a habitable space

#### **210.8(A)(11) GFCI for Indoor Damp and Wet Locations**

- GFCI protection is now required at indoor damp and wet locations of dwelling units
- Covers areas considered a damp or wet location not within 1.8 m (6 ft) of a sink, bathtub, or shower area
- Change will require GFCI protection for all 125-volt through 250-volt receptacles supplied by a single-phase branch circuit rated 150 volts or less to ground installed in indoor damp or wet locations regardless of the room or areas of the dwelling unit

#### **210.8(B) Other Than Dwelling Units**

- New GFCI requirements at non-dwelling unit locations were added for:
  - Damp locations
  - Accessory buildings
  - Laundry areas
  - Areas around bathtubs and shower stalls

#### **210.8(B)(6): Indoor “damp” location**

- was added to the existing GFCI requirement for indoor wet non-dwelling unit locations for clarity and consistency as shock hazard in a damp location is similar to a wet location

**210.8(B)(8):** Non-dwelling unit accessory buildings added to existing GFCI provisions for garages, service bays, and similar areas (*other than vehicle exhibition halls and showrooms*) 210.8(B)(8) (cont.): *Accessory buildings can have same degree of shock hazard as garages and vehicle service bays and deserved the same level of GFCI protection*

**210.8(B)(11):** *GFCI protection added for receptacles installed in non-dwelling unit laundry areas*



- *Laundry areas at non-dwelling units are similar to laundry areas of a dwelling unit and deserve the same GFCI protection*

**210.8(B)(12):** *GFCI protection added for receptacles installed within 1.8 m (6 ft) of the outside edge of non-dwelling unit bathtubs or shower stalls*

- *Shower stalls and bathtubs can exist in commercial and industrial locations outside of a locker room or bathroom for a variety of purposes such as decontamination, and safety applications*

**210.8(B)(2) GFCI for Kitchens and More**

- Additional language was added to clarify that areas not defined as a kitchen with a sink and permanent provisions for either food preparation or cooking have the same potential for shock hazards as a kitchen
- This would include areas such as:
  - Ice cream parlors
  - Coffee shops
  - Smoothie stores
- These areas typically have stainless steel countertop and/or stainless-steel appliances but no “permanent provisions for cooking”

**210.8(D) GFCI Protection for Specific Appliances**

- New List Item (D) correlates the requirements found in 422.5(B) (*Type of GFCI protection for appliances*) and refers to the list of GFCI requirements for appliances in 422.5(A)
- Provides continued consistency as the list of appliances requiring GFCI protection is modified in future *Code* editions

**210.8(E) GFCI for Equipment Requiring Servicing**

- GFCI protection now required for all receptacles required by 210.63 for:
  - 210.63(A): HVAC equipment
  - 210.63(B)(1): Indoor service equipment
  - 210.63(B)(2): Indoor equipment requiring dedicated equipment space

**210.63 expanded for this Code cycle**

- These receptacles can be located up to 7.5 m (25 ft) away from equipment, use of extension cord is not uncommon (*increasing the likelihood of a shock hazard*)

**210.8(F) GFCI for Outdoor Outlets**

- GFCI protection is now required on dwelling unit outdoor outlets supplied by single-phase branch circuit rated 150 volts or less to ground, and 50 amperes or less

**210.11(C)(3) Bathroom Branch Circuit(s)**

- Additional text added clarifies that only bathroom receptacles required to be supplied by 20-ampere rated bathroom receptacle outlet branch circuits are receptacle outlet(s) required by 210.52(D) and any other receptacles installed in the bathroom that serve a countertop or work surface
- 210.52(D) requires at least one receptacle outlet installed within 900 mm (3 ft) of the outside edge of each basin in dwelling unit bathroom

#### **210.11(C)(4) Garage Branch Circuit(s)**

- Garage receptacle outlet 120-volt, 20-ampere branch circuits are only required for the receptacles required by 210.52(G)(1) for attached garages and in detached garages with electric power
- Section 210.52(G)(1) requires at least one receptacle outlet to be installed in each vehicle bay of an attached garage and in each detached garage with electric power, with these required receptacle outlet(s) located not more than 1.7 m (5½ ft) above the floor

#### **210.12(C) AFCI for Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities**

- AFCI protection has been expanded to patient sleeping rooms in nursing homes and limited-care facilities

#### **210.12(D) AFCI for Extensions or Modifications at Guest Rooms and Guest Suites**

- Guest rooms and guest suites of hotels and motels have been added to the areas requiring AFCI protection for extensions and modifications of existing occupancies
- AFCI protection is now required at dwelling units, dormitory units, and guest rooms and guest suites of hotels and motels where branch-circuit wiring is modified, replaced, or extended

#### **210.15 Reconditioned Equipment**

- New section added prohibiting GFCI devices, AFCI devices, and ground-fault protection equipment from being reconditioned
- Several new sections were added throughout the *Code* with permission for or against equipment being reconditioned

#### **210.52(C) Receptacles at Countertops and Work Surfaces**

- Revision clarifies that the receptacle outlets installed for countertop or work surfaces [210.52(C)] are not permitted to satisfy the requirement for receptacle outlet placement (*wall spacing*) as provided in 210.52(A)

#### **210.52(C)(2) Receptacles at Island and Peninsular Countertops**

- For island and peninsular countertop and work surfaces, the horizontal measurement was replaced with a square foot calculation to determine the number of receptacles required
- Previously, a measurement was required across the countertop with at least one receptacle required to be installed at each island countertop space or peninsular countertop space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater

#### **210.52(E)(3) Receptacles at Balconies, Decks, and Porches**

- The required receptacle outlet for balconies, decks, and porches is also required at decks that are installed in a freestanding manner where connection to the actual dwelling is not made at any point
- At least one 125-volt, 15- or 20-ampere receptacle outlet is required to be installed at every dwelling unit balcony, deck, or porch

#### **210.65 Receptacles for Meeting Rooms**

- Meeting room receptacle outlet rules received revisions and a new home at 210.65 rather than its original location at 210.71
- These revisions also allow a floor receptacle outlet (*as previously required*) or a floor outlet to serve receptacle(s) to accommodate hardwired desk or furniture that could have built-in receptacle outlets

#### **215.9 GFCI Protection for Feeders**

- Revision provides correlation with GFCI protection requirements in 210.8 by removing the existing limitations of a feeder to provide GFCI protection to only 15 and 20-ampere receptacle branch circuits
- Feeders are now permitted to be protected by a ground-fault circuit interrupter (GFCI) installed in a readily accessible location which will also provide the necessary GFCI protection to any branch circuit in lieu of the provisions for such interrupters as specified in 210.8 (*GFCI protection for personnel*) and 590.6(A) (*GFCI protection for personnel for temporary wiring installations*)

#### **215.10, Ex. No. 3 GFP for Feeders**

- New exception added to permit temporary feeders to be used during repair, maintenance or emergencies without GFP of equipment
- Time period permitted for these temporary feeders not to exceed 90 days

#### **220.12 Lighting Load for Specified Non-Dwelling Occupancies**

- Section 220.12 and Table 220.12 has been extensively revised
- General lighting load values for specific occupancies at Table 220.12 have received very minimal revisions since the 1971 edition of the *NEC*

#### **220.14(J) and 220.11 Lighting Loads for Dwelling Units**

- *NEC* calculation of 3.0 watts per square foot for dwelling units was moved from Table 220.12 to 220.14(J) and reference to Table 220.12 was removed from 220.14(J)
- Table 220.12 revised to only addresses non-dwelling unit *occupancies*
- New sentence added to address motors rated less than 1/8 HP and connected to a lighting circuit (*small motor loads will now be included in the general lighting load*)

#### **220.42 General Lighting**

- Demand factors for derating feeder and service conductors in hospitals were deleted

- Now required to include 100% of total VA of the calculated lighting load
- Table 220.42 still applies a demand factor to lighting loads at dwelling units, hotels and motels, and warehouses with all other occupancies required to include 100% of the total volt-amperes (VA) of the lighting load

#### **220.53 Appliance Load - Dwelling Unit(s)**

- All fastened in place household electric cooking equipment (*not just an electric range*) added to the list of appliances that cannot be included in the four or more appliances eligible for 75% derating demand factor

#### **225.30(B) Number of Supplies (Feeders) Common Supply Equipment**

- New text added permitting more than one feeder (*up to six feeders*) under very limited circumstances

#### **230.46 Splices and Tapped Conductors**

- The requirement for marking power distribution blocks used on service conductors required to be marked “suitable for use on the line side of the service equipment” or equivalent was moved from 314.28(E)(1) to 230.46
- All power distribution blocks, pressure connectors, and devices for splices and taps of service conductors must be listed

#### **230.62(C) Barriers**

- Previous provision for barriers at service panelboards, switchboards, and switchgear has been moved to Article 230 to apply to all service equipment
- All service equipment is now required to be provided with barriers to prevent line side inadvertent contact

#### **230.67 Surge Protection**

- New requirement added for surge protection on all services at dwelling units
- The surge protection device (SPD) must be an integral part of the service equipment or located immediately adjacent to the service equipment

#### **230.71 Maximum Number of Disconnects**

- Revision eliminates more than one service disconnecting means in the same panelboard or other enclosure
- Continues to retain the six service disconnect rule for services with the up to six service disconnects required to be installed in separate enclosures only

#### **230.71 Maximum Number of Disconnects**

- Revision eliminates more than one service disconnecting means in the same panelboard or other enclosure

- Continues to retain the six service disconnect rule for services with the up to six service disconnects required to be installed in separate enclosures only

#### **230.85 Emergency Disconnects**

- New requirement added requiring an emergency disconnect at a readily accessible outdoor location for dwelling units
- New outdoor emergency disconnecting requirement primarily based upon providing first responders an outdoor accessible emergency or service disconnecting means during an

#### **240.6(C) Restricted Access Adjustable-Trip Circuit Breakers**

- New provision added to recognize modern electronic trip units provided with a password to keep unauthorized users from changing the settings on a restricted access adjustable-trip circuit breaker(s)
- Adjustable settings on an adjustable-trip circuit breaker needs to be protected from inadvertent settings out of the desired operational settings, such as restricted access to the adjusting means

#### **240.6(C) Restricted Access**

- Adjustable-Trip Circuit Breakers
- New provision added to recognize modern electronic trip units provided with a password to keep unauthorized users from changing the settings on a restricted access adjustable-trip circuit breaker(s)

#### **240.87 Arc Energy Reduction**

- An instantaneous trip setting that is less than the available arcing current is one of seven methods recognized to achieve arc energy reduction
- Revision to 240.87(B)(5) clarifies that temporary adjustment of the instantaneous trip setting to achieve arc energy reduction shall not be permitted

#### **240.88 Reconditioned Equipment**

- New section added dealing with reconditioned equipment to indicate that molded-case circuit breakers shall not be permitted to be reconditioned
- Each Code Making Panel (CMP) was asked to review the equipment they have purview over and determine what equipment could be reconditioned and what equipment could not be reconditioned but rather replaced when necessary

#### **Article 242 Overvoltage Protection (New)**

- New article added to provide the general, installation, and connection requirements for overvoltage protection and overvoltage protective devices for clarity and usability
- Relocates previous Articles 280 (Surge Arresters, Over 1000 Volts) and 285 (Surge-Protective Devices, 1000 Volts or Less) into a new Article 242

#### **250.25 Grounding Systems Permitted to Be Connected on the Supply Side Service Disconnect**

- New section created to cover the requirements for grounding of supply-side disconnects permitted to be connected on the supply-side of a service
- Points user of the Code to 250.24 (*Grounding Service-Supplied Alternating-Current Systems*) for the grounding and bonding requirements for these supply-side disconnects

#### **250.64(A) Aluminum or Copper-Clad Aluminum GECs**

- 250.64(A) formatted into a list format for improved clarity and usability
- Clarifies that terminations for aluminum or copper-clad aluminum grounding electrode conductors (GEC) located in the interior of equipment “listed and identified for the environment” are separated from the earth and can be terminated within 450 mm (18 in.) of the earth

#### **250.64(B)(2) and (B)(3) GEC Installations Exposed to Physical Damage**

- Revision clarifies that Schedule 80 PVC is required when PVC conduit is used for protection from physical damage for a grounding electrode conductor (GEC)
- This is consistent with other sections of the *Code*, such as 230.50(B)(1) where Schedule 80 PVC is an option to provide protection from physical damage for service-entrance conductors

#### **250.68(C)(3) GEC Connections to Rebar-Type Concrete-Encased Electrodes**

- New provisions added to clarify that the rebar system in a footing or foundation is not suitable as the conductor to interconnect other grounding electrodes
- 250.68(C)(3), which gives the permission to use a rebar extension for connection of GECs and bonding jumpers was reformatted into a list format

#### **250.104(A)(1) Bonding of Metal Water Piping Systems**

- Revision clarifies that bonding jumper(s) used to bond metal water piping system(s) together are not required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum
- Bonding jumper(s) used to bond metal water piping together still required to be sized based on Table 250.102(C)(1) but not required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum

#### **250.104(A)(3) Buildings or Structures Supplied by Feeder(s) or Branch Circuit(s)**

- Revision clarifies the sizing requirements for bonding jumper(s) used for bonding metal water piping systems when a building or structure is supplied by a feeder or branch circuit
- Reference changed from Table 250.102(C)(1) to 250.102(D) (*and Table 250.122*) based on the largest overcurrent device supplying circuits the building or structure

#### **250.109 Metal Enclosures**

- New section added indicating metal enclosures can be used to connect bonding jumpers or equipment grounding conductors, or both, together to become a part of an effective ground-fault current path
- Metal covers and metal fittings attached to these metal enclosures are also considered to be connected to the enclosed bonding jumpers or equipment grounding conductors, or both

#### **250.121(B) Restricted Use of Metal Frame of Building or Structure as EGC**

- New sub-section added to prohibit the structural metal frame of a building or structure from being used as an equipment grounding conductor (EGC)
- These prohibitive EGC rules were previously found at 250.134(A) and only applied to electrical equipment secured to and in electrical contact with a metal rack or structure provided for the electrical equipment's support

#### **250.122(B) Adjustment of EGC Sizing**

- Revisions clarify that adjustment and/or correction factors do not require an increase in the size of the equipment grounding conductor (EGC)
- If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) (*temperature adjustment factors*) or 310.15(C) (*number of current-carrying conductors adjustment factors*), wire-type EGCs, if installed, are required to be increased in size proportionately (*same ratio*) to the increase in circular mil area of the ungrounded conductors

#### **250.148 Continuity of EGCs and Attachment in Boxes**

- Revision clarifies that all wire-type equipment grounding conductors (EGC) associated with any spliced circuit conductors must be connected within the box or to the box

#### **250.184(C), Exception – Multigrounded Neutral Systems**

- New exception added to relieve bonding the neutral conductor to a grounding electrode in an uninterrupted conductor exceeding 400 m (1300 ft) if the only purpose for removing the cable jacket is for bonding the neutral conductor to a grounding electrode in a multigrounded neutral system

#### **250.187 Impedance Grounded Neutral Systems**

- Revisions clarify that the conductor from the neutral point of a transformer to the grounding impedance device does not meet the definition of neutral conductor in Article 100 since it is not intended to carry current during normal operation
- The conductor from the neutral point of a transformer in this system to the grounding impedance device is now identified as a grounded conductor

### **Chapter Three Wiring Methods and Materials**

### **300.4(G) Protection Against Physical Damage - Insulated Fittings**

- Previous *Code* text required conductors to be protected by an identified fitting providing a smoothly rounded insulating surface where insulated circuit conductors of 4 AWG or larger enter a raceway in a cabinet, pull box, junction box, or auxiliary gutter
- Title of 300.4(G) was revised to remove the word “Insulated” to cover alternative metal fittings (*such as a metal grounding bushing/locknut*)

### **300.7(A) Raceways Exposed to Different Temperatures - Sealing**

- Where raceways or sleeves are known to be subjected to different temperatures, and where condensation is known to be a problem, required to be sealed with a sealant identified for use with cable insulation, conductor insulation (*rather than filled with an approved material*)
- Previously required the raceway or sleeve to be filled with an “approved material”

### **300.15(F) Boxes, Conduit Bodies, or Fittings - Where Required: Fitting**

- Revisions occurred to make it clear that listed transition fittings and listed interconnector devices are permitted to be installed in concealed locations behind drywall and similar locations
- At each conductor splice point, outlet point, switch point, junction point, etc., a fitting identified for the use is permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting and the fitting is accessible after installation, unless the fitting is listed for concealed installation

### **300.22(D) Wiring in Air-Handling Areas Under Raised Floors (ITE Rooms)**

- Revision occurred to reference 645.5(E) (*Supply Circuits and Interconnecting Cables – Under Raised Floors*) rather than the entire Article 645 for electrical wiring in air-handling areas beneath raised floors for information technology equipment
- Installation must first meet the requirements of 645.4 (*Special Requirements for Information Technology Equipment Rooms*) so that 645.5(E) can permit the different requirements that normally would be required in 300.22(C) for wiring under raised floors

### **300.25 Exit Enclosures (Stair Towers)**

- New section added pertaining to the allowable electrical wiring methods serving electrical equipment in exit enclosures (*stairways*)
- Where an exit enclosure is required to be separated from the building, only electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure

### **300.45 Warning Danger Signs**

- Editorial revisions for signs required to be posted at points of access to conductors for raceway and cable systems of over 1000 volts replacing the word “Warning” with the word “Danger”



- Sign or label required to convey the following wording: DANGER—HIGH VOLTAGE—KEEP OUT

#### **Article 310 Reorganized**

- Article 310 was extensively reorganized to increase the usability of the article
- The ampacity tables in Article 310 will simply be titled as Table 310.16 through Table 310.21
- The scope of Article 310 is limited to not more than 2000 volts
- Requirements and ampacity tables for conductors over 2000 volts have been incorporated into new Article 311
- Copper-clad aluminum conductors must meet the material requirements of Section 310.3(B)

#### **Article 310 Ampacity Tables**

- The ampacity tables will simply be titled as Table 310.16 through Table 310.21 (*Example: Table 310.15(B)(16) will now be simply Table 310.16*)
- New sections were added at 310.16 through 310.21 that now refer to the ampacity tables and contain conditions of use previously found in the table headings

#### **Article 310 Allowable Ampacity for Conductors**

- Revision occurred throughout Article 310 removing the term “allowable” from allowable ampacities for conductors
- “Allowable” removed from Article 310 thirteen times throughout the article

#### **310.10 and Ampacity Tables – Conductor Types Added**

- Type XHHN, XHWN, and XHWN-2 were added to the “Uses Permitted” locations and the ampacity tables based on appropriate temperature ratings
- These three types of conductor insulations were recognized by the 2017 *NEC* at Table 310.104(A) [*now Table 310.4(A)*]

#### **310.12 Single-Phase Dwelling Services and Feeders**

- New dwelling unit service ampacity table from Informative Annex D, Example D7 added at 310.12 [*formerly Table 310.15(B)(7)*]
- Text added indicating Table 310.12 permitted to be used if there are no temperature correction or adjustment factors needed

#### **Article 311 Medium Voltage Cable (New)**

- In order to consolidate the medium voltage requirements previously found in Articles 310 (*Conductors or General Use*) and Article 328 (*Medium Voltage Cable*), and to improve the usability of the *Code*, the requirements are combined into a new Article 311
- New article will cover the use, installation, construction specifications and ampacities for medium voltage conductors and cable (Type MV)

#### **312.8(B) Power Monitoring or Energy Management Equipment**

- The term “Energy Management Equipment” added to equipment permitted within the wiring space of enclosures for switches or overcurrent devices along with power monitoring equipment

#### **314.16(B)(5) EGC Box Fill Calculations**

- Volume allowance for equipment grounding conductors (EGC) and equipment bonding jumpers was revised to add an additional  $\frac{1}{4}$  volume allowance to the existing single volume allowance
- New  $\frac{1}{4}$  volume allowance to be counted in installations with more than four EGCs or equipment bonding conductors

#### **314.27(C) Boxes at Ceiling-Suspended (Paddle) Fan Outlets**

- Revision will now generally require all outlet boxes mounted in a location acceptable for the installation of a ceiling-suspended (paddle) fan in the ceilings of habitable rooms of dwelling units to be listed for the sole support of ceiling-suspended (paddle) fan
- Previously, outlet boxes or outlet box systems were required to be listed for sole support of a ceiling-suspended (paddle) fan where a “spare,” separately switched, ungrounded conductor

#### **320.80(A) Type AC Cable Ampacity – Thermal Insulation**

- Type AC cable is now required to comply with adjustment factors of Table 310.15(C)(1) [*previously T. 310.15(B)(3)(a) (More Than Three-Current-Carrying Conductors)*] when installed without maintaining spacing

#### **330.130 Type MC-HL Cable in Hazardous (Classified) Locations**

- New requirements added for Type MC cable with a designation of “MC-HL” installed in a hazardous (classified) location

#### **334.2 Nonmetallic-Sheathed Cable – Type NMS Deleted**

- All references to Type NMS cable has been deleted from Article 334 as this cable construction is no longer manufactured

#### **334.30 Securing and Supporting of Type NM Cable**

- Revision will clarify how Type NM cable should be measured from the enclosure to the securing method with the cable length between the cable entry and the closest cable support not exceeding 450 mm (18 in.)

#### **Article 337 Type P Cable (New)**

- A new article was added covering the use, installation, and construction specifications for Type P cable
- Based on cable performance and requirements for some land-based operations (drilling rigs), Type P cable was originally proposed to be added to the 2020 *NEC* for hazardous area applications only

#### **338.2 Definitions - Service-Entrance Cables**

- New definition for “Service-Entrance Conductor Assembly” added to differentiate between service-entrance cables and assemblies of single-insulated USE conductors

### **338.100 Construction of Service-Entrance Cables**

- All conductors of a cabled assemblies of multiple single-conductors of a Type USE cable are now required to be insulated
- Type SE or USE cable with an overall covering containing two or more conductors are permitted to have one conductor uninsulated

### **342.10(E) IMC Subject to Severe Physical Damage**

- New sub-section (E) clarifies that intermediate metal conduit (Type IMC) is permitted to be installed where subject to severe physical damage
- “Physical damage” or “severe physical damage” are not defined in the *NEC (determined by AHJ)*

### **342.14 Dissimilar Metals – Type IMC**

- Revision added to make it clear that stainless steel fittings, and enclosures can be used with galvanized steel IMC but galvanized fittings should not be used with stainless steel IMC

### **344.10(A) Galvanized Steel, Stainless Steel, and Red Brass RMC**

- Revision to clarify that red brass RMC is not restricted to just underground or swimming pool applications
- Previous 344.10(A)(2) stating that red brass RMC is permitted to be installed for direct burial and swimming pool applications has been deleted (*not the only application for red brass RMC*)

### **350.10(4) Uses Permitted for Type LFMC**

- Conductors or cables with higher temperature ratings permitted to be used in LFMC as long as the conductors or cables are not operated at a higher temperature than the LFMC temperature rating
- Same change occurred for liquidtight flexible nonmetallic conduit (LFNC) at 356.10(8)

### **370.20 Conductor Size and Termination (Cablebus)**

- Two new informational notes were added to 370.20 related to conductor sizing and terminations for cablebus
- Two new informational notes point to 110.14(C) for conductors operating up to 2000 volts and 110.40 for medium voltage conductors operating above 2000 volts to 35,000 volts

### **374.6 Listing Requirements -(Cellular Metal Floor Raceways)**

- New provision added to require cellular metal floor raceways shall be listed
- Cellular metal floor raceways consist of the hollow spaces in cellular metal floors and associated fittings that serve as enclosures for wires and cables

### **380.12(7) Uses Not Permitted – Multioutlet Assemblies**

- New text added prohibiting a multioutlet assembly from being cord and plug connected

- Multioutlet assemblies intended for permanent connection only with a branch circuits  
*(prohibited from employing a cord and plug connection)*

#### **382.104(C) Flat Conductor EGC for Nonmetallic Extensions**

- Revision replaces “grounding conductor” with appropriate term “equipment grounding conductor” for concealable nonmetallic extensions

#### **392.10 Single Conductor Cables in Cable Trays**

- Revision provides clarity relative to the limitations of single conductor applications in cable tray systems

#### **392.30(B)(4) Cable Ties Used for Securement and Support in Cable Trays**

- New provision added identifying cable ties used to secure and support conductors and cables in a cable tray as an acceptable means of securement when identified for securement and support in a cable tray

#### **392.44 Expansion Splice Plates for Cable Trays**

- New section added for expansion splice plates to address thermal expansion and contraction due to temperature variations for cable trays
- Important that cable tray installations incorporate features which provide adequate compensation for their thermal contraction and expansion

#### **392.46 Bushed Conduit and Tubing at Cable Trays**

- New *Code* language added giving permission for individual conductors or multi-conductor cables to enter enclosures through bushed nonflexible conduits or tubing or opening associated with a flange that is connecting the cable tray system directly to equipment
- Limited to “individual conductors or multiconductor cables with entirely nonmetallic sheaths” as other wiring methods with metallic sheaths such as Type MC cable requires a listed connector to protect the internal conductors from abrasion where the cable is terminated or transitions to another wiring method.

**THE END**

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