2011 National Electrical Code Update Training

Henrico County
Department of Building Construction and Inspections

Before we begin...
- Please turn off anything that rings, dings, sings, clangs, bangs, buzzes or plays the William Tell Overture.
Questions

• Questions are Welcome!! You are probably not the only person with the same question.

• Ask questions when the applicable slide is showing.

• Questions & Answers will be recorded and posted on our web page.

Introduction

• This presentation will highlight the most significant changes in the new code.

• This presentation was prepared by members of the Henrico Electrical Inspection staff.
FOLLOW-UPS
Delinquent permits

- Case inactive for 63 days
  - Follow-up activity automatically generated
  - Inspector call or site visit
  - Passed follow-up inspection does not close the case
- Permit cancelled after 6 months of inactivity and no violations
  - Can request permit extensions in writing
- If final inspection has not been approved and/or violations are not corrected a Notice of Violation will be issued
- Court if Notice of Violation not satisfied
PHONE CALLS

- Generally not required for someone to be on site unless ACCESS is an issue
  - Security
  - Ladder
  - Locked doors
- Contact phone numbers
  - Not office personnel
  - Someone familiar with the job
- Inspector time request for ACCESS purposes ONLY
  - Job to be complete prior to inspection request
  - AM & PM requests
  - 30 minute courtesy call
- Water & Sewer (open ditches) – we will accommodate as best we can

Objectives

- Participants will have a better understanding of:
  - The relationship between the published model code and the amendments made by the State,
  - The significant changes from the 2008 edition to the 2011 edition of the NEC and the electrical provisions of the 2012 IRC
  - Henrico County policies concerning interpretation and enforcement of the new provisions.
How Did We Get Here?

- Relationship of State Building Code to NEC
- The NEC is adopted as a model code in the IRC and the IBC.
- These are adopted as part of the VUSBC

VUSBC

- Virginia Uniform Statewide Building Code.
- Comprised of IRC and IBC and any amendments made by the State.
VUSBC

NEC 2011
Throughout this presentation the changes to the code will be in **RED**.

The items that are discussed because of continuing violations or unchanged items that are here for clarity will remain in **BLACK** type.

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**NEC Code Wide**

- Fine print note (FPN)
- Changed to **Informational Note**
- Sometimes taken as code language
**Article 100 Definitions**

- Very Important
- A lot of questions can be answered by reviewing defined terms
- Often overlooked

**Article 100 cont.**

**Arc Fault Circuit Interrupter (AFCI)**. Moved to definitions because other parts of code are now requiring AFCI protection. The definition did not change.

- **Bathroom.** An area including a basin with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures.
Article 100 cont.

- **Intersystem Bonding Termination** - A device that provides a means for connecting communications systems grounding conductor(s) & bonding conductor(s) at the service equipment or at the disconnecting means for buildings or structures supplied by a feeder or branch circuit.

Article 100 cont.

- **Kitchen** - An area with a sink & permanent facilities for food preparation & cooking.
- **Luminaire** - A complete lighting unit consisting of a light source as a lamp or lamps, together with the parts designed to position the light source & connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light. A lamp holder itself is not a luminaire.
Article 100 cont.

General Requirements
- Apply to all Articles of the Code unless amend by that Article
- A lot of failed inspections result from this Article
- 110.3(B) Listing and Labeling and Manufactures Installation Instructions

Article 110
Article 110 cont.

- **110.7 Wiring Integrity** - completed wiring installations shall be free from short circuits, ground faults, or any connections to ground other than as required or permitted elsewhere in this code.

- **110.11 Deteriorating Agents** - identifies enclosures types and electrical equipment that must be protected against damage from the weather during building construction. **New wording** = equipment not identified for outdoor use, such as "dry locations," "indoor use only," "damp locations," or enclosures Types I,2,5,12, I2K and/or 13, shall be protected against permanent damage from the weather during building construction.

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**Ready for Rough-in**

![Ready for Rough-in Image]
Article 110 cont.

110.12 (A) Unused Openings - Unused openings, other than those intended for the operation of the equipment, those intended for mounting purposes, or those permitted as part of the design for the listed equipment, shall be closed to afford protection substantially equivalent to the wall of the equipment.

NEC 110.14

- Added language for more finely stranded conductors.
- Conductors and connectors for conductors more finely stranded than Class B and class C stranding as shown in Chapter 9, Table 10, shall be identified for the specific conductor class or classes.
NEC 110.14

NEC 110.14
NEC 110.14

- Arc-Flash Hazard Warning
- Required on switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units
- Must be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.
NEC 110.16

(A) 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.

110.24

- (A) 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.
110.24 cont

(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.

Article 200

200.4 Neutral Conductors. Neutral conductors shall not be used for more than one branch circuit, for more than one multiwire branch circuit, or for more than one set of ungrounded feeder conductors unless specifically permitted elsewhere in the Code.
Article 210

- **210.4(A) General** … All conductors of a multiwire branch circuit shall originate from the same panelboard or similar distribution equipment.

- **210.4(B) Disconnecting Means.** Each multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates.

Article 210 cont.

- **210.4(D) Grouping.** The ungrounded and grounded conductors of each multiwire branch circuit shall be grouped by wire ties or similar means in at least one location within the panelboard or other point of origination.

- Exception: The requirement for grouping shall not apply if the circuit enters from a cable or raceway unique to the circuit that makes the grouping obvious.
Article 210 cont.

- 210.5(C) Where the premises wiring … each ungrounded conductor of a branch circuit shall be identified by phase or line and system at all termination, connection, and splice points. ... The method utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

210.8

- Ground-Fault Circuit-Interrupter Protection for Personnel
- Ground-fault circuit-interruption for personnel shall be provided as required in 210.8(A) through (C). The ground-fault circuit-interrupter shall be installed in a readily accessible location
Article 210 cont.

- 210.8 Dwelling units
- Changed number (7)
- (7) Sinks – located in areas other than kitchens where receptacles are installed within 1.8 m (6 ft) or the outside edge of the sink

210.8(B)

- Other Than Dwelling Units
- (5) Sinks – where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink
- Exception No. 2 to (5): For receptacles located in patient bed locations of general care and critical care areas of health care facilities other than those covered under 210.8(B)(1). GFCI protection shall not be required.
210.8(B) cont.

- Other than dwelling Units
- 3 new locations
- (6) Indoor wet locations
- (7) Locker rooms with associated showering facilities.
- (8) Garages, service bays, and similar areas where electrical diagnostic equipment, electrical hand tools, or portable lighting equipment are to be used.
210.8(B) cont.

Article 210 cont.

- 210.12(B) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.
Exception No. 1: If RMC, IMC, EMT, Type MC or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit Type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
210.12 cont.

- Exception No. 2: Where a listed or nonmetallic conduit or tubing is enclosed in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

210.12 cont.

- Added new requirement
- (B) Branch Circuit Extensions or Modifications – Dwelling Units. In any of the areas specified in 210.12(A), where branch-circuit wiring is modified, replaced, or extended, the branch circuit shall be protected by one of the following:
210.12 cont

- (1) A listed combination-type AFCI located at the origin of the branch circuit
- (2) A listed outlet branch-circuit type AFCI located at the first receptacle outlet of the existing branch circuit
Article 210 cont.

- State amendment to 210.12
- Applies only to IRC
- Buildings such as motels, hotels, dorms, apartment buildings permitted under the IBC would still have to comply with all provisions of 210.12

Article 210 cont.

210.52 Dwelling Unit Receptacle Outlets. This section provides requirements for 125-volt, 15- and 20-ampere receptacle outlets. The receptacles required by this section shall be in addition to any receptacle that is:

1. Part of a luminaire or appliance, or
2. Controlled by a wall switch in accordance with 210.70(A)(1), Exception No. 1 or
Article 210 cont.

- (3) Located within cabinets or cupboards, or
- (4) Located more than 1.7m (5 ½ ft) above the floor.
- 210.52 Dwelling Unit Receptacle Outlets
- Added a provision for receptacle outlet assemblies listed for the application in both bathrooms and kitchens

210.52 cont.
210.52 cont.

- Where used as the required receptacles must be the permanent wired type, not cord and plug connected

210.52(E)(1) Added that the outside receptacles have to be accessible while standing at grade level and not more than 6½ feet above grade.

210.52(E)(3) Balconies, Decks, and Porches. Balconies, decks and porches that are accessible from inside the dwelling unit shall have at least one receptacle outlet installed within the perimeter of the balcony, deck, or porch. The receptacle shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch surface.
Article 210 cont.

- The exception for 210.52(E)(3) was deleted.
- All porches and balconies accessible from inside the dwelling shall a receptacle installed inside the perimeter of the porch
- Still not more than 2.0 m (6 ½ ft) above porch or balcony surface
210.52(I)

- Foyers. Foyers that are not part of a hallway in accordance with 210.52(H) and that have an area greater than 5.6 sq. meters (60 sq. ft.) shall have a receptacle(s) located in each wall space 900 mm (3 ft.) or more in width and unbroken by doorways, floor-to-ceiling windows, and similar openings.
Article 210 cont.

- 210.60(A) General. Guest rooms or guest suites in hotels, motels, sleeping rooms in dormitories, and similar occupancies shall have outlets installed in accordance with 210.52(A) and 210.52(D).

- 210.62 Show Windows. At least one receptacle outlet shall be installed within 450 mm (18 in.) of the top of a show window for each 3.7 linear m (12 linear ft) or major fraction thereof of show window area measured horizontally at its maximum width.

Article 225

- 225.27 Raceway Seal

Where a raceway enters a building or structure from an underground distribution system, it shall be sealed in accordance with 300.5(G). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, shield, or other components.
Article 240

- 240.4(D) Small Conductors. Unless specifically permitted in 240.4(E) or (G), the over current protection shall not exceed that required by (D)(1) through (D)(7) after any correction factors for ambient temperature and number of conductors have been applied.
Article 240 cont.

- 240.20 has been renumbered to 240.15 moving it from part II of 240 to part I of 240.
- 240.24(F) Not Located Over Steps. Overcurrent devices shall not be located over steps of a stairway

Article 250

- 250 and throughout the NEC grounding and bonding terms have been revised and defined for improved clarity and usability.
- 250.8 Connection of Grounding and Bonding Equipment.
  - (A) Permitted Methods. Grounding conductors and bonding jumpers shall be connected by one of the following means:
    - (1) Listed pressure connectors
    - (2) Terminal bars
Article 250 cont.

- (3) Pressure connectors listed as grounding and bonding equipment
- (4) Exothermic welding process
- (5) Machine screw-type fasteners that engage not less than two threads or are secured with a nut
- (6) Thread-forming machine screws that engage not less than two threads in the enclosure
- (7) Connections that are part of a listed assembly
- (8) Other listed means

Article 250 cont.

(B) Methods Not Permitted. Connection devices or fittings that depend solely on solder shall not be used.
Article 250 cont.

- 250.32 (B) Now requires equipment ground to all separate structures.
- No more 3 wire feeders to detached structures

Article 250 cont.

- 250.35 Permanently Installed Generators. A conductor that provides an effective ground-fault current path shall be installed with the supply conductors from a permanently installed generator(s) to the first disconnecting mean(s) in accordance with (A) or (B)
  - (A) Separately Derived System. Where the generator is installed as a separately derived system, the requirements in 250.30 shall apply.
Article 250 cont.

- (B) Nonseparately derived system. Where the generator is not installed as a separately derived system, an equipment bonding jumper shall be installed between the generator equipment grounding terminal and the equipment grounding terminal or bus of the enclosure of supplied disconnecting mean(s) in accordance with (B)(1) or (B)(2).

Article 250 cont.

- 250.68 Grounding Electrode Conductor and Bonding Jumper Connection to Grounding Electrodes. The connection of a grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system and associated bonding jumper(s) shall be made as specified 250.68 (A) and (B).
Article 250 cont.

- 250.68 (A) Accessibly. All mechanical elements use to be terminate a grounding electrode conductor or bonding jumper to a grounding electrode shall be accessible.
- 250.68(A) Ex. Exothermic or irreversible compression connections used at terminations, together with the mechanical means used to attach such terminations to fireproofed structural metal whether or not the mechanical means is reversible, shall not be required to be accessible.
250.92

(B) Method of Bonding at the Service
Bonding jumpers meeting the requirements of this article shall be used around impaired connections such as reducing washers or oversized, concentric, or eccentric knockouts. Standard locknuts or bushings shall not be the only means for the bonding required by this section but shall be permitted to be installed to make a mechanical connection of the raceway(s)
Article 250 cont.

250.94 Bonding for Other Systems. An intersystem bonding termination for connecting intersystem bonding and grounding conductors required for other systems shall be provided external to enclosure at the services equipment and at the disconnecting means for any additional buildings or structures. The intersystem bonding terminal shall be accessible for connection and inspection.

Article 250 cont.

The intersystem bonding terminal shall have the capacity for connection of not less than three intersystem bonding conductors. The intersystem bonding terminal device shall not interfere with opening a service or metering equipment enclosure. The bonding terminal shall be one of the following:

(1) A set of terminals securely mounted to the meter enclosure and electrically connected to the meter enclosure. The terminal shall be listed as grounding and bonding equipment.
Article 250 cont.

- (2) A bonding bar near the service equipment enclosure, meter enclosure or raceway for service conductors. The bonding bar shall be connected with a minimum 6 AWG copper conductor to an equipment grounding conductor(s) in the service equipment enclosure, meter enclosure, or exposed nonflexible metallic raceway.

- (3) A bonding bar near the grounding electrode conductor. The bonding bar shall be connected to the grounding electrode conductor with a minimum 6 AWG copper conductor.

Article 250 cont.

- 250.94 Ex. In existing buildings or structures where any of the intersystem bonding and grounding conductors required by 770.93, 800.100(B), 810.21(F), 820.100(B), 830.100(B) exists, installation of the intersystem bonding termination is not required. An accessible means external to enclosures for connecting intersystem bonding and grounding electrode conductors shall be permitted at the service equipment and at the disconnecting means for any additional buildings or structures by at least one of the following means:
250.94 cont.

- (1) Exposed nonflexible metallic raceways
- (2) An exposed grounding electrode conductor
- (3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding conductor to the grounded raceway or equipment
250.118

• (10) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:
  • (a) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118(1)

250.118 cont.

• (b) The combined metallic sheath and uninsulated equipment grounding / bonding conductor of interlocked metal taped-type MC cable that is listed and identified as an equipment grounding conductor
• (c) The metallic sheath or the combined metallic sheath and equipment grounding conductors of the smooth or corrugated tube-type MC cable that is listed and identified as an equipment grounding conductor
Article 250 cont.

- **250.121 Use of Equipment Grounding Conductors**
- An equipment grounding conductor shall not be used as a grounding electrode conductor.

**250.122**

- Removed 30 and 40 ampere overcurrent devices from list.
- They were the same as 60 ampere.
- Cannot reduce size of equipment grounding conductors in paralleled installations.
250.122 cont.

Article 250 cont.

- 250.146 (D) Isolated Receptacles... … Where installed in accordance with the provisions of this section, this equipment grounding conductor shall also be permitted to pass through boxes, wireways, or other enclosures without being connected to such enclosures.
300.4(E)

- 300.4(E) Cables, Raceways, or Boxes Installed Under Roof Decking.
- A cable- or raceway, or box installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so the nearest outside surface of the cable or raceway is not less than 38 mm (1 ½ in.) from the nearest surface of the roof decking.

300.4(E) cont.

- Added new sentence to end
- A cable, raceway, or box shall not be installed in concealed locations in metal corrugated sheet decking type roof.
Article 300 cont.

- FPN: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide “hold down” strength of the waterproof membrane or roof insulating material.

- Exception: Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).
300.4(H)

- New section added
- (H) Structural Joints. A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction, or deflection, used in buildings, bridges, parking garages, or other structures
Table 300.5

- Added Type MI and MC to burial depths under a building

300.5(C)

- Underground Cables Under Buildings
- Added 2 exceptions
- Exception No. 1: Type MI cable shall be permitted under a building without installation in a raceway where embedded in concrete, fill, or other masonry in accordance with 332.10(6) or in underground runs where suitably protected against damage and corrosive conditions in accordance with 332.10(10)
300.5(C) cont.

- Exception No. 2: Type MC Cable listed for direct burial or concrete encasement shall be permitted under a building without installation in a raceway in accordance with 330.10(A)(5) and in wet locations in accordance with 330.10(11).

Article 300 cont.

- 300.5(B) Wet Locations.
- The interior of enclosures or raceways installed underground shall be a wet location. Insulated conductor and cables installed in these enclosures or raceways in underground installations shall be listed for the use in wet locations and shall comply with 310.8(C). Any connections or splices in an underground installation shall be approved for wet locations.
Article 300 cont.

- 300.5(D)(1) Emerging from grade.
- Direct-buried conductors and cables emerging from grade and specified in column 1 and 4 of table 300.5 shall be protected by enclosures or raceways extending from the minimum cover distance below grade required by 300.5(A) to point at least 2.5 m (8 ft) above finished grade. In no case shall the protection be required to exceed 450mm (18 in.) below finished grade.

Article 300 cont.

- 300.9 Raceways in Wet Locations Above Grade.
- Where raceways are installed in wet locations above grade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations above grade shall comply with 310.8(C).
300.11(A)(2)

- (2) Non-Fire Rated Assemblies
- Added requirement to identify support wires
- Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means.

Article 300 cont.

- 300.12 Mechanical Continuity-Raceways and Cables.
- Exception No 2: Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformer, shall not be required to be mechanically secured to the equipment
Article 310

- A lot of changes to 310
- All the ampacity tables have been renumbered
- Some ampacities have been changes.
- Done to match Canadian ampacities

310.15(B)(2)(a)

- This is the temperature table that was at the bottom of the ampacity tables
- Values are the same
NEC 310.15(B)

- Table 310.15(B)(3)(a)
- The rules regarding how we count the conductors in a raceway or cable have changed.
- All conductors, even spares, can now count
Table 310.15(B)(16)

314.4

- **Metal Boxes.** Metal boxes shall be grounded and bonded in accordance with part I, IV, V, VI, VII, and X of Article 250 as applicable, except as permitted in 250.112(I).
314.24

- Minimum Dept of Boxes for Outlets, Devices, and Utilization Equipment. Outlet and device boxes shall have sufficient depth to allow equipment installed within them to be mounted properly and with sufficient clearance to prevent damage to conductors within the box.

- (1) (A) Outlet Boxes Without Enclosed Devices or Utilization Equipment. No box shall have an internal depth of less than 12.7 mm (1/2 in.).

314.24 cont.

- (B) Outlet and Device Boxes with Enclosed Devices. Boxes intended to enclose flush devices shall have an internal depth of not less than 23.8 mm (15/16 in).

- (C) Utilization Equipment. Outlet and device boxes that enclose utilization equipment shall have a minimum internal depth that accommodates the rearward projection of the equipment and the size of the conductors that supply the equipment. The internal depth shall include, where used, that of any extension boxes, plaster rings, or raised covers. The internal depth shall comply with all applicable provisions of (C)(1) through (C)(5).
314.24 cont.

- (1) Large Equipment. Boxes that enclose utilization equipment that projects more than 48 mm (1 7/8 in.) rearward from the mounting plane of the box shall have a depth that is not less than the depth of the equipment plus 6 mm (1/4 in.).

- (2) Conductors Larger Than 4 AWG. Boxes that enclose utilization equipment supplied by conductors larger than 4 AWG shall be identified for their specific function.

314.24 cont.

- (3) Conductors 8, 6, or 4 AWG. Boxes that enclose utilization equipment supplied by 8, 6, or 4 AWG conductors shall have an internal depth of not less than 52.4 mm (2 1/16 in).

- (4) Conductors 12 or 10 AWG. Boxes that enclose utilization equipment supplied by 12 or 10 AWG conductors shall have an internal depth that is not less than 30.2 mm (1 3/16 in.). Where the equipment projects rearward from the mounting plane of the box by more than 25 mm (1 in.), the box shall have a depth not less than that of the equipment plus 6 mm (1/4 in.).
314.24 cont.

- (5) Conductors 14 AWG and Smaller: Boxes that enclose equipment supplied by 14 AWG or smaller conductors shall have a depth that is not less than 23.8 mm (1 5/16 in.).
- Exception to (C)(1) through (C)(5): Utilization equipment that is listed to be installed with specified boxes shall be permitted.

314.27 Outlet Boxes

- (C) Added requirement at the end for spare conductors
- Where spare, separately switched, ungrounded conductors are provided to a ceiling mounted outlet box, in a location acceptable for a ceiling-suspended (paddle) fan in single or multi-family dwellings, the outlet box or outlet box system
314.27(C) cont.

- shall be listed for the sole support
- of a ceiling-suspended (paddle) fan
314.27 cont.

- (E) Utilization Equipment. Boxes used for the support of utilization equipment other than ceiling-suspended (paddle) fans shall meet the requirements of 314.27(A) and (B) for the support of a luminaire that is the same size and weight.

- Exception: Utilization equipment weighing not more than 3 kg (6 lb) shall be permitted to be supported on other boxes or plaster rings that are secured to other boxes, provided the equipment or its supporting yoke is secured to the box with no fewer than two No. 6 or larger screws.

330 Metal-clad cable: Type MC

- 330.10 (A) (11)
- A and B under this article unchanged
- C The insulated conductors under the metallic covering are listed for the use in wet locations and corrosion-resistant jacket is provided over the metallic sheath.
330.12 Uses Not Permitted

- Type MC cable shall not be used under either of the following conditions:
  - (1) Where subject to physical damage
  - (2) Where exposed to any of the destructive corrosive conditions in (a) or (b), unless the metallic sheath or armor is resistant to the conditions or is protected by material resistant to the conditions:
    - (a) Direct buried in the earth or embedded in concrete unless identified for direct burial.

330.12 cont.

- (b) Exposed to cinder fills, strong chlorides, caustic alkalis, or vapors of chlorine or of hydrochloric acids
334.12(B)(4)

- **334.12 Uses Not Permitted**
- **(A)(1) Exception:** *Type NM, NMC, and NMS cable shall be permitted in type I and II construction when installed within raceways permitted to be installed in Type I and II construction.*
- **(B)(4) In wet or damp locations**

334.12(C)

- **Unfinished Basements and Crawl Spaces**
- Where cable is run at angles with joists in unfinished basements and crawl spaces, it shall be permissible to secure cables not smaller than two 6 AWG or three 8 AWG conductors directly to the lower edge of the joist. Smaller cables shall be run either through bored holes in joist or on running boards. NM cable installed on the wall of an unfinished basement shall be permitted to be installed in a listed conduit or tubing or shall be protected in accordance with 300.4. Conduit or tubing shall be provided with a suitable insulating bushing or adapter at the point the cable enters the raceway.
334.12(C) cont.

- The NM cable sheath shall extend through the conduit or tubing and into the outlet or device box not less than 6 mm (1/4 in.). The cable shall be secured within 300 mm (12 in.) of the point where the cable enters the conduit or tubing. Metal conduit, tubing, and metal outlet boxes shall be connected to an equipment grounding conductor.
- State amendment to IRC but not IBC
- Apartments, Motels, Dorms, Nursing homes

334.80 Ampacities

- Where more than two NM cables containing two or more current-carrying conductors are installed, without maintaining space between the cables, through the same opening in wood framing that is to be fire- or draft-stopped using thermal insulation, caulk, or sealing foam, the allowable ampacity of each conductor shall be adjusted in accordance with Table 310.15(B)(2)(a) and the provisions of 310.15 (A)(2), exception shall not apply.
334.80 cont.

- Where more than two NM cables containing two or more current-carrying conductors are installed in contact with thermal insulation without maintaining space between cables, the allowable ampacity of each conductor shall be adjusted in accordance with Table 310.15(B)(2)(a).

Article 336

- Type TC cable
- 336.12 Uses Not Permitted
- (2) Installed outside a raceway or cable tray system, except as permitted in 336.10(4) and 336.10(7).
- (4) For messenger supported cable outside
- (7) Industrial establishments
336.12 cont.

- Mini split interconnect
- Generator controls

338.10(B)(4) SE Cable

- (a) Interior Installations. In addition to the provisions of this article, Type SE service-entrance cable used for interior wiring shall comply with the installation requirements of Part II of Article 334, excluding 334.80
338.10(a) cont.

- Where installed in thermal insulation, the ampacity shall be in accordance with the 60 degree C (140 F) conductor temperature rating. The maximum conductor temperature shall be permitted to be used for ampacity adjustments and correction purposes, if the final derated ampacity does not exceed that for a 60 degree C (140 F) rated conductor.

338.12 Uses Not Permitted.

- (A) Service-Entrance Cable. Service-entrance cable (SE) shall not be used under the following conditions or in the following locations:
  - (1) Where subject to physical damage unless protected in accordance with 230.50(A).
  - (2) Underground with or without a raceway.
338.12 cont.

- **(3)** For exterior branch circuits and feeder wiring unless the installation complies with the provisions of part I of Article 225 and is supported in accordance with 334.30 or is used as messenger-supported wiring as permitted in Part II of Article 396.

338.12 cont.

- **(B)** Underground Service-Entrance Cable. Underground service-entrance cable (USE) shall not be used under the following conditions or in the following locations:
  - (1) For interior wiring
  - (2) For aboveground installation except where USE cable emerges from the ground and is terminated in an enclosure at an outdoor location and the cable is protected in accordance with 300.5(D).
338.12 cont.

- **(3)** Installed as messenger-supported wiring in accordance with 225.10 and Part II of Article 396.

348 Flexible Metal Conduit: Type FMC

- **348.12** Uses not permitted. FMC shall not be used in the following:
  - (1) **In wet locations**
  - (4) In any hazardous (classified) location **except as permitted by other articles in this code.**
Article 404

404.2(C) Switches Controlling Lighting Loads. Where Switches control lighting loads supplied by a grounded general purpose branch circuit, the grounded circuit conductor for the controlling lighting circuit shall be provided at the switch location.
Exception: The grounded circuit conductor shall be permitted to be omitted from the switch enclosure where either of the following conditions in (1) or (2) apply:

(1) Conductors for the switches controlling lighting loads enter the box through a raceway. The raceway shall have sufficient cross-sectional area to accommodate the extension of the grounded circuit conductor to the switch location.

whether or not the conductors in the raceway are required to be increased in size to comply with 310.15(B)(3)(a)

(2) Cable assemblies for switches controlling lighting loads enter the box through a framing cavity that is open at the top or bottom on the same floor level, or through a wall, floor, or ceiling that is unfinished on one side.
Article 406

- 406.4(G) Voltage Between Adjacent Devices
- Same as switches now at 300 volts between devices
- Barrier required
- Applies to all devices in same box

Article 406 cont.

- 406.9(B) Wet Locations
- Added requirement for “extra duty”
- For other than one or two family dwellings, an outlet box hood installed for this purpose shall be listed, and where installed on an enclosure supported from grade as described in 314.23(B) or as described in 314.23(F) shall be identified as “extra duty”
406.9 cont.

Article 406 cont.
Article 406 cont.

- **406.12 Tamper-Resistant Receptacles in Dwelling Units**
  In all areas specified in 210.52, all nonlocking-type 125-volt, 15- and 20-ampere receptacles shall be listed tamper resistant receptacles.

Article 406 cont.

- **406.12 Exception: Receptacles in the following locations shall not be required to be tamper-resistant:**
  1. Receptacles located more than 5 1/2 feet above the floor.
  2. Receptacles that are part of a luminaire or appliance.
  3. A single receptacle or a duplex receptacle for two appliances located within dedicated space for each appliance that, in normal use, is not
Article 406 cont.

- easily moved from one place to another and that is cord and plug connected in accordance with 400.7(A)(6), or (A)(8).
- (4) Nongrounding receptacles used for replacements as permitted in 406.4(D)(2)(a).

406.13

- Tamper Resistant Receptacles in Guest Rooms and Guest Suites
- All non-locking type, 125-volt, 15 and 20 ampere receptacles located in guest rooms and guest suites shall be listed tamper-resistant receptacles
Tamper-Resistant Receptacles in child Care Facilities

In all child care facilities, all non-locking-type 125-volt, 15 and 20 ampere receptacles shall be listed tamper-resistant receptacles
408.3(D)

- 408.3(D) Terminals
- In switchboards and panelboards, load terminals for field wiring, including grounded circuit conductor load terminals and connections to the equipment grounding conductor bus for load equipment grounding conductors, shall be so located that is not necessary to reach across or beyond an uninsulated ungrounded line bus in order to make connections
Article 408

- **408.4(B) Source of Power**
- All switchboards and panelboards supplied by a feeder in other than one – or two – family dwellings shall be marked to indicate the device or equipment where the power supply originates.
Article 408 cont.

408.36 Overcurrent Protection

In addition to the requirements of 408.30, a panelboard shall be protected by an overcurrent protective device having a rating not greater than that of the panelboard. This overcurrent protective device shall be located within or at any point on the supply side of the panelboard.
Article 408 cont.

- There are some exceptions for multiple disconnects as allowed by 230.71
- For 2 mains on the supply side
- For existing panelboards in an individual residential occupancy

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Article 408 cont.

- 408.54 Maximum Number of Overcurrent Devices
  A panelboard shall be provided with physical means to prevent the installation of more overcurrent devices than the number for which the panelboard was designed, rated, and listed.
Article 408 cont.

- No more 42 circuit rule
- No more lighting and appliance panelboards.

Article 408 cont.

- 408.58 Panelboard Marking
  Panelboards shall be durably marked by the manufacturer with the voltage and the current rating and the number of phases for which they are designed and the manufacturer’s name or trademark in such a manner so as to be visible after installation, without disturbing the interior parts or wiring.
Article 410

- Added some definitions
- 410.10(D) Added: Luminaries located within the actual outside dimensions of the bathtub or shower to a height of 8 ft. vertically from the top of the bathtub rim or shower threshold shall be marked for damp locations, or marked for wet locations where subject to shower spray.

Article 410 cont.

- 410.16 Luminaires in Clothes Closets
- Added provisions for LED lighting
- Added dimensions for the installation of LED lighting
- Same as incandescent and must be inclosed
- Added LED clothes rods
410.16 cont.

Article 422

- 422.30 General
- A means shall be provided to simultaneously disconnect each appliance from all ungrounded conductors in accordance with the following sections of Part III. If an appliance is supplied by more than one branch-circuit or feeder, these disconnecting means shall be grouped and identified as the appliance disconnect
Article 450

- 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.
Article 514

514.11

(A) General. Each circuit leading to or through dispensing equipment, including all associated power, communications, data, and video circuits, and equipment for remote pumping systems, shall be provided with a clearly identified and readily accessible switch or other approved means, located remotely from the dispensing devices, to disconnect
514.11 cont.

- simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any.
- Single pole breakers utilizing handle ties shall not be permitted
Article 517

- Remember this article applies to, but is not limited to:
  - Hospitals
  - Doctors Offices
  - Dentist Offices
  - Eye care
  - Therapeutic Massage
  - Ready clinics in drug stores
  - Etc.

517.13(B)

- (1) General. The following shall be directly connected to an insulated copper equipment grounding conductor that is installed with the branch circuit conductors in the wiring methods as provided in 517.13(A)
  - (1) The grounding terminals of all receptacles
  - (2) Metal boxes and enclosures containing receptacles
517.13(B)

(3) All non-current carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

517.13(B) cont.
Article 590

- 590.4(D)(2) Receptacles in Wet Locations. All 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall comply with 406.9(B)(1).
- Means “extra duty” required
Article 680

- 680.2 Definitions
- Low Voltage Contact Limit. A voltage not exceeding the following values
  - (1) 15 volts (RMS) for sinusoidal ac
  - (2) 21.2 volts peak for nonsinusoidal ac
  - (3) 30 volts for continuous dc
  - (4) 12.4 volts for dc that is interrupted at a rate of 10 to 200 Hz

680.21(A)(5)

- (5) Cord-and-Plug Connections
- Pool associated motors shall be permitted to employ cord-and-plug connections. The flexible cord shall not exceed 900 mm (3 ft.) in length. The flexible cord shall include a copper equipment grounding conductor sized in accordance with 250.122 but not smaller than 12 AWG. The cord shall terminate in a grounding-type attachment plug.
680.21(C)

- (C) GFCI Protection. Outlets supplying pool pump motors connected to single-phase 120 volt through 240 volt branch circuits rated 15 or 20 amperes, whether by receptacle or direct connection shall be provided with ground-fault circuit-interrupter protection for personnel.

680.26(B)(7)

- (7) Fixed Metal Parts. All fixed metal parts shall be bonded including, but not limited to, metal sheathed cables and raceways, metal piping, metal awnings, metal fences, and metal door and window frames.
680.73

- Hydromassage bathtub electrical equipment shall be accessible without damaging the building structure or finish. Where the hydromassage bathtub is cord- and plug- connected with the supply receptacle accessible only through a service access opening, the receptacle shall be installed so that its face is within direct view and not more than 300 mm (1 ft.) of the opening.
Article 694

- New article covering Small Wind Electric Systems

Article 702

- 702.5 Capacity and Rating
- (B) System Capacity
- The calculations of load on the standby system shall be made in accordance with Article 220 or by other approved methods
Article 702 cont.

(1) Manual Transfer Equipment
Where manual transfer equipment is used, an optional standby system shall have adequate capacity and rating for the supply of all equipment intended to be operated at one time. The user of the optional standby system shall be permitted to select the load connected to the system.

Article 702 cont.

(2) Automatic Transfer Equipment
Where automatic transfer equipment is used, an optional standby system shall comply with (2)(a) or (2)(b)
(a) Full Load. The standby source shall be capable of supplying the full load that is transferred by the automatic transfer equipment.
Article 702 cont.

- (b) Load Management
- Where a system is employed that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the load management system

Questions?
Thank you for attending!