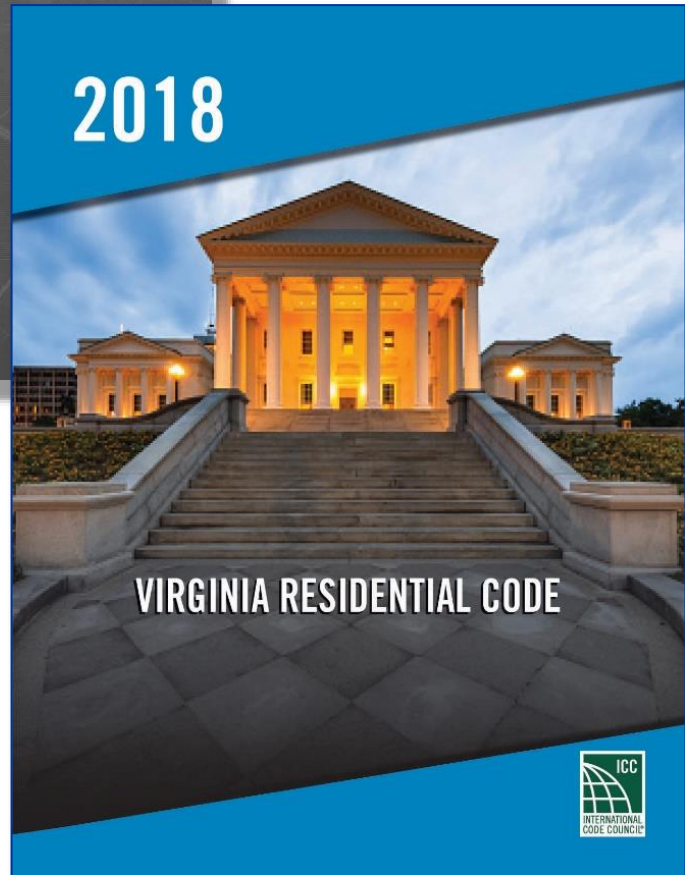
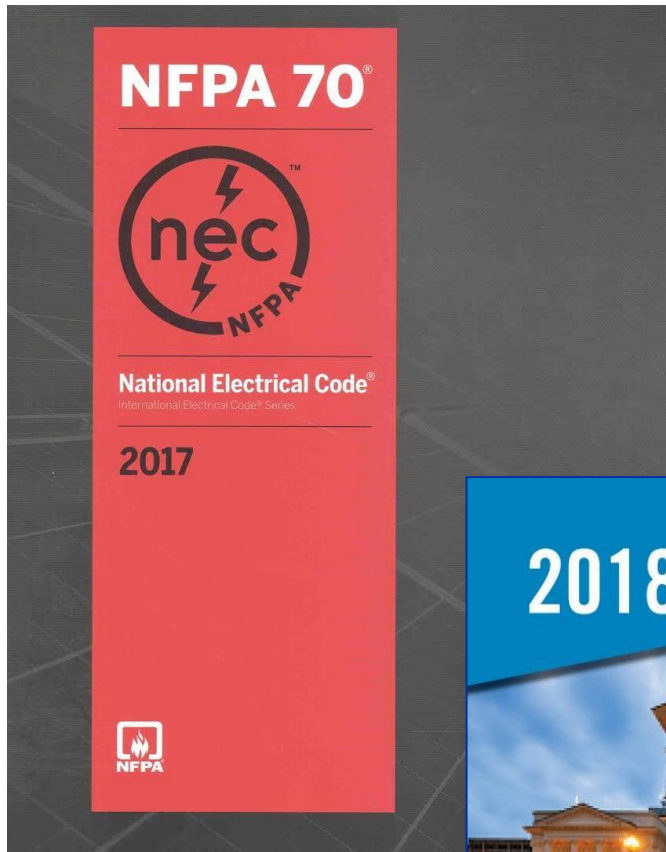


2018 Code Change Training

2017 NFPA 70 (NEC) and 2018 Virginia Residential Code (VRC) Part VIII - Electrical

Significant Changes and State Amendments





Agenda

2017 NEC and 2018 VRC - Electrical

- Significant NEC changes and VA amendments in chapter order
- NEC and IRC article/code section listed where applicable
- VA icon identifies VA amendments



NEC Code Wide Changes



- Increase in voltage to 1000 volts from 600 volts
- Limited Access Working Space
- Available Short-Circuit Current



NEC New Articles

- Art. 425 Fixed Resistance & Electrode Industrial Process Heating Equipment
- Art. 691 Large-Scale PV Systems
- Art. 706 Energy Storage Systems
- Art. 710 Stand-Alone Systems
- Art. 712 Direct-Current Microgrids

NEC 90.3 - Code Arrangement

Chapter 1 – General		Applies Generally to All Electrical Installations
Chapter 2 – Wiring and Protection		
Chapter 3 – Wiring Methods and Materials		
Chapter 4 – Equipment for General Use		
Supplements or Modifies Chapters 1 - 7		Chapter 5 – Special Occupancies
		Chapter 6 – Special Equipment
		Chapter 7 – Special Conditions
Chapter 8 – Communications Systems		NOT subject to the requirements of Chapters 1-7 except where requirements are specifically referenced in Chapter 8.
Chapter 9 – Tables		Applicable as referenced
Informative Annexes A – J		Information only; not mandatory

NEC Art. 100 Definitions

- *Field Evaluation Body (CMP-1)*
- *Buildings (CMP-1)*
- *Structures (CMP-1)*

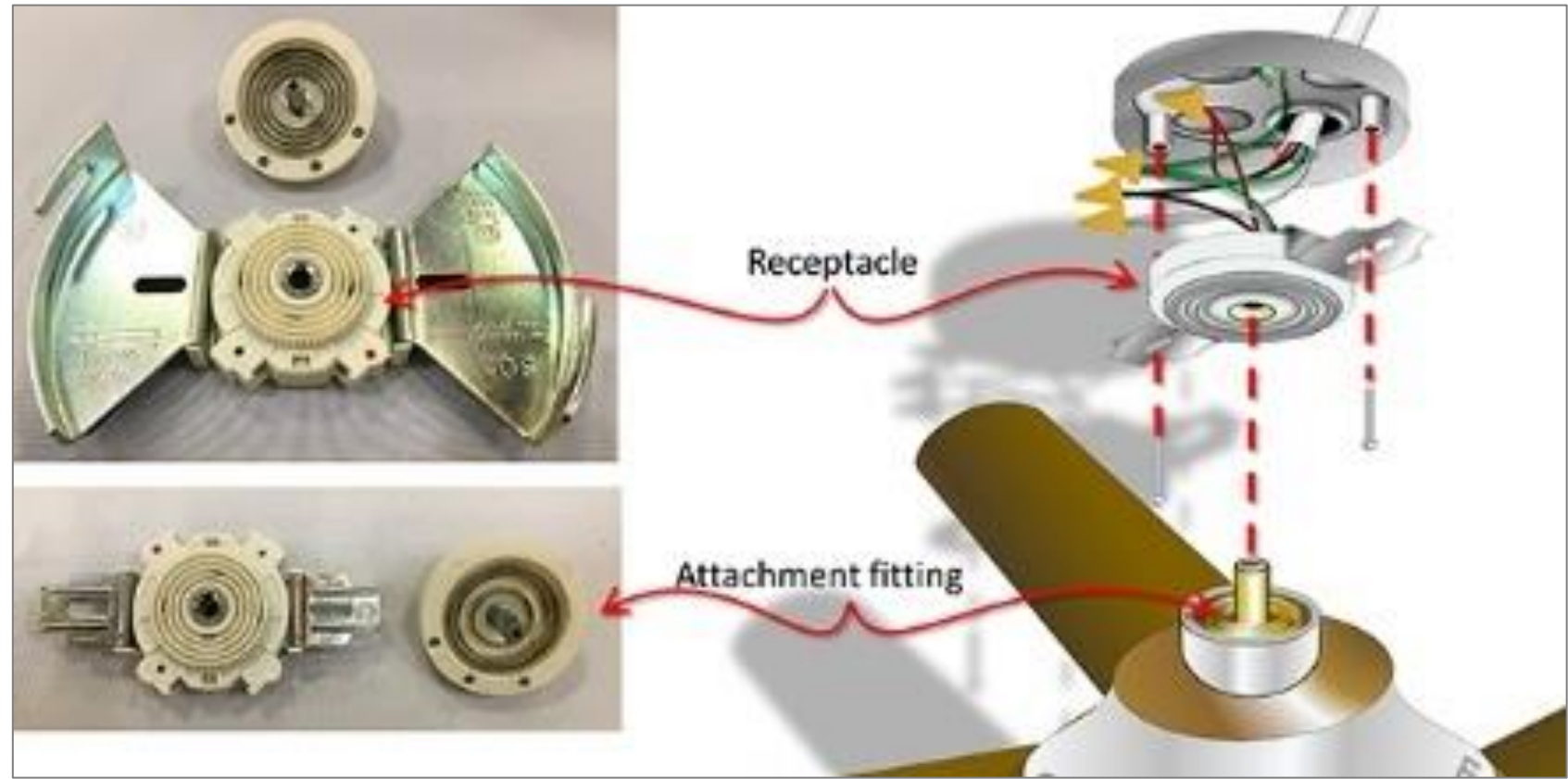
Article 100 Definitions – *Accessible, Readily (Readily Accessible)*

- Revisions were made to indicate that the use of a key does not fall under the “use of tools”
- Crawling under something to get to equipment is no longer acceptable



Article 100

Definitions – *Receptacle*



“A contact device installed at the outlet for the connection of an attachment plug, or for the connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle...”

110 – Reconditioned Equipment

- The change to this code section recognizes that equipment can be new, reconditioned, refurbished, or remanufactured but places **specific marking and labeling requirements on reconditioned equipment.**

NRTL Electrical testing	
Phone: 999-999-9999	
Service:	<u>RECONDITIONED</u>
BY:	<u>MIKE MILLER</u>
Date:	<u>9/5/2016</u>

110.14(D) / E3406.12 – Electrical Connection Torque Tools

- **Calibrated torque measuring tools** are now required where numeric torque values are indicated on equipment or manufacturer's installation instructions.



110.26(A)(4)- Limited Access

Includes new requirements for:

- (a) Access Openings
- (b) Width of the Working Space
- (c) Enclosure doors or hinged panels
- (d) Working Space



Chapter 2

Wiring and Protection

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210.5 (C)(1) - Branch Circuits Supplied from More Than One Nominal Voltage System

- New wording and an exception were added to the labeling requirements for installations on a premises where more than one nominal electrical system voltage exists.



210.8 – Measurements for GFCI Protection

- 210.8 - New language clarifies the measurement requirement
 - “shortest path” without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window
- 210.8 (7) Sinks
 - Clarification now specifies “...from the top inside edge”



Would this receptacle be required to be GFCI protected?

210.8(B) GFCI Protection for Personnel. Other than Dwelling Units.

- For single-phase receptacles required to be provided with GFCI protection for personnel:
 - Voltage threshold increased from 125V to **150V**
 - Amperage threshold increased from (15 and) 20 to **50A**
- Three-phase receptacles rated **150 volts** to ground or less, **100 amperes** or less must also be provided with GFCI protection for personnel



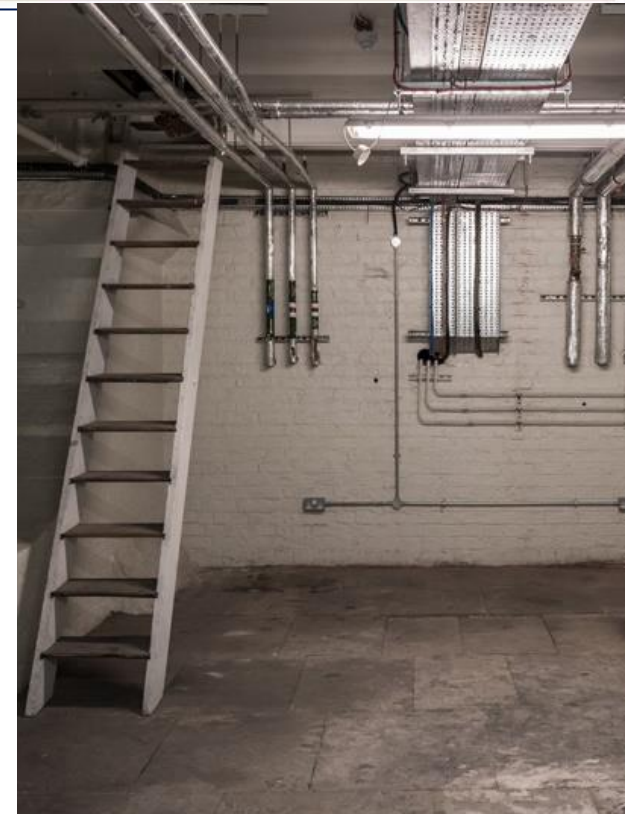
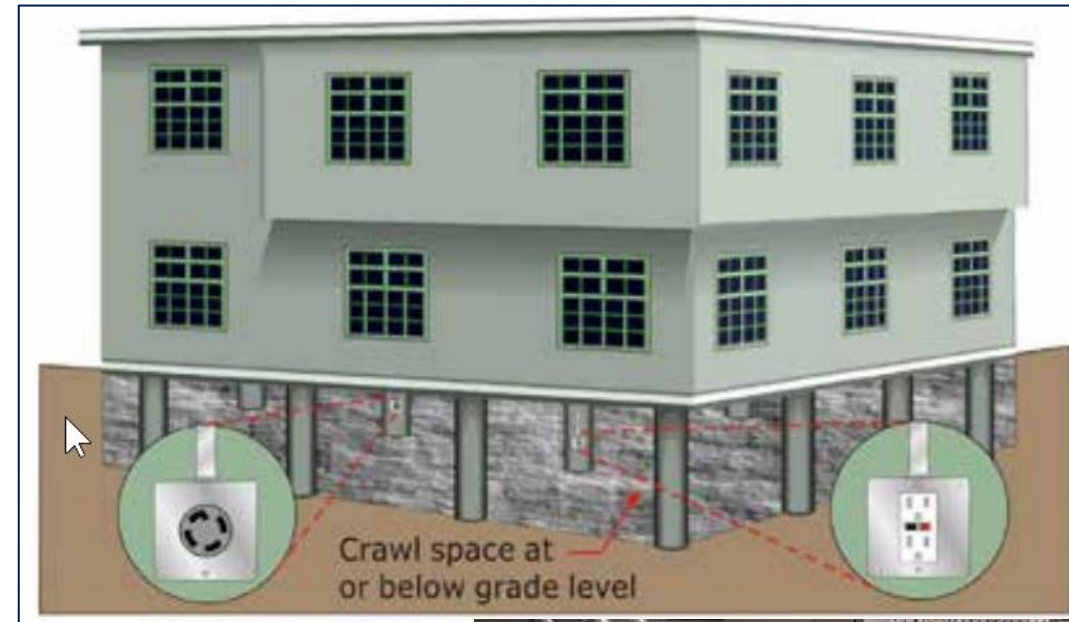
Square D © mini 50 A
GFCI breaker

210.8 (B)(9), (B)(10) GFCI Protection for Non - Dwelling Unit Crawl Spaces and Unfinished Basements

- There are now a total of 10 receptacle locations listed in 210.8(B) where GFCI protection is required for non-dwelling related receptacles.

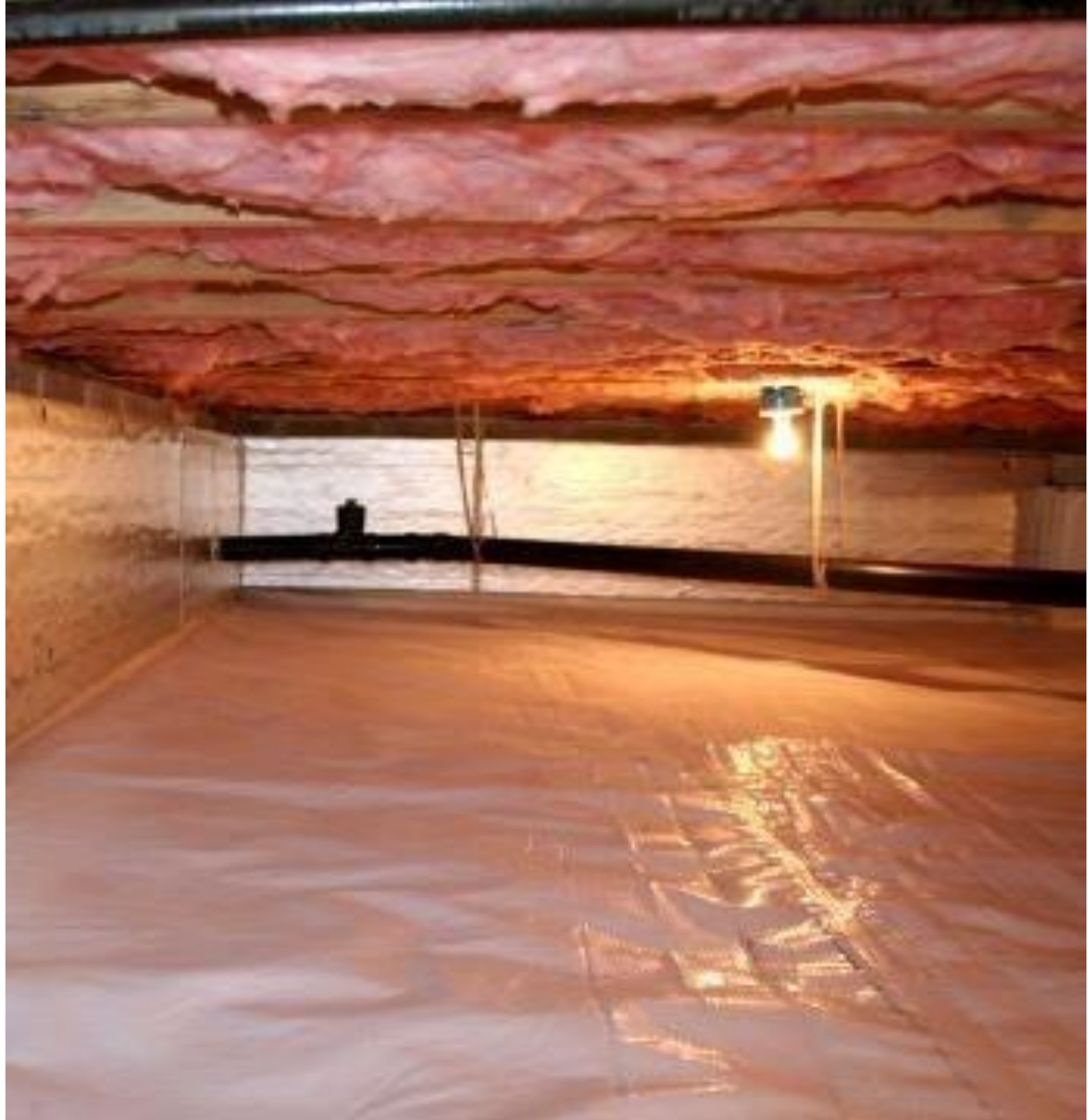
(9) Crawl spaces — at or below grade level

(10) Unfinished portions or areas of the basement not intended as habitable rooms

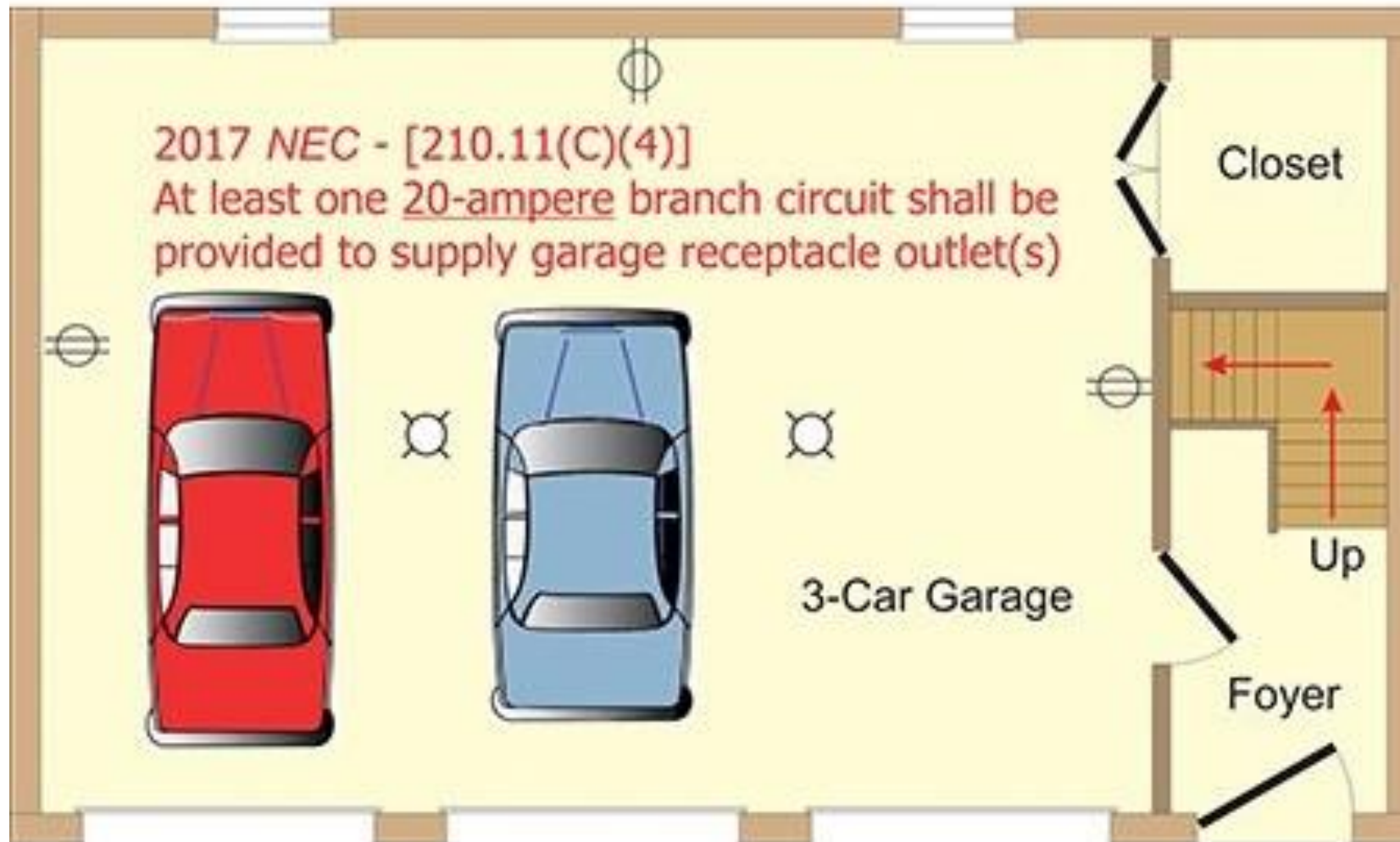


210.8 (E) – GFCI Protection – Crawl Space Lighting Outlets

- All crawl space lighting outlets, residential and commercial, require GFCI protection



210.11(C)(4) – Garage Branch Circuits



210.12(C) AFCI Protection now Required for Hotel/Motel Guest Rooms/Suites

- This new requirement applies to all 120-volt, single phase, 15- and 20-AMP branch circuits supplying outlets and devices in guest rooms and guest suites of hotels and motels.



VRC E3902 – Arc-Fault Protection



- AFCI required for kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas and similar rooms or areas
- **New USBC Exception** – AFCI not required where GFCI protection is required in accordance with E3902 and NEC 210.8(A)



210.52(A)(2)(1) – Receptacles for Fixed Cabinets Installed along a Wall Space

- If a fixed cabinet **has a countertop** then **it is included** in the wall space measurement.
- *Additional illustration next slide*

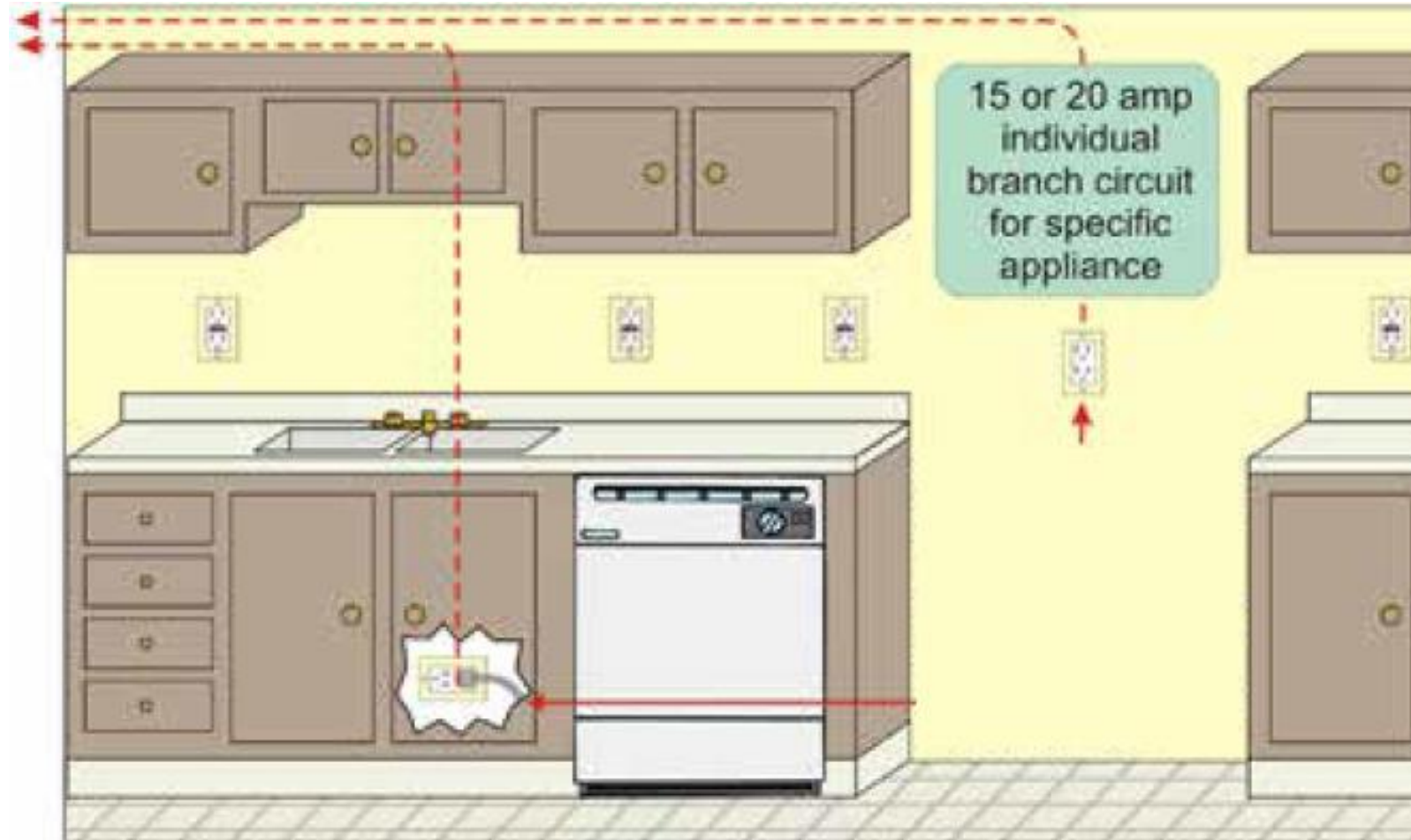


210.52(A)(2)(1) – Receptacles for Fixed Cabinets Installed along a Wall Space



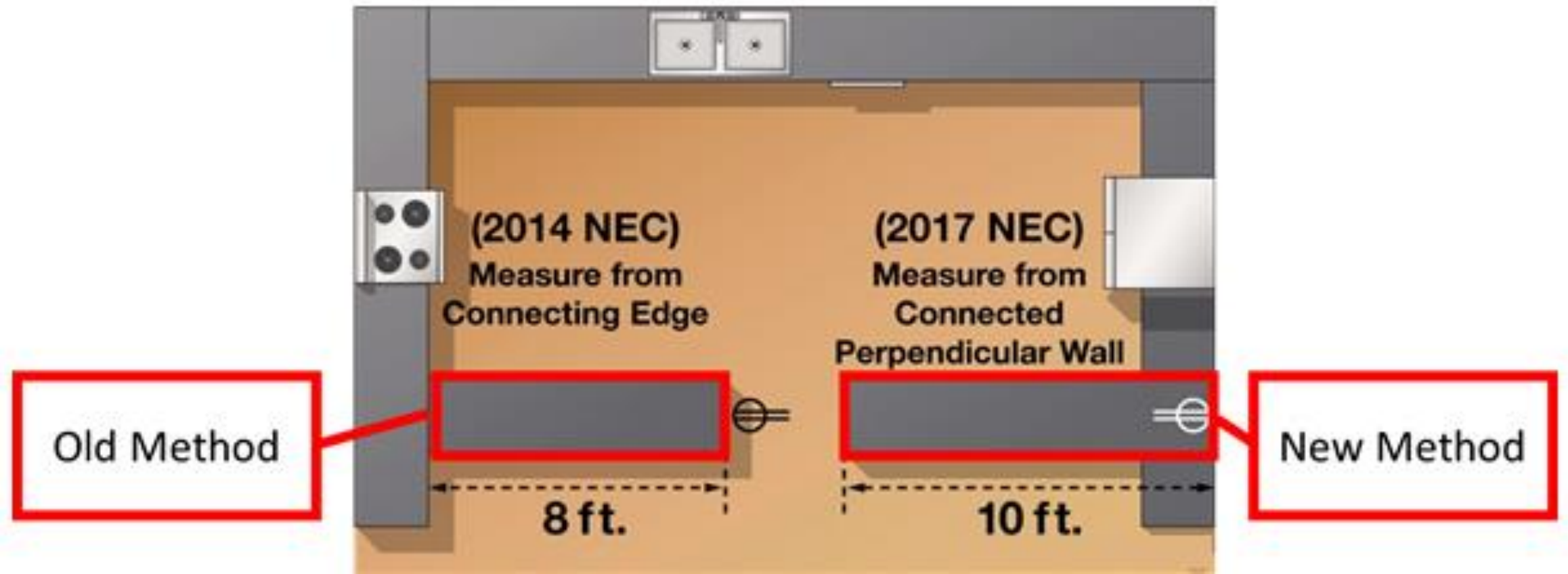
210.52(B)(1) – Ex. 2 - ~~Refrigerator~~ Appliance Branch Circuit

- Any dwelling unit **kitchen appliance** is now permitted (by the exception) to be supplied by an individual branch circuit rated **15 amps or greater**



210.52(C)(3) – Peninsular Countertop Spaces (E3901.4.3)

- The measurement point for peninsular countertops has been changed.
- The intent is to **eliminate all receptacles** from the ends and sides of peninsulas for **safety reasons**.



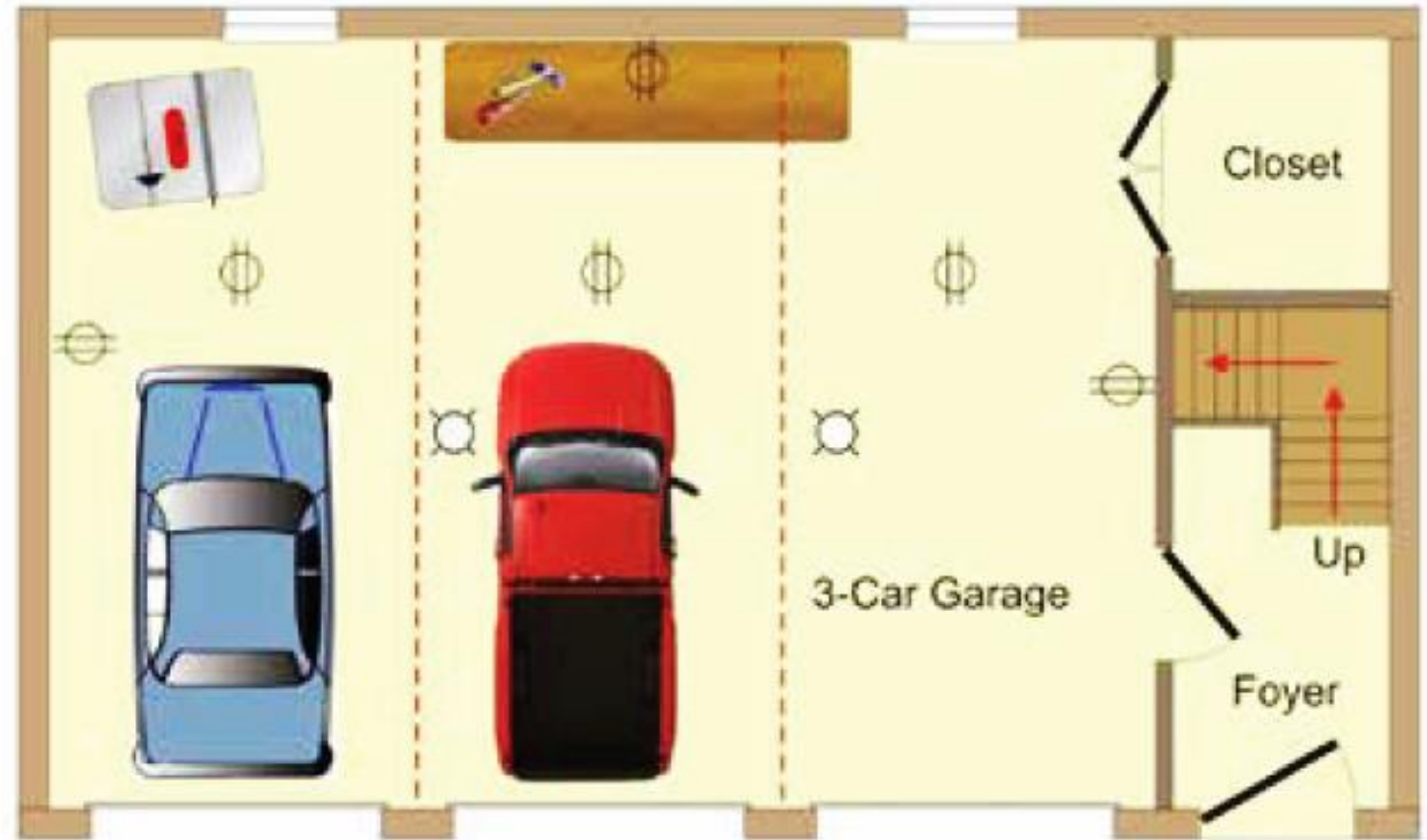
210.52(G) – Receptacle for Basements, Garages, and Accessory Dwellings

- Receptacle requirements for dwelling unit garages, basements, and accessory buildings **expanded to two-family dwellings.**



210.52(G)(1) – Dwelling Unit Garage Receptacles

- At least one receptacle outlet is required to be installed “in each vehicle bay and not more than 5½ ft. above the floor.”

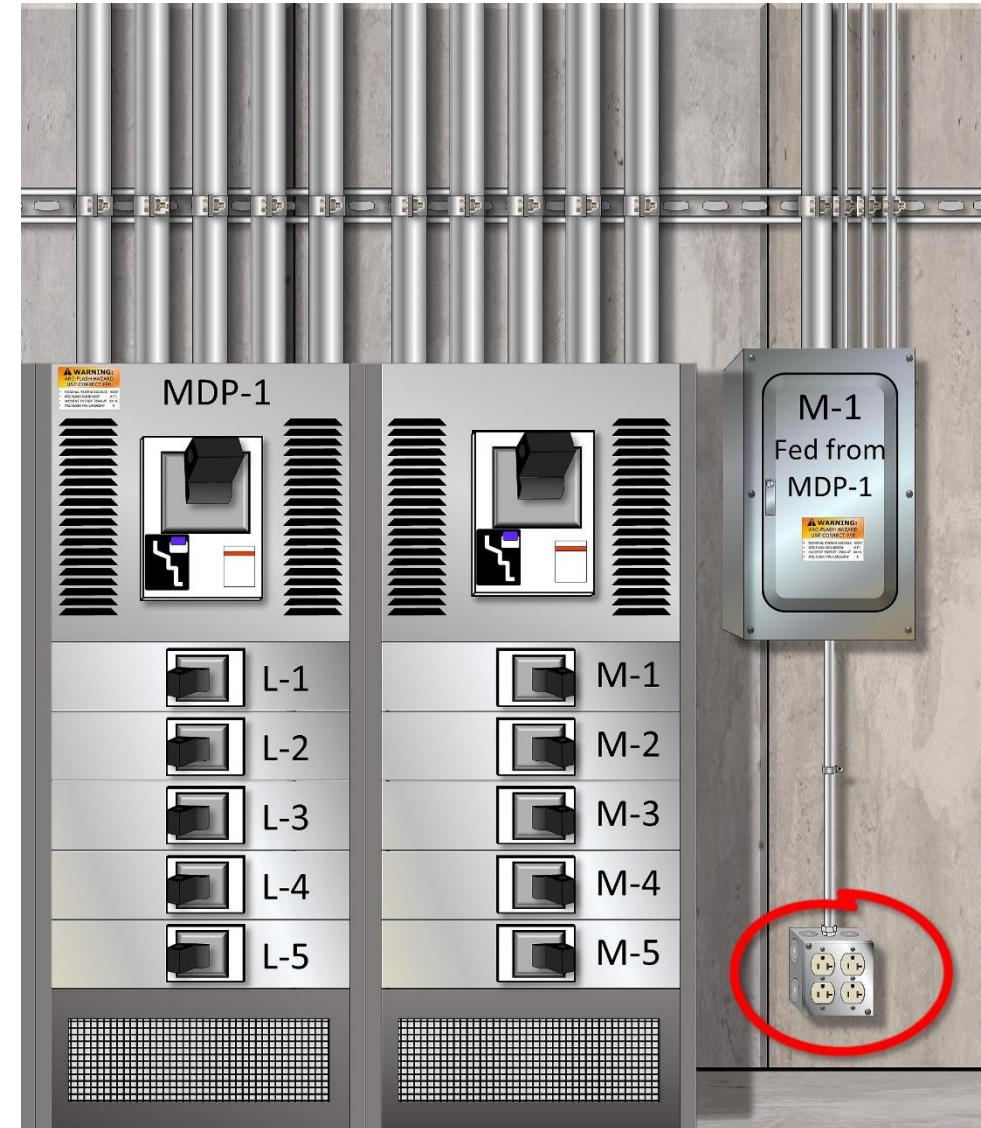


210.64 – Receptacle at (Indoor) Electrical Service Areas

- At least one...receptacle outlet shall be installed in an accessible location within 25-feet of the indoor electrical service equipment, and located within the same room or area as the equipment

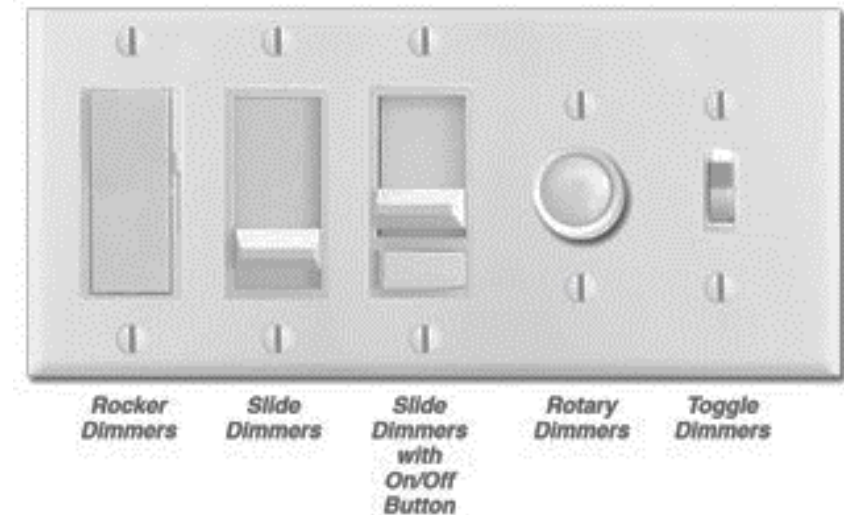
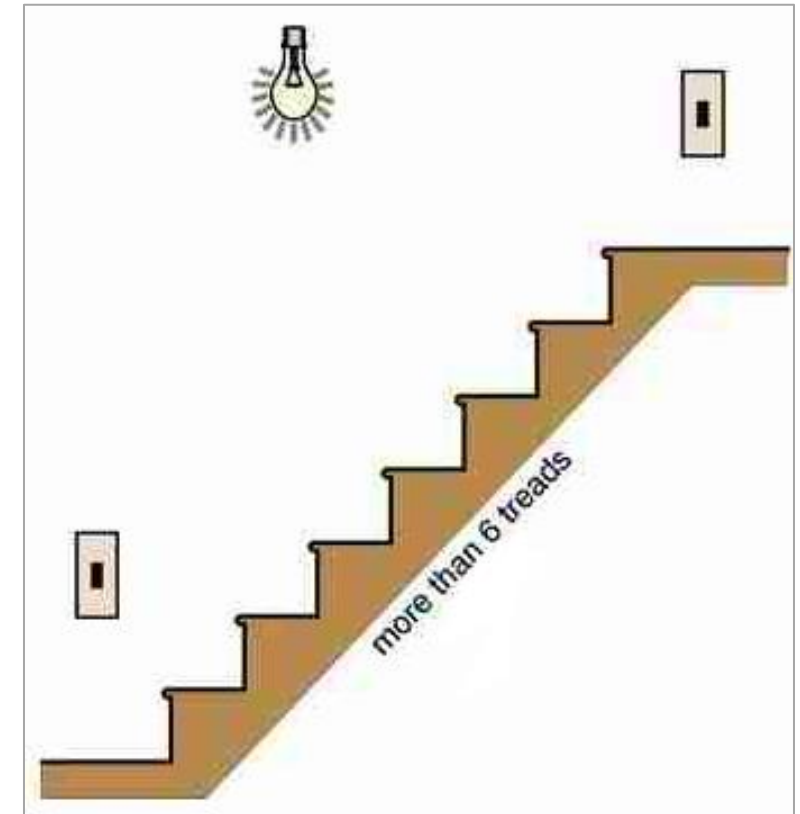
Exception #1: Not required in one- and two-family dwellings

Exception #2 (new): Not required where service voltage is greater than 120 volts to ground for services dedicated to equipment covered in Articles 675 and 682.



210.70 (A)(2)(4), VRC E3903.3.1- Dimmer Switches at Stairways

- The use of dimmer switches in these locations is now allowed, but only if **they provide the full range of dimming control at each location.**
- Applies to all occupancy types



210.70 (C) – Lighting Outlet(s) All Occupancies

- Changed from “Other Than Dwelling Units” to “All Occupancies”
- This lighting outlet requirement for storage or equipment spaces now applies to all **attics, underfloor spaces, utility rooms, and basements.**

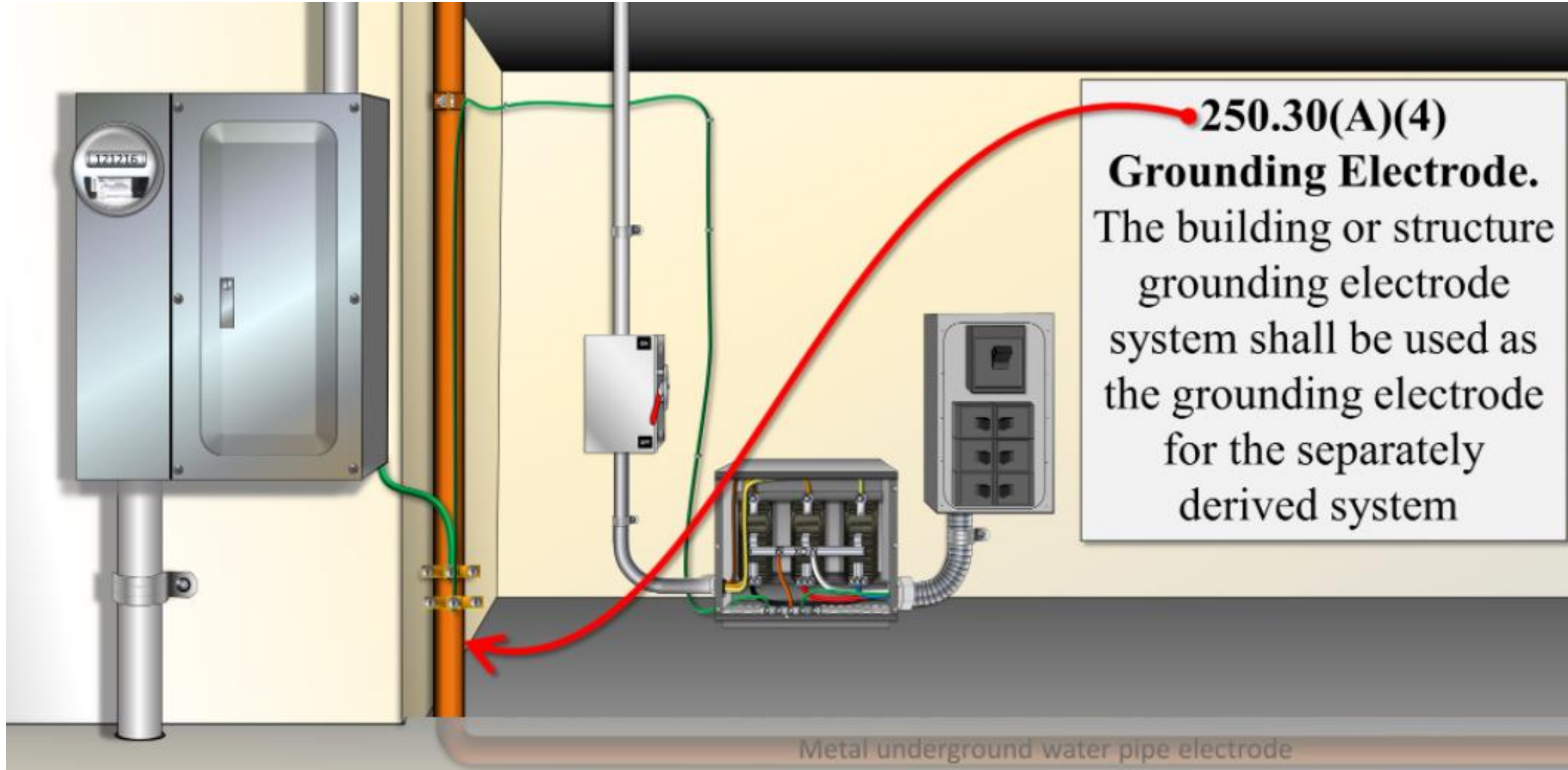


210.71 – Receptacle Outlets in Meeting Rooms

- New receptacle outlet requirements were added at 210.71 for non-dwelling unit meeting rooms, such as those found at hotels and convention centers.
- Addresses the minimum number of fixed-wall receptacle outlets, floor receptacle outlets, and floor spacing requirements



250.30 (A)(4) & (A)(5) – Grounding Electrode Conductor for a Single Separately Derived System



250.30 (A)(6) (a) – Grounding Electrode Conductor – Multiple Separately Derived Systems

- Metal water piping that complies with 250.68(C)(1) is now allowed to be used as common grounding electrode conductor for multiple separately derived systems

Grounding electrode conductor tap. Sized based on the size of the derived secondary conductors using Table 250.66.

Structural building steel can be used as a conductor to extend each transformer GEC to the grounding electrode.

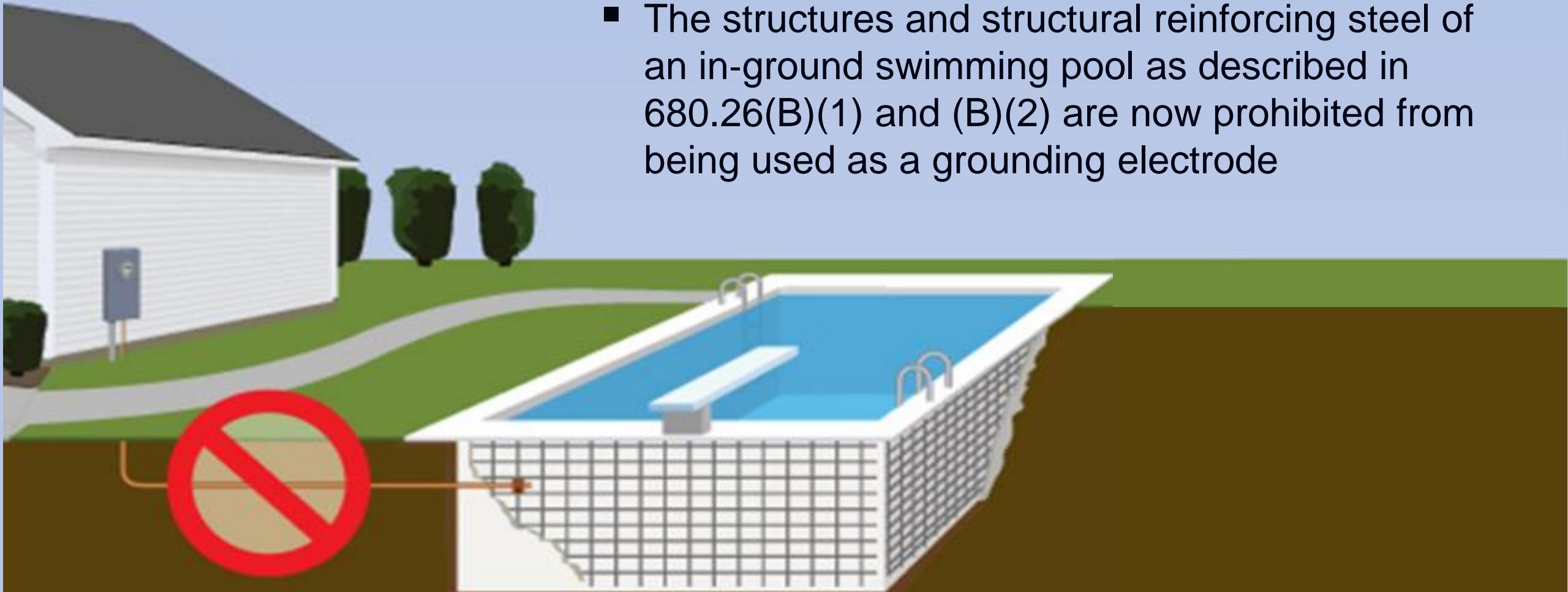
Interior metal water piping (electrically continuous with a metal underground water pipe electrode) and located no more than 5 ft. from the point of entrance to the building is permitted to extend the connection to an electrode.

3/0 AWG
copper GEC

Metal underground water pipe electrode

250.52(B)(3) – Swimming Pools Not Permitted for Use as a Grounding Electrode

- The structures and structural reinforcing steel of an in-ground swimming pool as described in 680.26(B)(1) and (B)(2) are now prohibited from being used as a grounding electrode



What questions do you have about the changes to Chapters 2 and 3?

Skill Check 1

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Chapter 3

Wiring Methods and Materials

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300.5 (D)(4) – Enclosure or Raceway Damage



- EMT now permitted to be used to protect cables subject to physical damage.
- If subject to corrosive environment, corrosion protection per 358.10

Table 300.5 – Minimum Cover Requirements

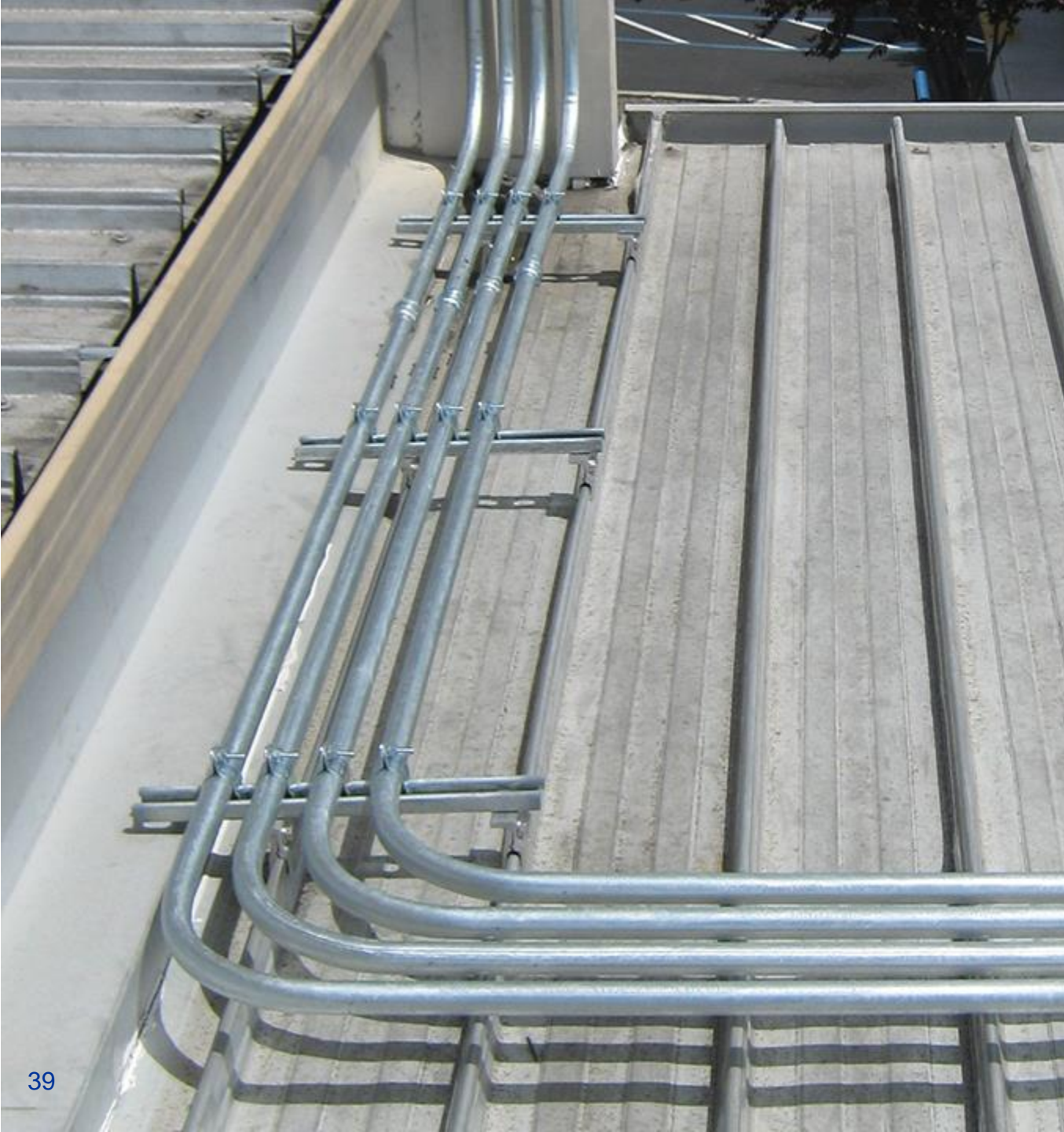
- Table 680.10 has been deleted and all requirements are now covered under **Table 300.5**.
- Two new footnotes were added for
 - Listed low voltage lighting systems
 - Pool, spa, and fountain lighting meeting certain conditions



300.5 (G) – Raceway Seals

- Conduits or raceways “through which moisture may contact live parts” **were already required to be “sealed or plugged at either or both ends”**.
- **Spare or unused raceways** are now required to be sealed
- **Sealant must now be identified** for use with the products being sealed.

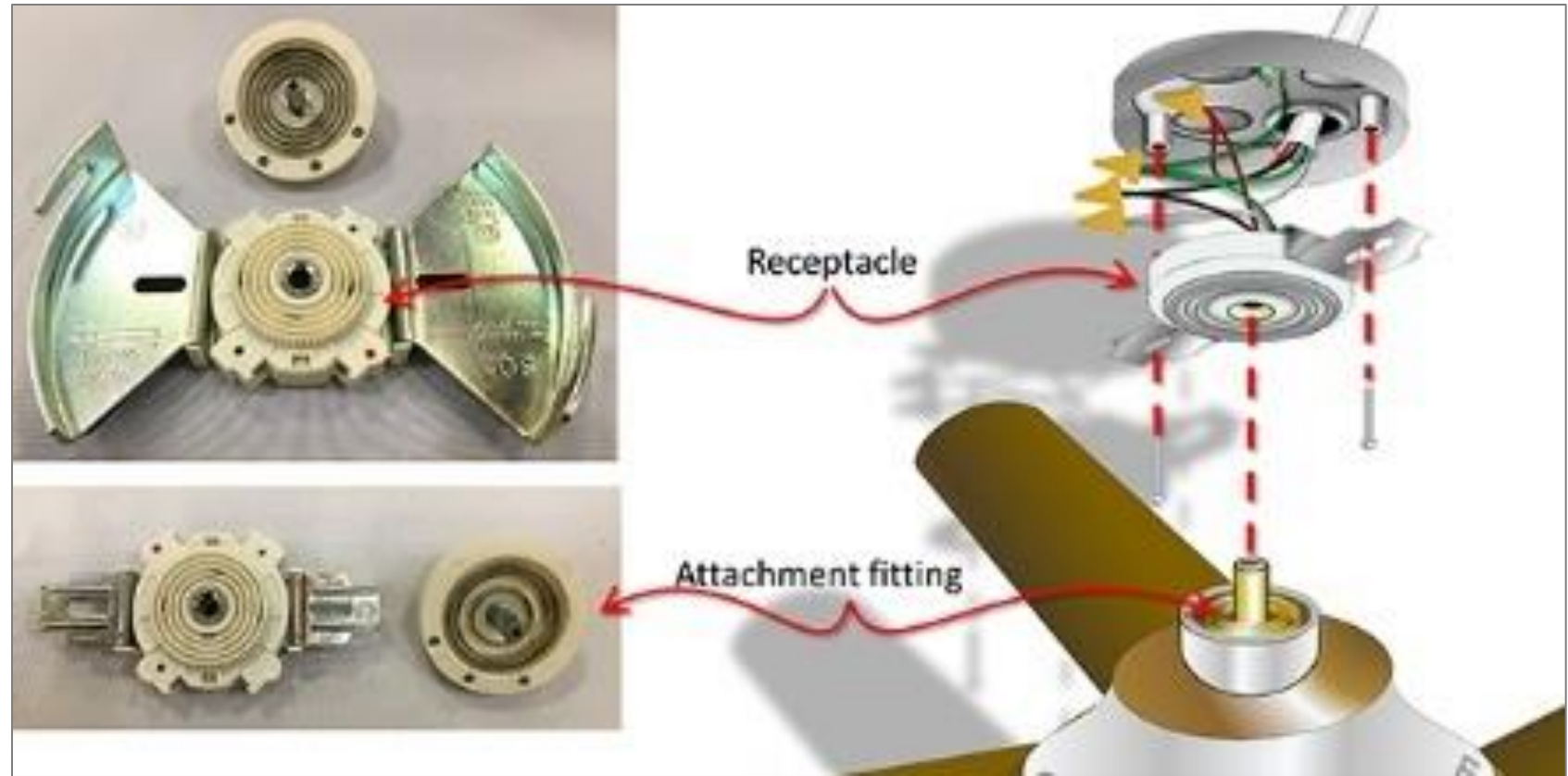




310.15 (B)(3) (c)- Raceways & Cables Exposed to Sunlight on Rooftops

- Table 310.15(B)(3)(c) is deleted
- Exposed cables & raceways must be installed a minimum of 7/8 inch above the roof.
- If less than 7/8 inch, add 60°F (33°C)

314.27 (E) – Separable Attachment Fittings



- Outlet boxes are now permitted to support **listed locking support and mounting receptacles** used in combination with **compatible attachment fittings** for supporting a luminaire, lampholder, or ceiling suspended (paddle) fan

320.6 – Listing Requirements



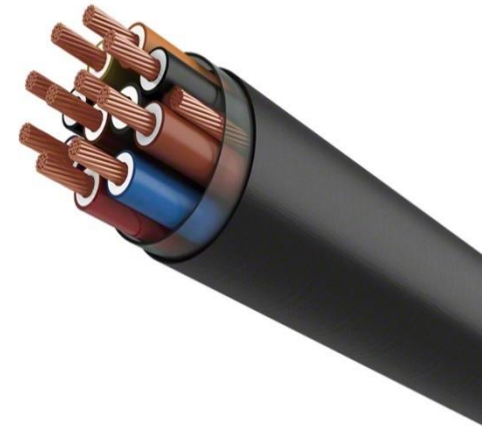
New requirements are added requiring most **wiring method (*cable*) and associated fittings** to be **listed**.



Same Listing Requirement Applied in 9 Locations:

320.6	Armored Cable: Type AC
322.6	Flat Cable Assemblies: Type FC
328.6	Medium Voltage Cable: Type MV
330.6	Metal-Clad Cable: Type MC
332.6	Mineral-Insulated, Metal-Sheathed Cable: Type MI
334.6	Nonmetallic-Sheathed Cable: Types NM, NMC, and NMS
336.6	Power and Control Tray Cable: Type TC
338.6	Service-Entrance Cable: Types SE and USE
340.6	Underground Feeder and Branch-Circuit Cable: Type UF

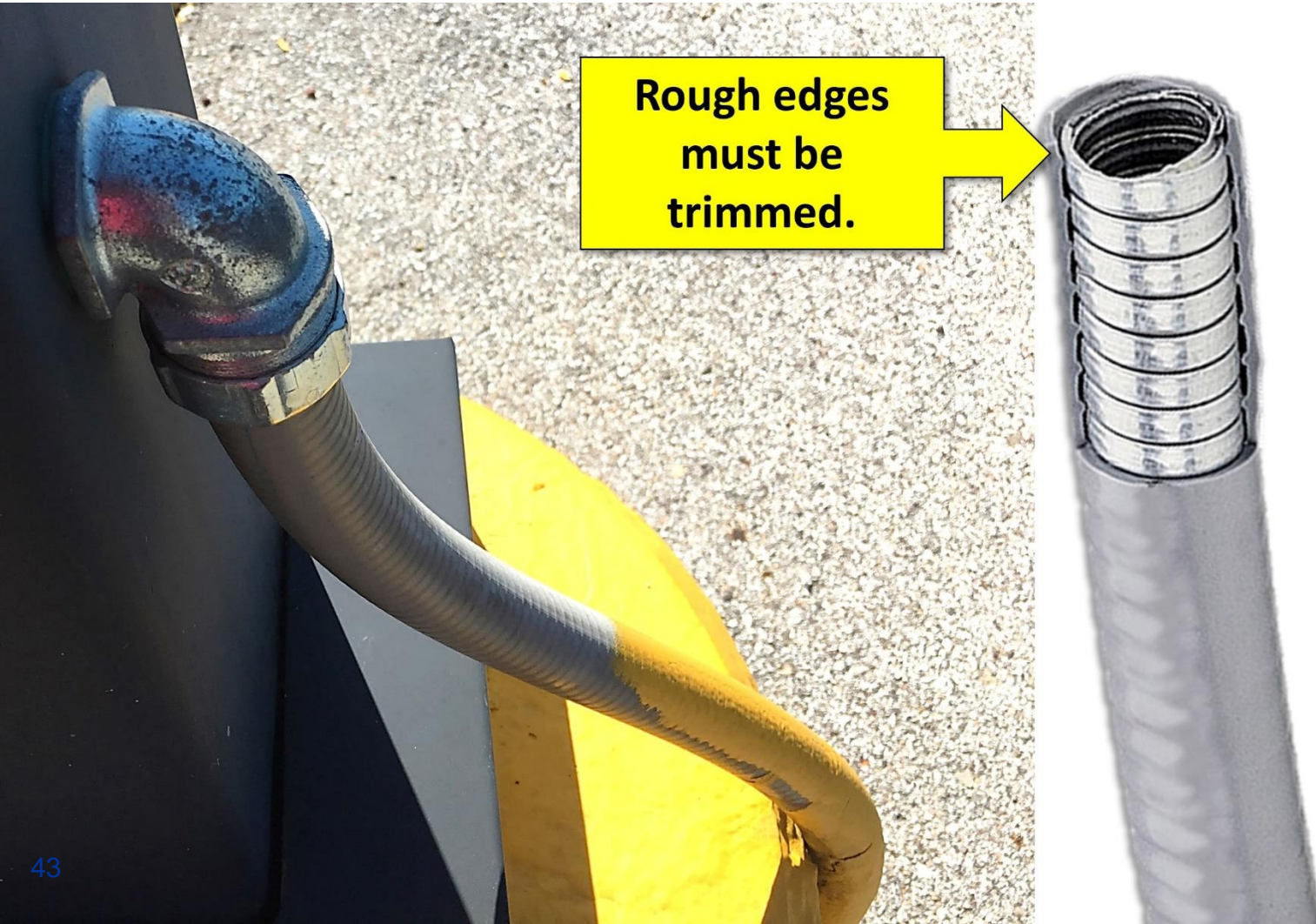
336.10 (9) – Uses Permitted for Type TC Cable



- **Type TC-ER** cable with a designation of “**JP**” (joist pull) will now be allowed to be installed exposed without a raceway at one- and two-family dwelling units
- Especially popular for standby generator installations



350.28 – Trimming of LFMC



- New language added requiring cut ends of liquidtight flexible metal conduit (LFMC) to be **trimmed inside and outside** to remove rough edges
- Proper trimming is necessary to allow the proper installation of the steel grounding ferrule and to maintain ground continuity of the steel sheath of the LFMC

Chapter 4

Equipment for General Use

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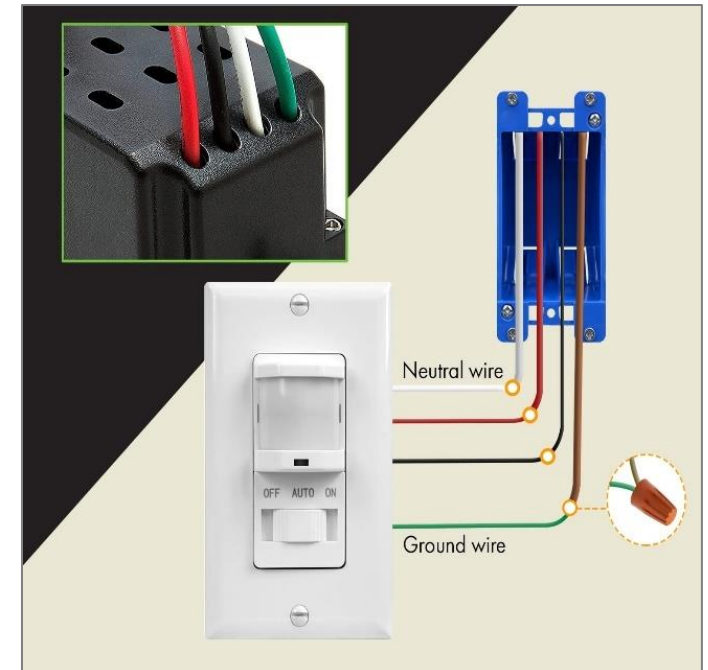
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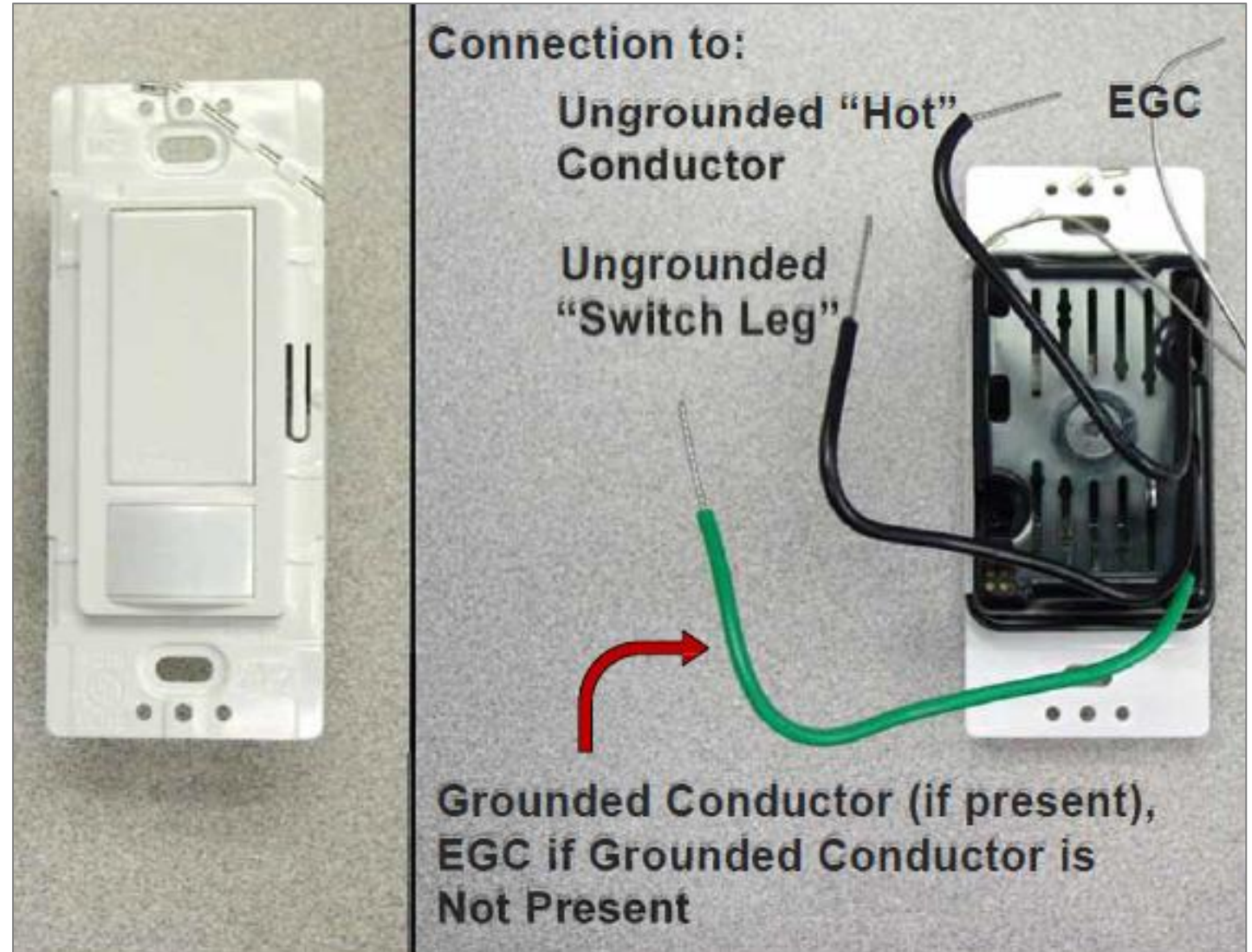
404.2 (C) & VRC E4001.15 – Grounded Conductor at Switch Locations

- Exception added to **exclude replacement or retrofit switches** if conditions met
- Exception added to limit the number of electronic lighting control switches on a branch circuit (5) or feeder (25)



404.22 – Electronic Lighting Control Switches

- New provisions added for “Electronic Lighting Controlled Switches” **prohibiting current** on the **equipment grounding conductor**



406.3 (F) – Receptacle with USB Charger

- New provisions require these devices to be **listed** and constructed such that the Class 2 circuitry is **integral with the receptacle**



406.6 (D) – Receptacle Faceplate with Integral Night Light and/or USB Charger

- New provisions require these devices to be **listed** and constructed such that the Class 2 circuitry is “**integral with the flush device cover plate**”



Courtesy of SnapPower

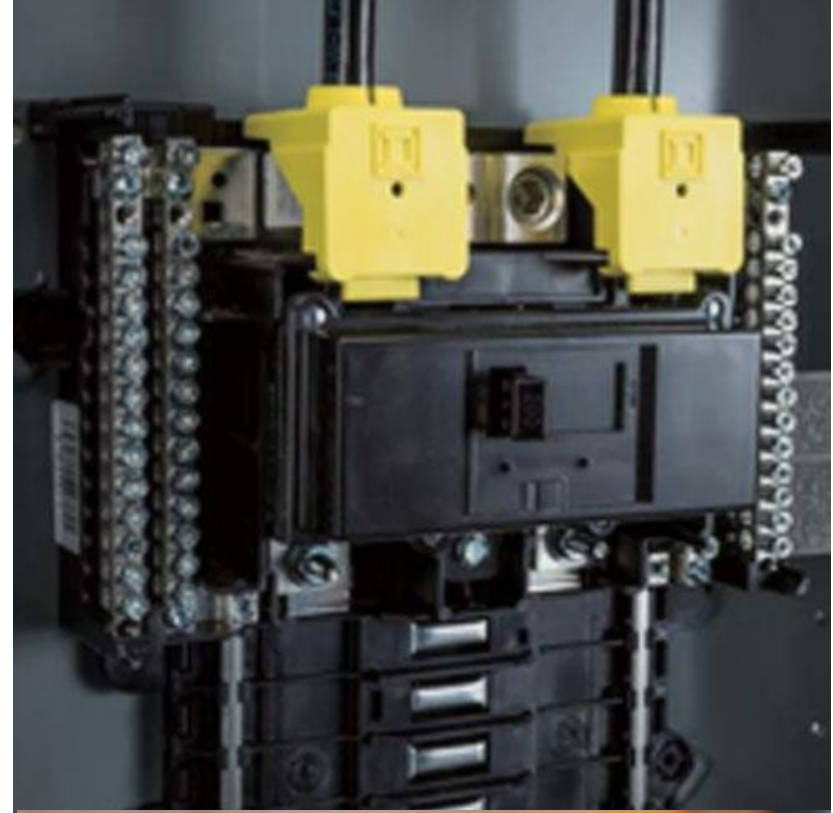
406.12- Tamper-Resistant (TR) Receptacles

- List is expanded and now includes additional locations where tamper-resistant receptacles are required
- Locations are based on “where small children are likely to congregate”.



408.3 (A) (2) - Barriers at Service Panelboards

- New requirements added for **barriers** to be placed in all **service panelboards**
- Identified as a **safety concern** by installers and proponents of electrical safety in the workplace



422.5 – GFCI Protection for Personnel (appliances)

- All GFCI protection requirements for appliances were consolidated into 422.5 for simplicity.
- Appliances requiring GFCI protection are listed in Part (A).
- Part (B) Provides location requirements.



422.16 (B) (2) – Built-In Dishwashers and Trash Compactors (E4101.3)

Dishwasher

- Outlet in **adjacent space only**, cord length between **3 – 6.5 ft.**

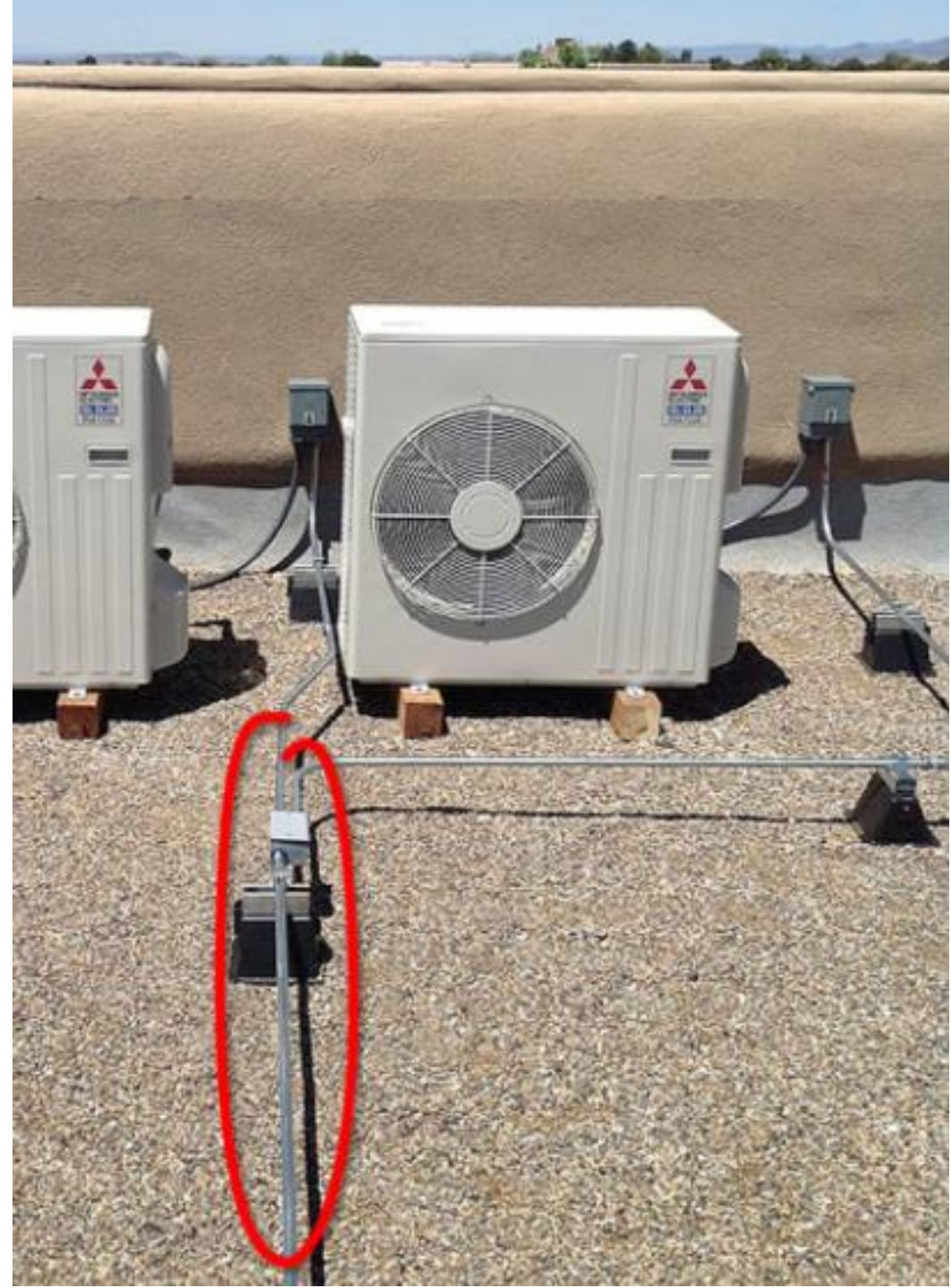
Trash Compactor

- **Same or adjacent space**, cord length **3 – 4 ft.**



440.9 – Grounding and Bonding

- A new code section was added to address HVAC equipment grounding and bonding when metal raceways are involved.



What Questions?

Skill Check 2

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Chapter 5

Special Occupancies

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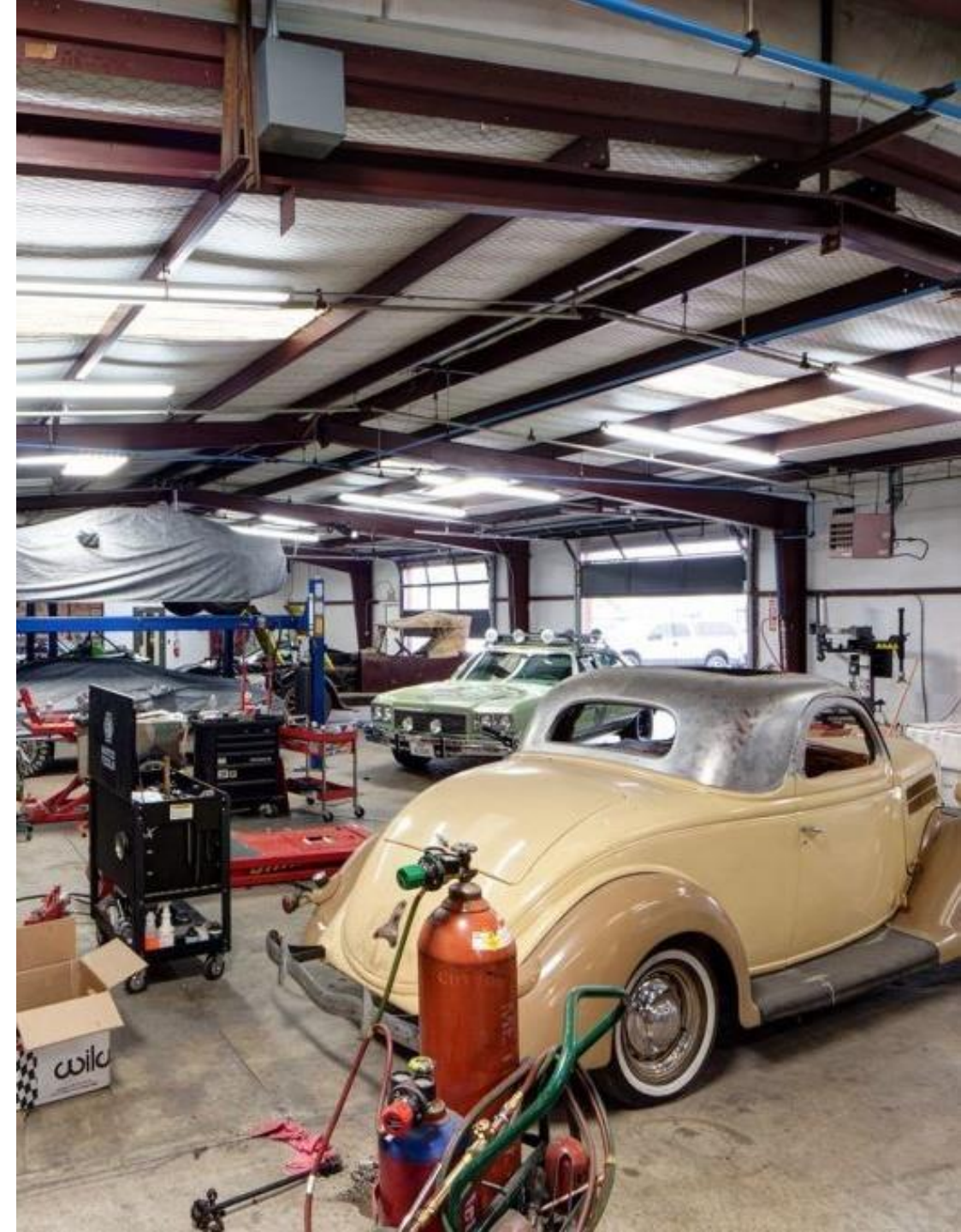
500.2 – Definitions (related to hazardous locations)

- All relocated to Article 100 [CMP-14]



511 – Commercial Garages, Repair and Storage

- Two new tables 511.3 (C) & (D) replace previous text and better describe how to classify these facilities



511.8, 514.8 – Underground Wiring

- New Section 511.8 allows the use of PVC, RTRC and HDPE conduit for underground wiring in Commercial Garages
- Section 514.8 now allows HDPE conduit for underground wiring in motor fuel dispensing facilities
 - For both – applies when installed under a minimum of 24" of cover and other specific criteria are met



514.11 - Circuit Disconnects – Motor Fuel Dispensing Facilities

- Sections (A), (B), & (C) are updated to clarify requirements for emergency shutoff devices for attended and unattended facilities



516 Part IV - Spray Application Operations in Membrane Enclosures

- New Part IV addresses classification requirements for these enclosures
- Informational note provides references for more information on restrictions and limited uses

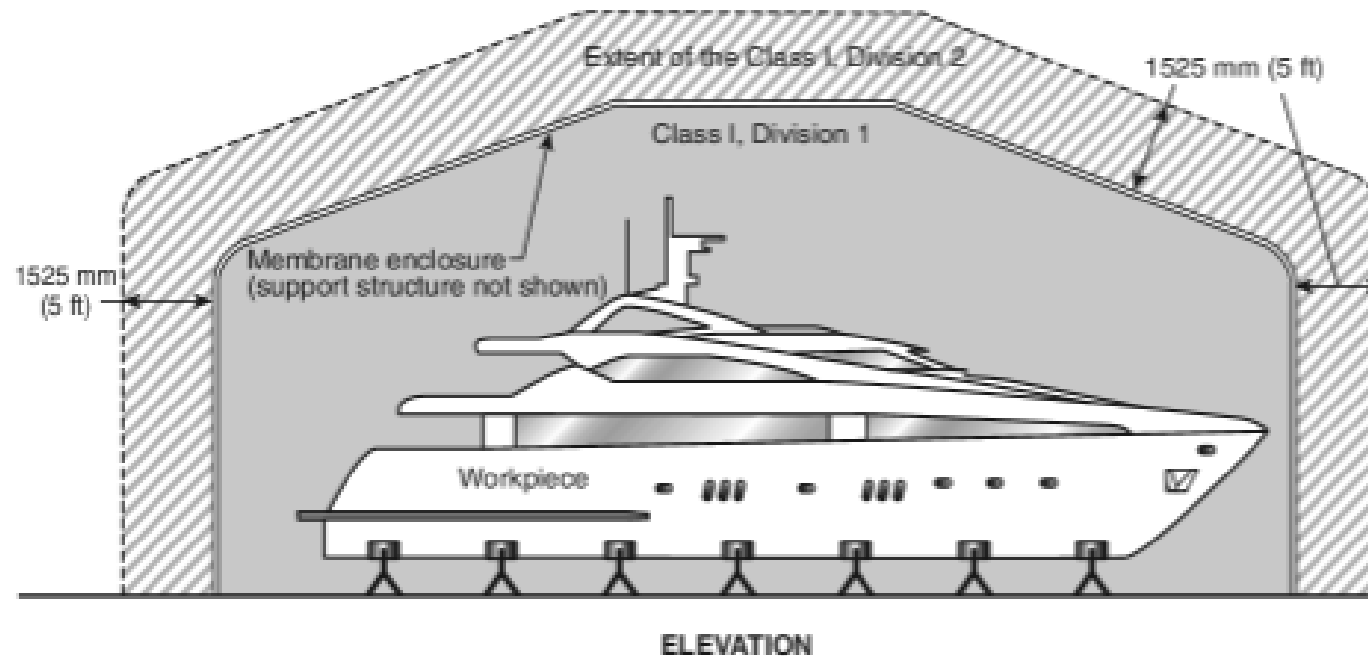


FIGURE 516.18 Electrical Classifications for Temporary Outdoor Membrane Enclosures
[33:Figure 18.7.1.1]

517.2 – Health Care Facilities - Definitions

- *Patient Care Space “Category 1-4”*
- *Governing Body*
- *Invasive Procedure*
- *Medical Office (Dental Office)*



517.16 – Isolated Ground Receptacles

- New sections have been added to cover requirements for the installation of IGR in patient care spaces outside of a patient care vicinity



525.23 (D) – Carnivals, Circuses, Fairs, and Similar Events – GFCI Protection

- GFCI shall be listed, labeled, and identified for portable use.



New Article 555

Adopted from the
2020 NEC

3 slides

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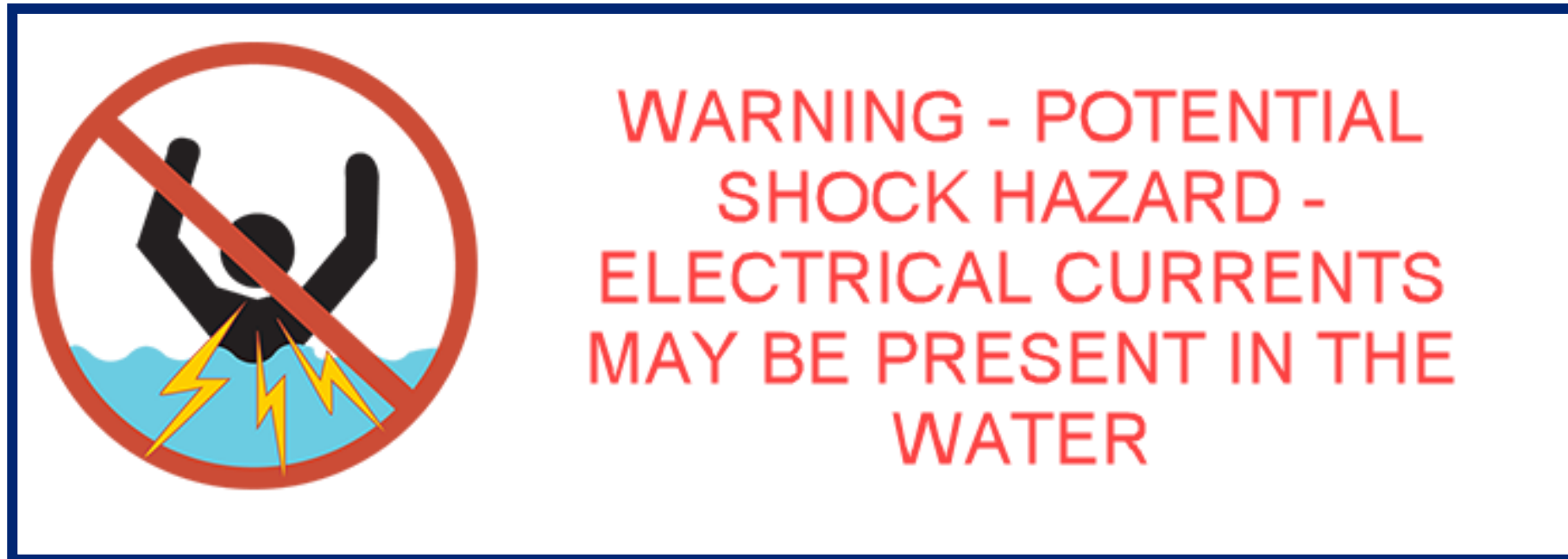
555 (2020) - Marinas, Boatyards, and Commercial/Noncommercial Docking Facilities

- Now applies to **all dwelling unit boat docking facilities**



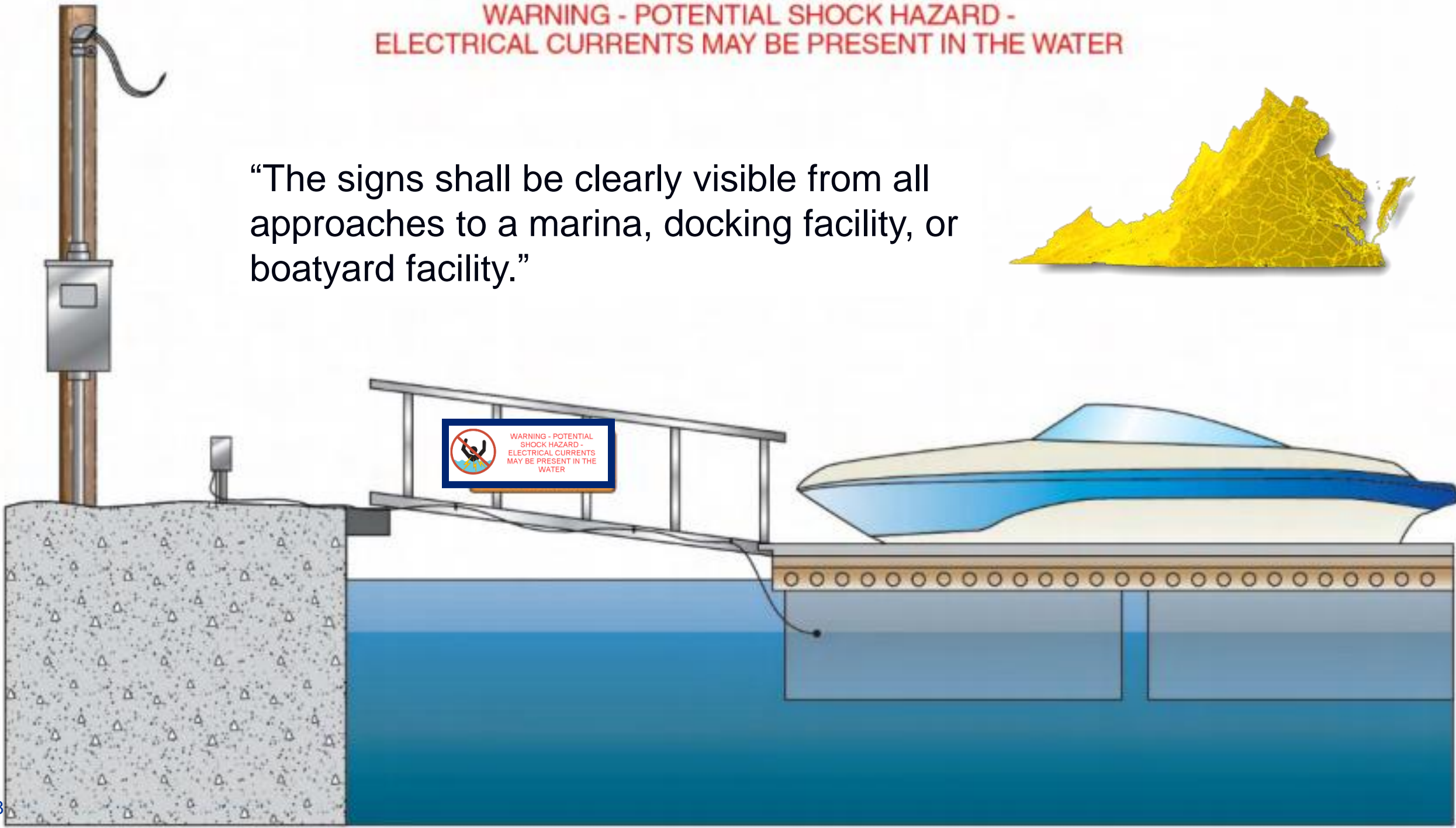
555.10 (2020) – Signage – Marinas, Boatyards, and Commercial/ Noncommercial Docking Facilities

- New requirement for precautionary signage clearly visible from all approaches



WARNING - POTENTIAL SHOCK HAZARD -
ELECTRICAL CURRENTS MAY BE PRESENT IN THE WATER

“The signs shall be clearly visible from all approaches to a marina, docking facility, or boatyard facility.”



Chapter 6

Special Equipment

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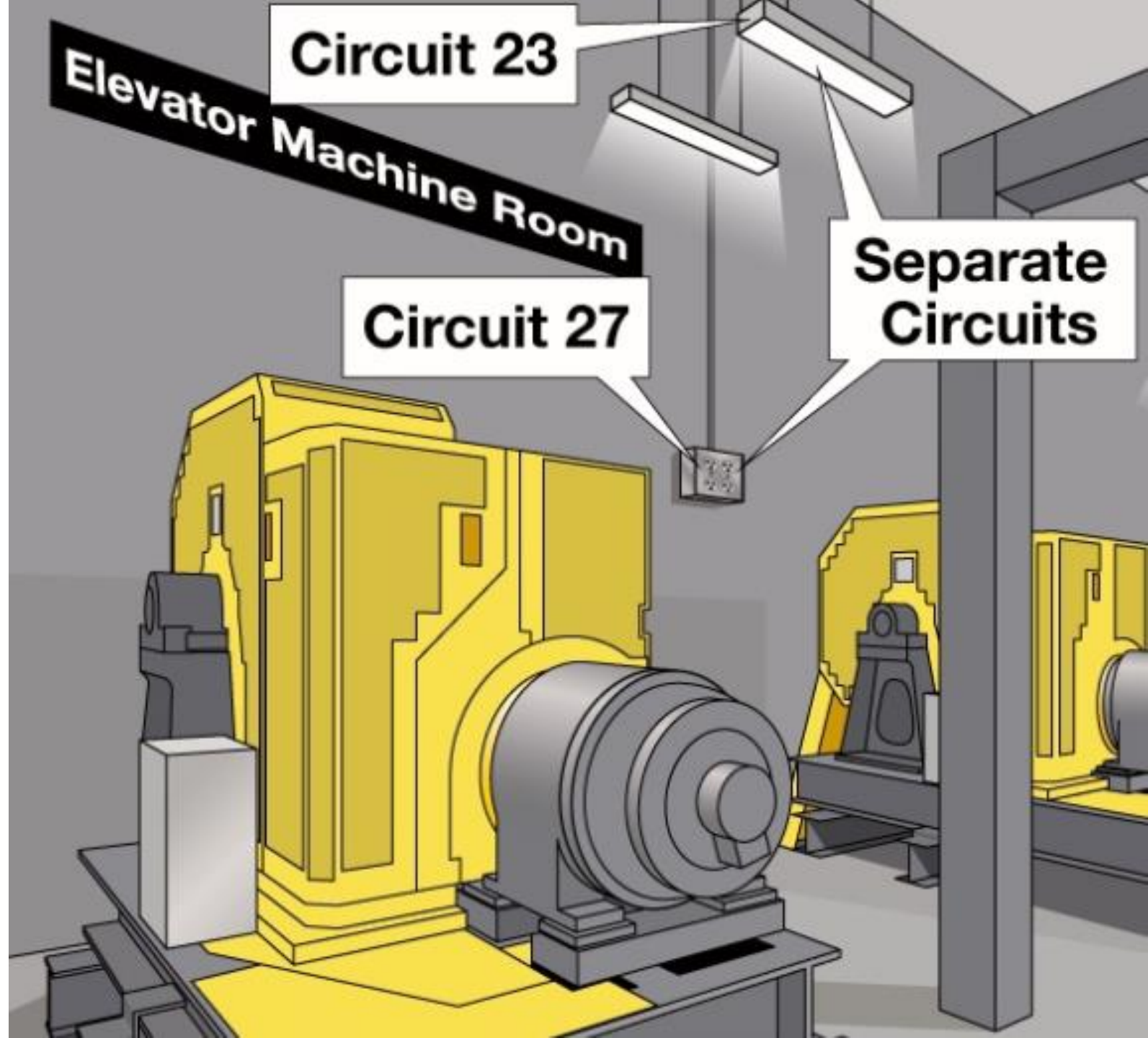
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620.23 – Branch Circuits for Machine Room or Control Room/ Machinery Space

- Change requires the circuit supplying the lighting to be separate from the circuit supplying the receptacles.



625.2 – Definitions – Electric Vehicle Charging Systems

Two new definitions

- Wireless Power Transfer
- Wireless Power Transfer Equipment



680.2 and 680.80

New definition AND section for *Electrically Powered Pool Lift*

- A new definition and a new part VIII was added for electrically powered pool lifts.
- Article 680 now addresses these types of installations with adequate safety requirements for all pool users.



680.2 – Definitions – Storable Pools

Revised: *Storable Pools*

- *Definition clarified by adding “constructed on or above the ground”*



680.7 – Swimming Pools... - Grounding and Bonding Terminals

- Grounding and Bonding Terminals shall be **identified for use** in wet and corrosive environments.
- Field-installed grounding and bonding connections in a damp, wet, or corrosive environment shall be composed of **copper, copper alloy, or stainless steel** and **listed for direct burial use**.



~~Table 680.10— Underground Wiring Location~~



- Provisions of 680.10 (Underground Wiring Location) are moved to 680.11 - Table 680.10 is deleted.
- Table 300.5 burial depth requirements will now apply around swimming pools, hot tubs, fountains, and similar installations
- Also, underground wiring is now permitted to be installed in close proximity of the pool regardless of whether “necessary to supply pool equipment” or not.



680.12 & 680.14

- New requirement for **protection against a corrosive environment** for electrical equipment installed in equipment rooms and pits added at **680.12** and **680.14**
- New provisions added at 680.14 for locations considered to be a **corrosive environment**



Article 690

Solar Photovoltaic (PV) Systems

- 4 related slides

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2017



690.7 – Maximum Voltage of PV Systems

- Maximum Voltages Updated

On 1 & 2 Family Dwellings	600 Volts DC
On Commercial Buildings	1000 Volts DC
Free-Standing Systems	1500 Volts DC



690.12 – Rapid Shutdown of PV Systems on Buildings

- “Rapid Shutdown” requirements have been revised and divided into four sub-sections
- Emphasizes that the main purpose is **reduced shock hazard for emergency responders**
- Controlled conductors outside the “array boundary” (1’ in all directions) must comply with new 690.12(B)(1)
- Switch must be located **outside** for 1 & 2 family dwellings



690.13 & .15

- Part III - Disconnecting Means
 - has been rewritten and reorganized to include several new code sections
 - New .15 (B) Interrupting Rating
 - New .15 (C) Isolating Device
 - New .15 (D) Equipment Disconnecting Means

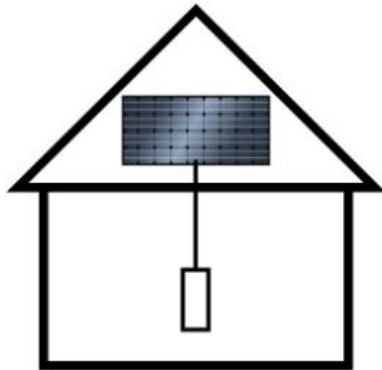


690.56 (C) – Identification of Power Sources - Rapid Shutdown

- Identification label requirements are revised extensively
- Switch must be labeled “RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM”
- Two label options based on what type of rapid shutdown system is present

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN
SWITCH TO THE
“OFF” POSITION TO
SHUT DOWN PV SYSTEM
AND REDUCE
SHOCK HAZARD
IN THE ARRAY.



SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN
SWITCH TO THE “OFF”
POSITION TO SHUT DOWN
CONDUCTORS OUTSIDE THE
ARRAY. CONDUCTORS WITHIN
THE ARRAY REMAIN ENERGIZED
IN SUNLIGHT.

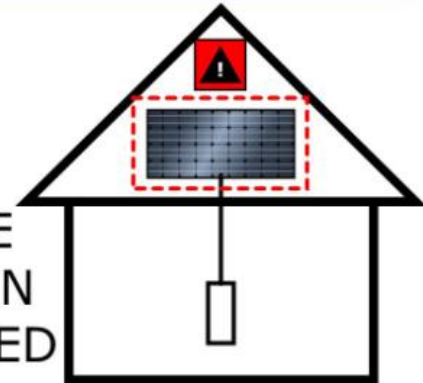


FIGURE 690.56(C)(1)(a) Label for PV Systems that Shut Down the Array and the Conductors Leaving the Array.

FIGURE 690.56(C)(1)(b) Label for PV Systems that Shut Down the Conductors Leaving the Array Only.

Chapter 7

Special Conditions

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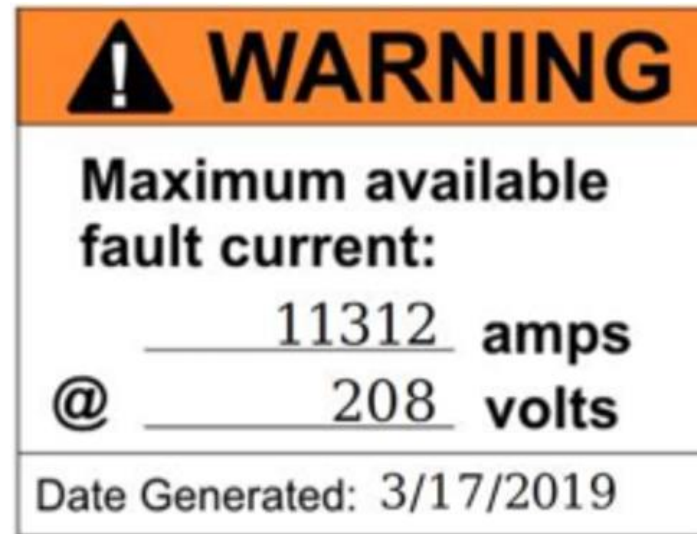
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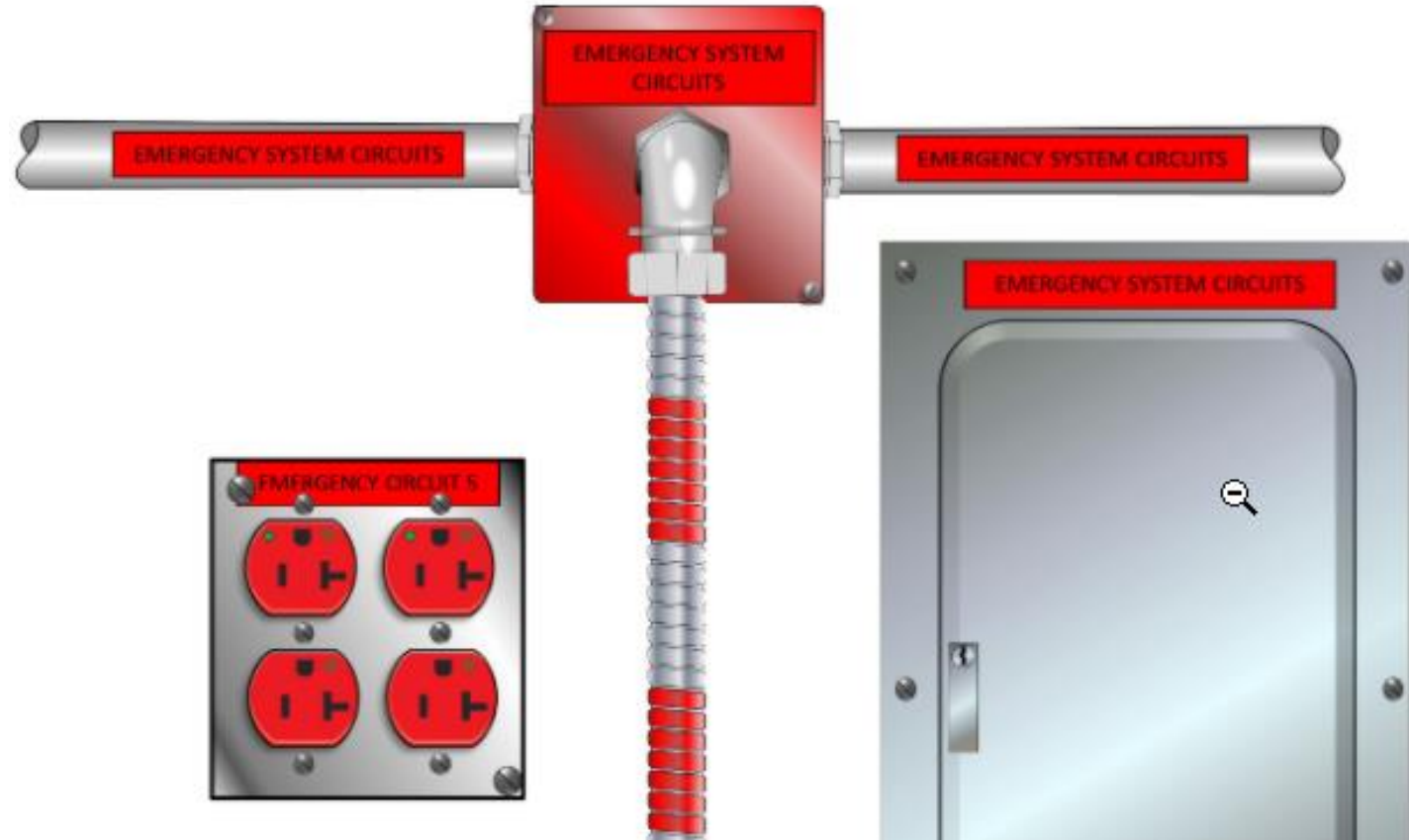
700.5 (E) – Documentation for Transfer Equipment

- Short-circuit rating shall be Field Marked on the exterior of the equipment.



700.10 (A) – Identification (Emergency System Wiring)

- Requirements were revised for the proper identification of emergency systems
- Intent is to provide installers, electricians, and the AHJ with the ability to identify components of an emergency circuit or system



700.10 (D) – Fire Protection – Emergency Systems



- Educational occupancies with an occupant load 300 or greater are added to the list of occupancy types requiring additional feeder protection.
- Revised code language also clarifies the five rules for Feeder-Circuit Wiring protection.

700.10 (D)(3) – Fire Protection – Emergency Systems – Generator Control Wiring Methods

- A new special provision for generator wiring is added at 700.10(D)(3)



702.12 (C) – Power Inlets for Optional Standby Generators

- New requirements added to ensure that disconnection of the power inlet (rated 100 amps or more) does not occur under load.
- 2 new exceptions



What questions are still
out there?

Skill Check 3

NFPA 70®



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2017



Thank You for Attending!

2017 NFPA 70 (NEC) and 2018 Virginia Residential Code (VRC) Part VIII - Electrical

Significant Changes and State Amendments

