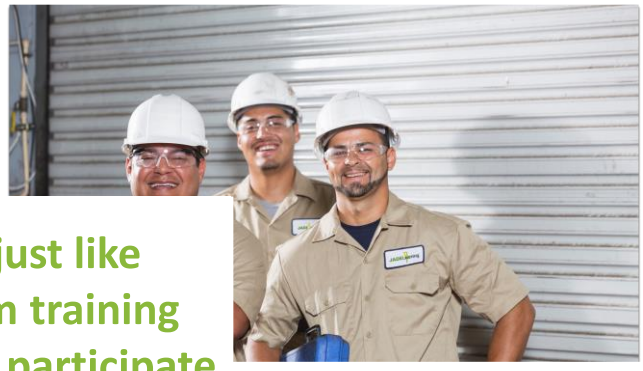

JADE
LEARNING
A TPC COMPANY

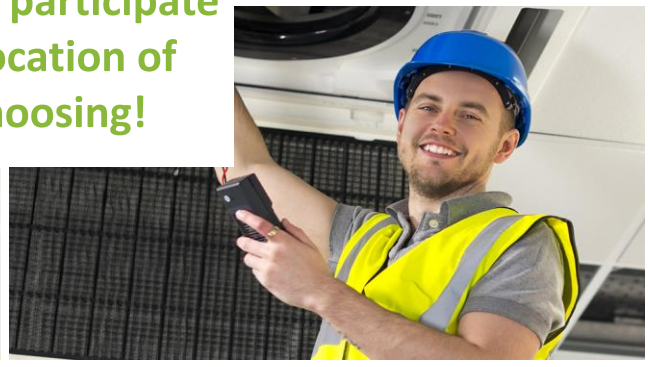
1


JADE Learning
A Trusted
Electrical CE
Provider Since
1996

2



VILT is just like classroom training except you participate from a location of your choosing!

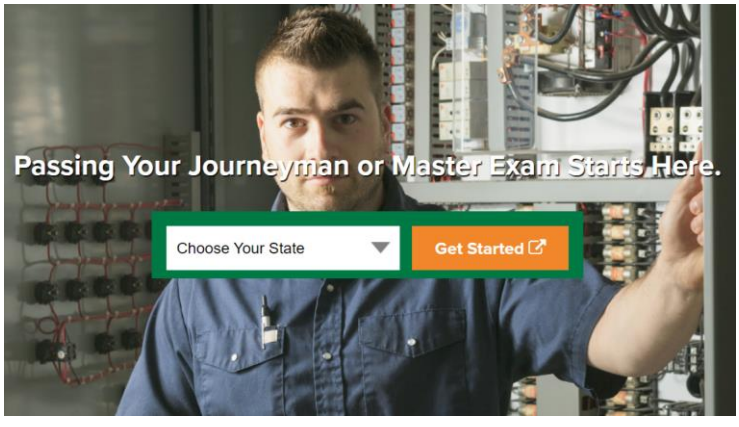


3

JADE LEARNING
A TPC COMPANY

Complete Exam Prep and Practice Tests to Prepare You For Your Next Electrical Exam!

Online Exam Prep



Sign up here:
electricalexamprep.jadelearning.com

2020 NEC Changes

www.jadelearning.com

4

For just $60, the most important NEC updates for 2020 are at your fingertips.

Spend less time searching the Code and more time on-the-job with JADE Learning's new 2020 NEC Challenge!

2020 NEC Challenge

Sign up here:
jadelearning.com/nec-challenge

- Subscribe to the 2020 NEC Challenge
- Receive Questions and Code Explanations for a Year
- Master the 2020 NEC!

INSTALLING PHOTOVOLTAIC SYSTEMS

Based on the NEC

Installing Photovoltaic Systems

Solar PV Training Course Based on the NEC

Learn:

- How PV technology works
- System components
- System types
- How PV power merges with utility
- Bi-directional metering
- Installation methods
- Sizing conductors
- Disconnects
- Rapid shutdown

Sign up here: jadelearning.com/solar-technician-training

JADE LEARNING
A TPC COMPANY

Welcome NC Electricians!

What Does North Carolina Require?

4 to 8 Hours of Continuing Education Required

- NC I, L, U, SP SFD licensees must complete 8 hours of continuing education every year. Half of those hours must come from an in-person or VILT classroom session.
- NC SP-FA/LV, SP-EL, SP-PH, SP-WP, SP-ES, SP-SP licensees must complete 4 hours of continuing education every year. Half of those hours must come from an in-person or VILT classroom session.
- Today's class is worth 4 hours of classroom/VILT continuing education.

JADE LEARNING
A TPC COMPANY

Important Reminders

- If you have trouble hearing or need assistance, let us know.
- Make sure you have paid and provided JADE Learning your electrical license number.
- Be sure to sign-in/check-in and confirm your registration information is correct. Make sure your name is showing correctly.
- You will be emailed a copy of your certificate within 2 business days.
- You must complete a short survey at the end of class to receive credit from the state. Your instructor will provide the link and answer any questions.

Questions? Concerns?

Call the JADE Learning office at 1-800-443-5233

2020 NEC Changes Part 1

Important Changes From the 2020 NEC

8:00 AM – 8:15 AM	**Registration / Check In**
8:15 AM – 9:30 AM	**NEC Introduction and Chapter 1**
9:30 AM – 9:40 AM	**Break**
9:40 AM – 10:30 AM	**NEC Chapter 2**
10:30 AM – 10:40 AM	**Break**
10:40 AM – 11:50 AM	**NEC Chapter 3 and 4**
11:50 AM – 12:00 PM	**Questions for instructor?**
End of class	

2020 NORTH CAROLINA STATE ELECTRICAL CODE

Article 10 - ADMINISTRATIVE SECTION 10.1 states that all **Administrative Regulations & Code Amendments** declared in:

https://www.ncosfm.gov/codes/state-electrical-division/state-electrical-code-and-interpretations

along with requirements from the 2020 National Electrical Code (NFPA-70 - 2020) as adopted by the North Carolina Building Code Council on June 8, 2021, and made effective November 1, 2021, shall be known as the **North Carolina Electrical Code**, and may be cited as such or as the **State Electrical Code**. **NOTE: This code shall not apply to one- and two-family dwellings. The 2017 State Electrical Code shall apply to one- and two-family dwellings.**

JADE LEARNING
A TPC COMPANY

11

11

WHERE TO APPLY NORTH CAROLINA ELECTRICAL CODE

NEW 2020 NC Electrical Code	OLD 2017 NC Electrical Code
Multi-family dwellings such as apartment buildings containing three or more dwelling units.	Single-family dwellings.
Any building with three or more dwelling units such as assisted living facilities.	Two-family dwellings such as duplex buildings.
Commercial spaces where applicable.	
Industrial spaces where applicable.	
Any other space governed by the current NC Electrical Code.	

12

2020 NEC Changes
The Scope of the NEC

JADE LEARNING
A TPC COMPANY

13

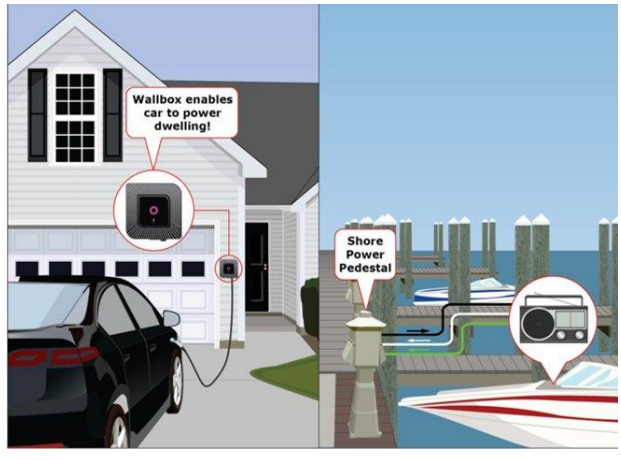
13

90.2(A) Scope. Covered.

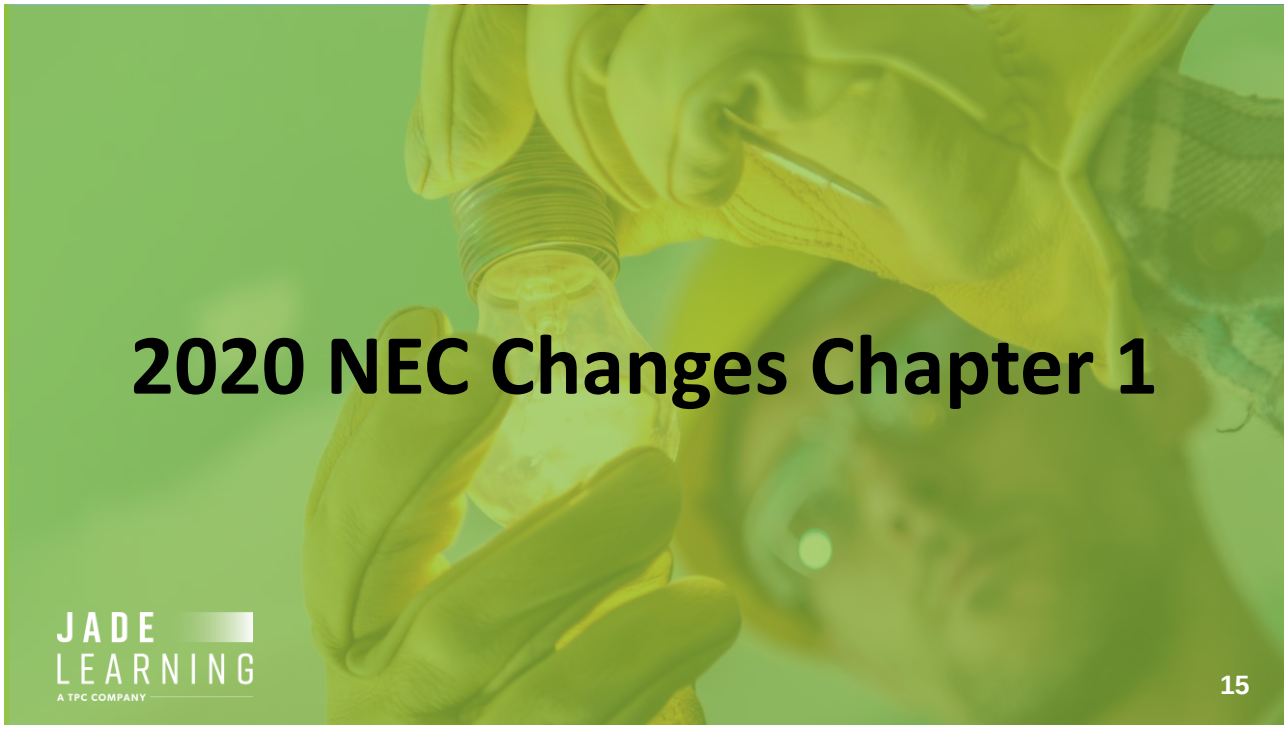
JADE LEARNING
A TPC COMPANY

Newly Added to the Scope of the 2020 NEC

- Installations that supply shore power to ships and watercraft inside marinas and boatyards.
- The monitoring of leakage current at those same installations.
- Installations that export power from electric vehicles to a building or structure's wiring. *(Called bidirectional current flow).*



14



15

JADE LEARNING
A TPC COMPANY

What is CHAPTER-1 of the 2020 NEC?

GENERAL

Chapter 1 covers the following general electrical requirements:

- NEC Definitions
- Requirements for electrical installations

16

Let's Begin with

Definitions

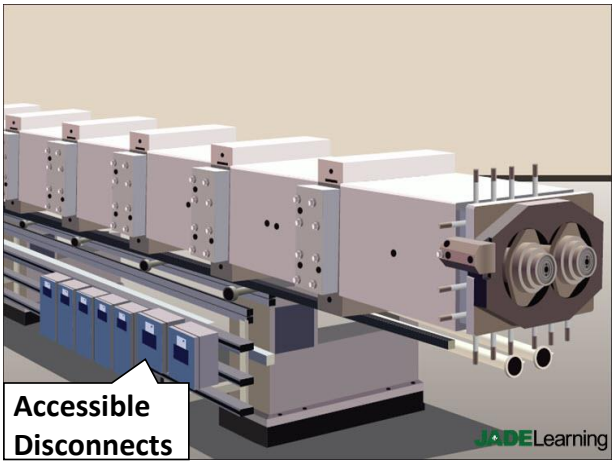
Important Changes in the 2020 NEC

100 Definitions- Accessible.

Newly Revised Definition for: ***Accessible*** *(1 of 3)*

Accessible (Equipment)—
Capable of being reached for operation, renewal, and inspection.

NOTE: This new definition is similar to but not the same as equipment defined as: *READILY ACCESSIBLE*

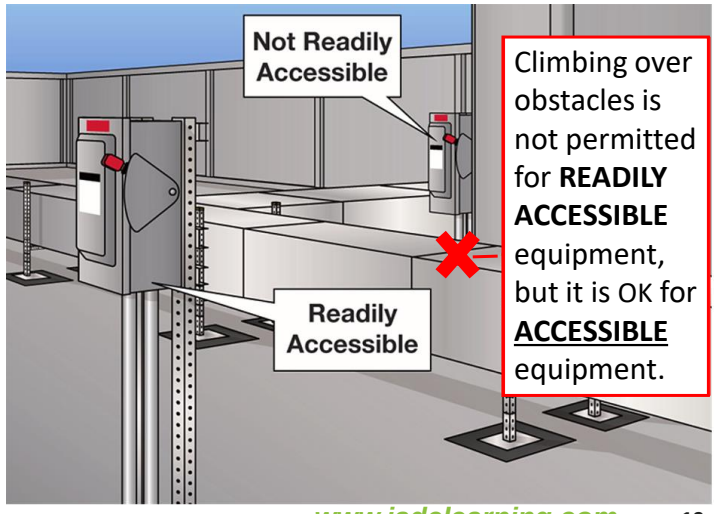


100 Definitions- Accessible.

JADE LEARNING
A TPC COMPANY

Newly Revised Definition for: ***Accessible*** *(2 of 3)*

READILY ACCESSIBLE
Capable of being reached quickly for operation, renewal, or inspection without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders and so forth.



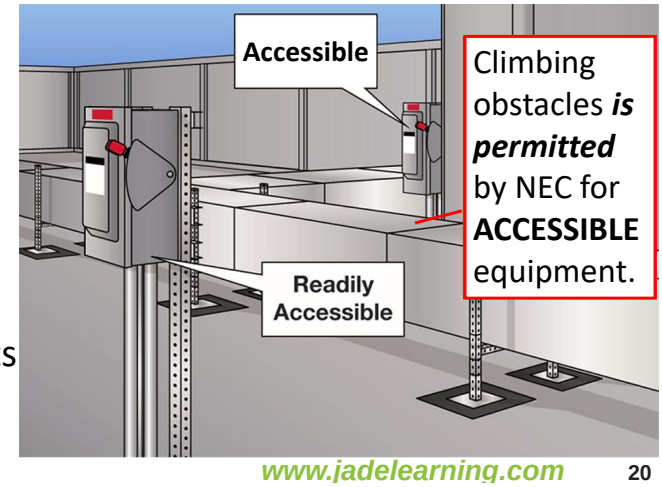
100 Definitions- Accessible.

JADE LEARNING
A TPC COMPANY

Newly Revised Definition for: ***Accessible*** *(3 of 3)*

Summary:
The new definition for *Accessible* is not the same as being *Readily Accessible.*

Notice "ACCESSIBLE" doesn't care if you must use tools or ladders, or if you must climb over or move objects to reach equipment.



100 Definitions- Attachment Fitting.

JADE LEARNING
A TPC COMPANY

A Brand-New Definition: ***Attachment Fitting***

Attachment fitting—
A device that, by insertion into a locking support and mounting receptacle, establishes a connection between conductors of the attached utilization equipment and the branch-circuit conductors connected to the locking support and mounting receptacle.

100 Definitions- Dormitory Unit.

JADE LEARNING
A TPC COMPANY

A Brand-New Definition: ***Dormitory Unit***

(1 of 2)

A Dormitory Unit—

- A building or space in a building where sleeping accommodations are provided for more than 16 people who are not related.
- May be one room or a series of closely associated rooms under single management.
- Does not contain individual cooking facilities.

100 Definitions- Dormitory Unit.

JADE LEARNING
A TPC COMPANY

(2 of 2)

A Brand-New Definition: ***Dormitory Unit***

Now electricians and inspectors can recognize a *DORMITORY UNIT* and properly apply:

GFCI protection:
210.8(B)

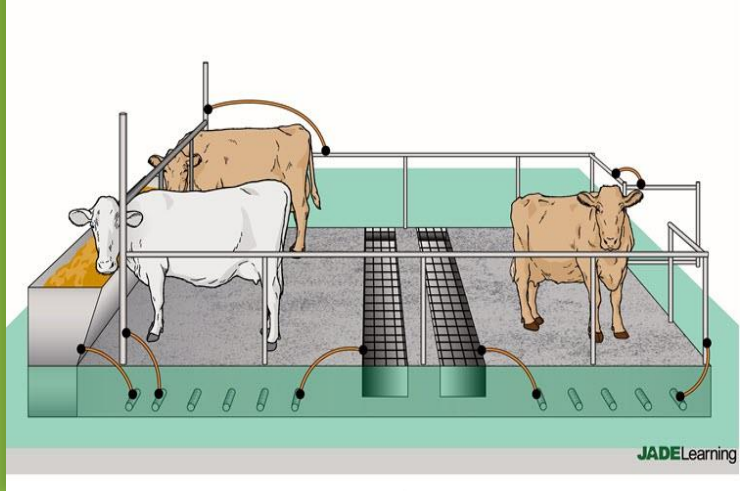
AFCI protection:
210.12(B)

Tamper-resistant receptacles:
406.12(7)

100 Definitions- Equipotential Plane.

JADE LEARNING
A TPC COMPANY

A Brand-New Definition: ***Equipotential Plane***



Equipotential Plane— *Accessible conductive parts bonded together to reduce voltage gradients* (differences) *in a designated area.*

Equipotential simply means: **EQUAL VOLTAGE**

100 Definitions- Fault Current & Available Fault Current.

JADE LEARNING A TPC COMPANY

(1 of 3)

Brand-New Definitions: ***Fault Current & Available Fault Current***

- ***Fault Current—***

The current delivered at a point on the system during a short-circuit condition.

- ***Available Fault Current—***

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition.

100 Definitions- Fault Current & Available Fault Current.

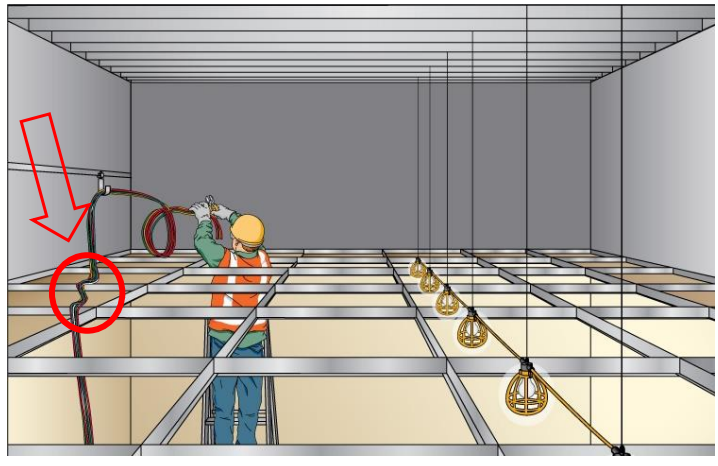
JADE LEARNING A TPC COMPANY

(2 of 3)

Example: ***Fault Current & Available Fault Current***

***Example*:**
If this energized wiring shorts against the metal grid ceiling, the current flowing on the grid ceiling will become the **FAULT CURRENT**.

The MAXIMUM current that can flow during this event is **AVAILABLE FAULT CURRENT.**

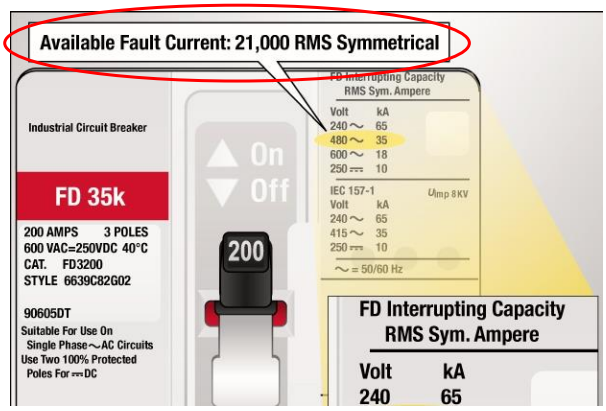


100 Definitions- Fault Current & Available Fault Current.

JADE LEARNING A TPC COMPANY

(3 of 3)

Example: ***Fault Current & Available Fault Current***



Example:
The **AVAILABLE FAULT CURRENT** is marked on this service disconnect switch. The marking means at this specific equipment site, up to 21,000 amps of current can flow should a short-to-ground or phase-to-phase fault event occur.

100 Definitions- Grounded Conductor.

JADE LEARNING A TPC COMPANY

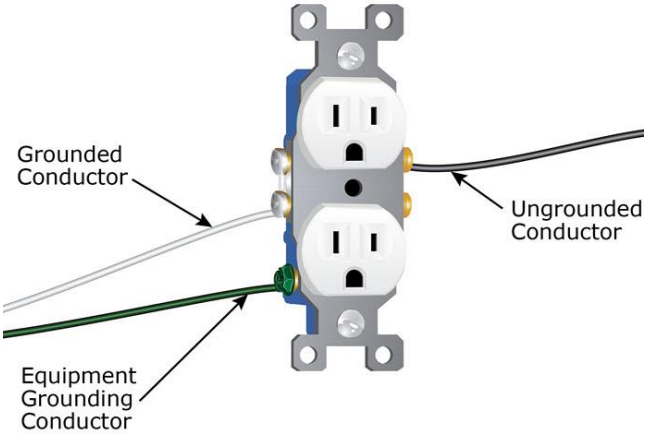
(1 of 2)

A New *Informational Note* says:

Although an Equipment Grounding Conductor (EGC) is grounded, it is not considered a "grounded conductor" by the NEC.

Remember, an EGC is typically green or bare and only carries fault-current; it is NOT considered a current-carrying conductor.

A Grounded Conductor is usually white (or gray) and it is considered a current-carrying conductor.



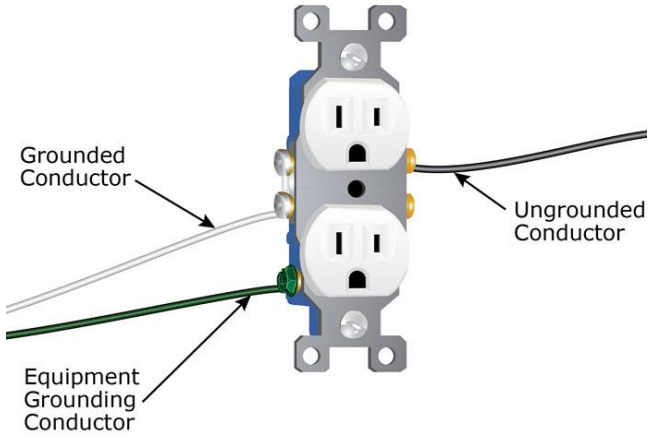
100 Definitions- Grounded Conductor.

(2 of 2)

***Example*:**

Grounded Conductor per the NEC: The white or gray conductor that provides a return path for current and measures zero-volts.

Grounding Conductor per the NEC: The green or bare conductor (or metal conduit) that carries fault-current, should a short-to-ground condition occur. This path enables the circuit breaker or fuse to trip.



100 Definitions- Habitable Room.

Brand-New Definition: ***Habitable Room***

A room for living, sleeping, eating or cooking, but excluding bathrooms, closets, hallways, storage, and utility spaces.

Includes:
- Bedrooms
- Family Rooms
- Kitchens
- Dining Rooms

Does not Include:
- Bathrooms
- Closets
- Hallways
- Storage &
- Utility Spaces

100 Definitions- Island Mode.

Brand-New Definition: ***Island Mode***

JADE LEARNING
A TPC COMPANY

(1 of 2)

WHAT IS ISLAND MODE? If you disconnect power-producing equipment or an isolated microgrid system (such as a solar PV system) from the utility company power that it works in conjunction with, you have placed that equipment or microgrid system into an operational mode called ***ISLAND MODE.***

100 Definitions- Island Mode.

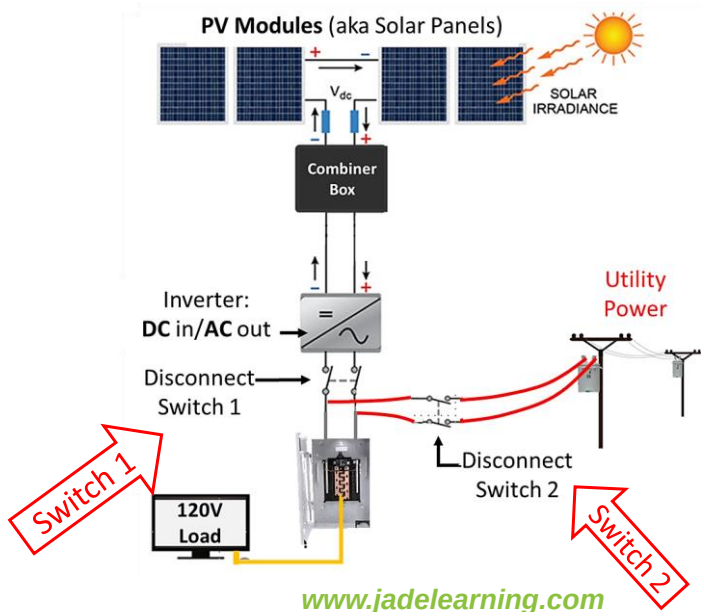
(2 of 2)

JADE LEARNING

Example: ***Island Mode***

To put this microgrid (PV) system into ***ISLAND MODE,*** you would open Switch 2, and close Switch 1.

The power generated by the PV system would then be "islanded" or isolated from utility power.



100 Definitions- Labeled.

A new ***Informational Note*** now accompanies the definition of ***LABELED***

LABELED *(Definition has not changed)—*
Equipment or material with a label, symbol, or identifying mark acceptable to the AHJ.

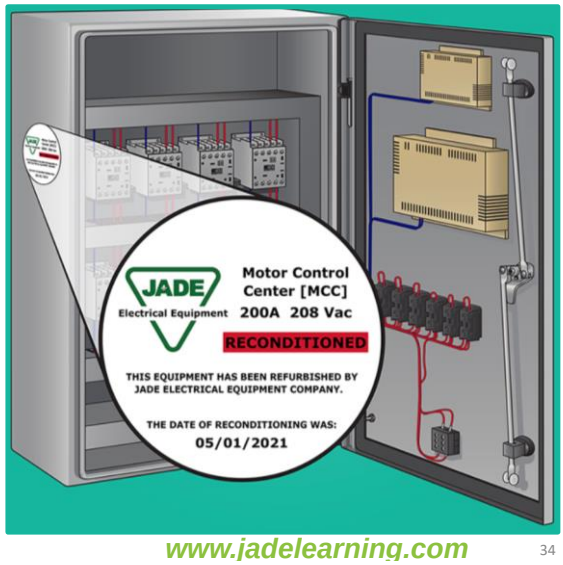
Informational Note *(new for the 2020 NEC)—*
If a listed product is of such a size, shape, material, or surface texture that it is not possible to apply legibly the complete label to the product, the label may appear on the smallest unit container in which the product is packaged.

100 Definitions- Reconditioned.

Brand-New Definition: ***Reconditioned***

Reconditioned—
Electromechanical systems, equipment, apparatus, and components that are restored to operating conditions.

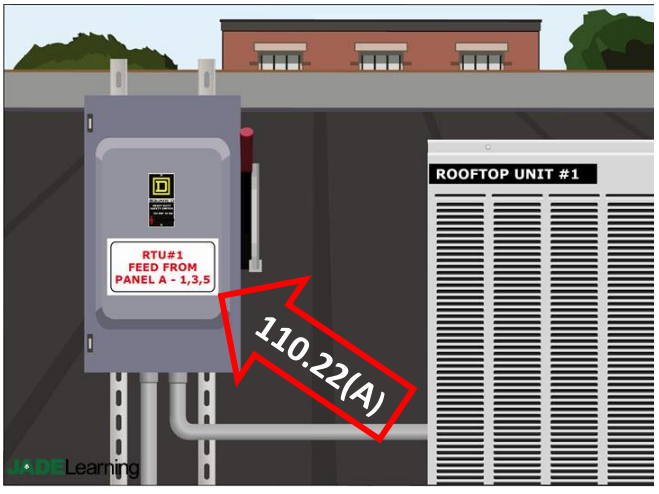
- Also referred to as rebuilt, refurbished, or remanufactured.
- Replacing a damaged circuit breaker with a new circuit breaker is NOT considered reconditioning a panel.



Marking of Equipment & Working Clearances

Important Changes in the 2020 NEC

110.22 Requirements for Electrical Installations. Identification of Disconnecting Means.



Section 110.22(A) in the 2020 NEC requires the following new markings on non-dwelling equipment disconnects:

In other than one- or two-family dwellings, the marking shall include the identification of the circuit source that supplies the disconnecting means.

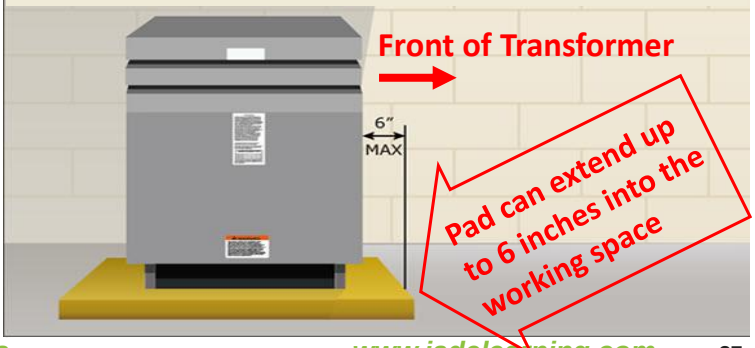
110.26(A)(3) Height of Working Space.

The 2020 NEC Clarifies:

Support structures such as concrete pads located under electrical equipment cannot extend more than 6 inches beyond the front of electrical equipment.

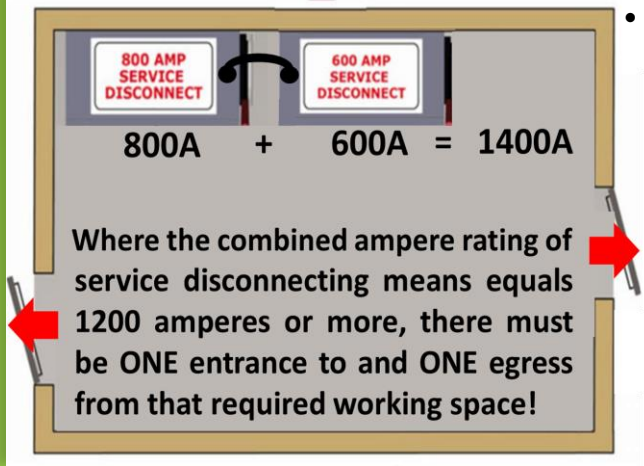
- **The 2017 NEC did not specify if a concrete pad holding equipment off the ground was included in the 6-inch rule!**

Working clearance described in 110.26(A)(3): The working space must be clear and extend from grade, floor, or platform, to a height of 6 ½ ft. or the height of the equipment, whichever is greater.



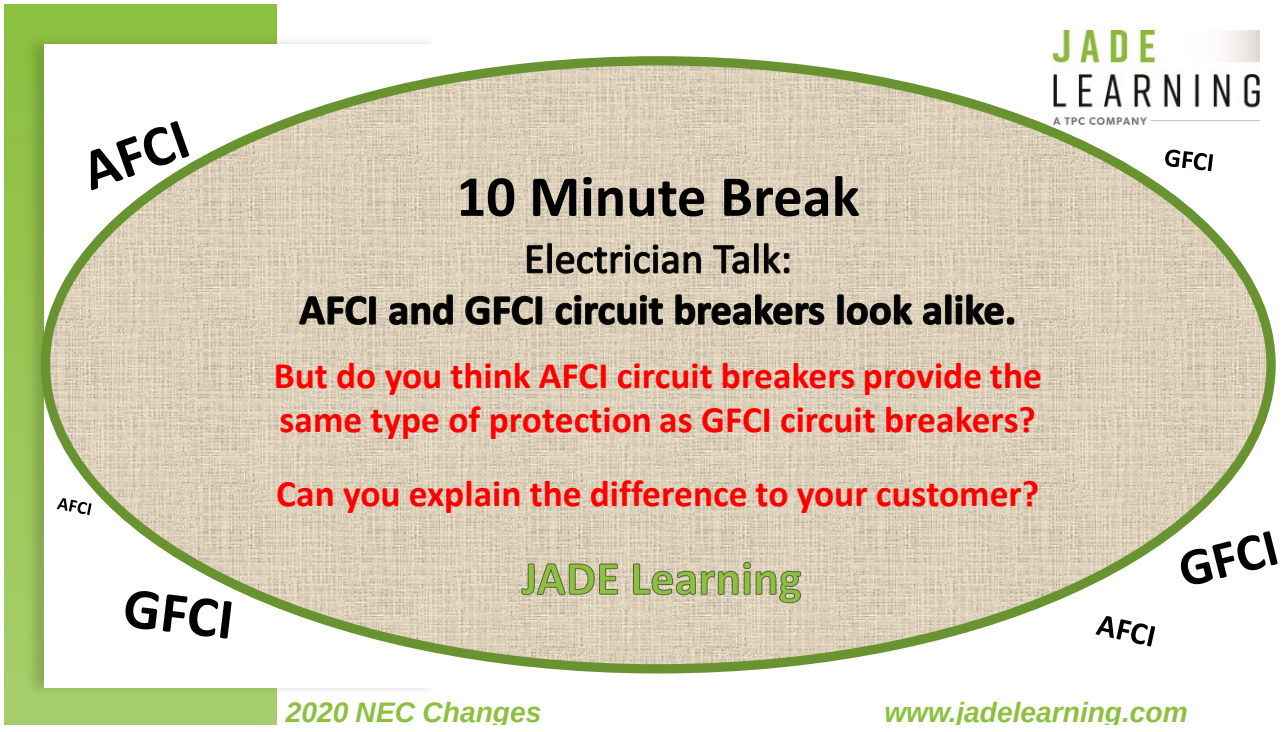
110.26(C)(2) Large Equipment.

The conditions that trigger the requirement to have *TWO OPENINGS* near large electrical equipment have changed in the 2020 NEC:

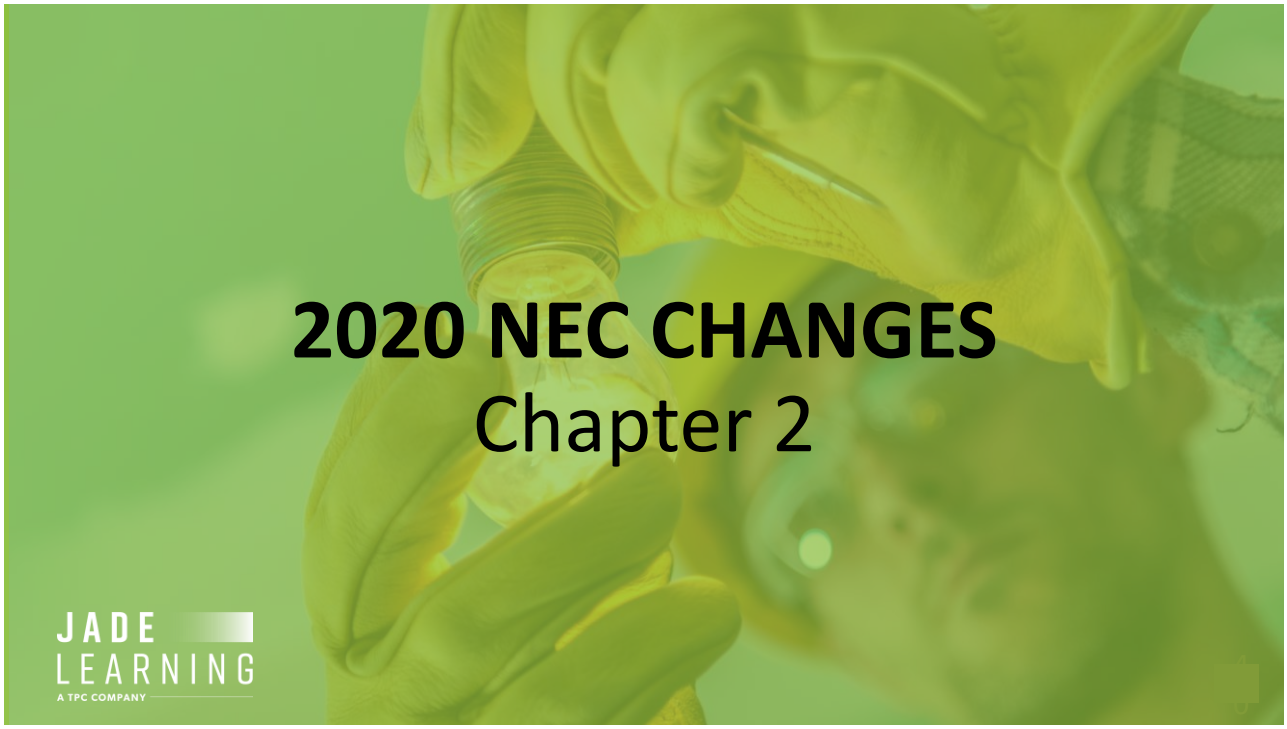


- In the 2020 NEC, one entrance and one egress is required for any area containing service disconnecting means with a *combined rating* of 1200 amps or more, when equipment is over 6 feet wide and installed according to Section 230.71.

NOTE: You must now consider the TOTAL AMPS of multiple pieces of equipment in an equipment area.


JADE LEARNING
A TPC COMPANY
AFCI
GFCI
10 Minute Break
Electrician Talk:
AFCI and GFCI circuit breakers look alike.
But do you think AFCI circuit breakers provide the same type of protection as GFCI circuit breakers?
Can you explain the difference to your customer?
JADE Learning
AFCI
GFCI
GFCI
AFCI
2020 NEC Changes
www.jadelearning.com

39


2020 NEC CHANGES
Chapter 2
JADE LEARNING
A TPC COMPANY

40

JADE LEARNING
A TPC COMPANY

What is CHAPTER-2 of the 2020 NEC?

WIRING and PROTECTION

Chapter 2 covers the following *Wiring and Protection requirements:*

- Use and identification of grounded (white) conductors
- Branch circuits and feeders
- Services
- Overcurrent and overvoltage protection
- Grounding and bonding

JADE LEARNING
A TPC COMPANY

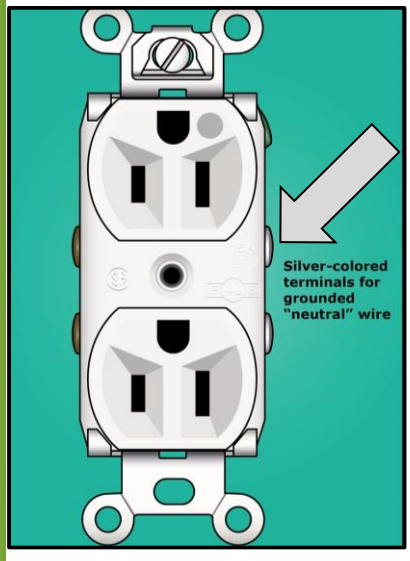
Identifying Conductors and Terminals

Important Changes in the 2020 NEC

200.10(B) Identification of Terminals.

JADE LEARNING
A TPC COMPANY

(1 of 2)



- **2017 NEC:**

Grounded (neutral) terminals must be coated or manufactured of metal that is white in color or marked by the word "white" or with the letter "W."

- **2020 NEC:**

Grounded (neutral) terminals must be coated or manufactured of metal that is white or silver or marked by the word "white" or with the letter "W."

200.10(B) Identification of Terminals.

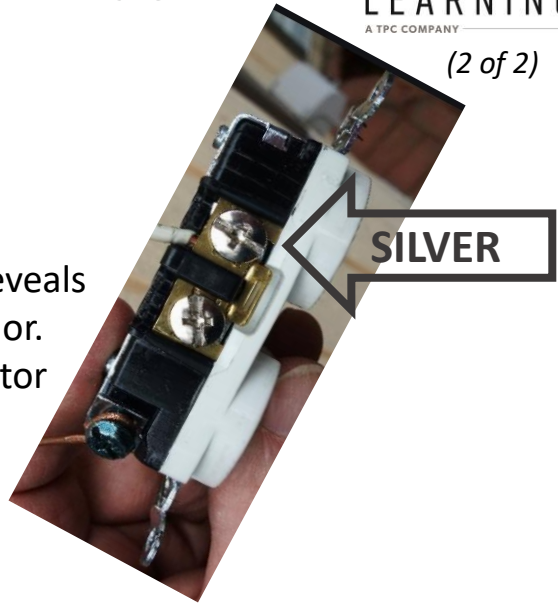
JADE LEARNING
A TPC COMPANY

(2 of 2)

Why the change?

A close look at a receptacle or switch reveals terminals or screws are not white in color. The terminals for the grounded conductor are usually silver in appearance.

THE NEC WAS JUST CATCHING UP!

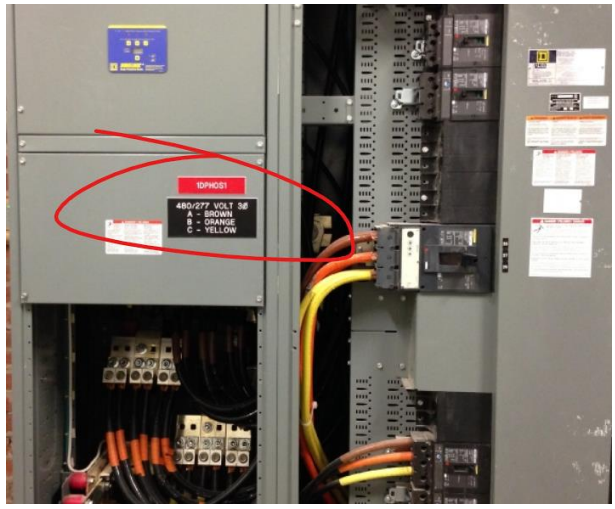


210.5(C)(1) Branch Circuits Supplied From More Than One Nominal Voltage System.

(1 of 4)

JADE LEARNING
A TPC COMPANY

What the 2017 and 2020 Code share in common:
Where the building's wiring contains branch circuits supplied from more than one voltage system, each ungrounded (hot) conductor of each branch circuit must be identified by phase or by line.



210.5(C)(1) Branch Circuits Supplied From More Than One Nominal Voltage System.

(2 of 4)

JADE LEARNING
A TPC COMPANY

The 2017 Code Language:

210.5(C)(1) Branch Circuits Supplied from More Than One Nominal Voltage System. *Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b).*

(a) Means of Identification. *The means of identification shall be……*

210.5(C)(1) Branch Circuits Supplied From More Than One Nominal Voltage System.

(3 of 4)

The 2020 Code Language:

210.5(C)(1) Branch Circuits Supplied from More Than One Nominal Voltage System. *Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by system voltage class at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b). Different systems within the same premises that have the same system voltage class shall be permitted to use the same identification.*

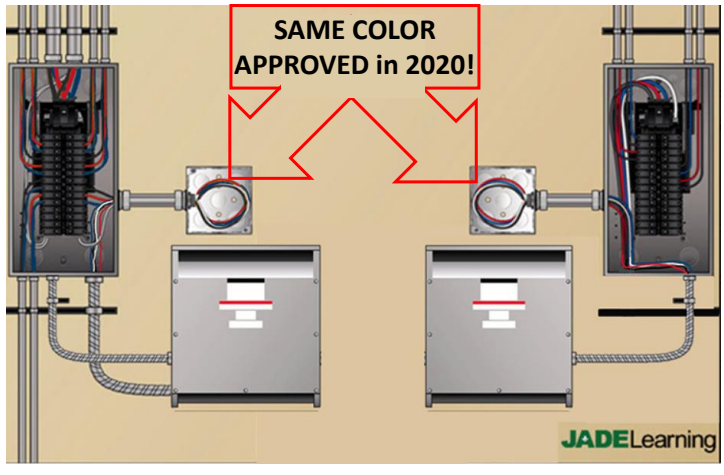
(a) Means of Identification. *The means of identification shall be……*

210.5(C)(1) Branch Circuits Supplied From More Than One Nominal Voltage System.

(4 of 4)

Summary

- **2017 NEC:** Different electrical systems of the same voltage class in the same building must use different identification systems at every termination.
- **2020 NEC:** Different electrical systems of the same voltage class in the same building are now allowed to use **the same** means of identification.



GFCI Protection

General Requirements

Important Changes in the 2020 NEC

210.8 GFCI Protection for Personnel

(1 of 3)

The 2020 NEC SAYS

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

For the purposes of this section when determining the distance from receptacles, the distance shall be measured as the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a window.

210.8 GFCI Protection for Personnel

(2 of 3)

The 2020 NEC SAYS

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

For the purposes of this section when determining the distance from receptacles, the distance shall be measured as the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a window.

Amended by NC!

210.8 GFCI Protection for Personnel

NC AMENDMENT *(3 of 3)*

Amended text underlined below.

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

For the purposes of this section when determining the distance from receptacles, the distance shall be measured as the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a window, **door or doorway, excluding cabinet doors.**

GFCI Protection

Dwelling Units

Important Changes in the 2020 NEC

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

(1 of 2)

New in the 2020 NEC

GFCI protection is now required in ***11 locations*** in a dwelling per NEC Section 210.8(A).

The 2017 NEC required only 10 locations!

210.8(A)(11) *[LOCATION 11]:* Indoor Damp And Wet Locations.

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

(2 of 2)

Example: *[LOCATION 11]*

210.8(A)(11) requires GFCI protection for:
INDOOR DAMP AND WET LOCATIONS …….like a designated DOG WASHING AREA IN THE HOME!

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

(1 of 3)

210.8(A)(2) Garages & Accessory Buildings.

No changes to GFCI protection requirements for dwelling unit garage & accessory buildings in the 2020 NEC, but there are NC amendments!

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

NC AMENDMENT *(2 of 3)*

First, what does the 2020 NEC say?

NEC 210.8(A)(2) requires GFCI protection for receptacles located in dwelling unit garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use.

But NC AMENDMENT 210.8(A)(2) declares an exception to that ground-fault (GFCI) requirement:

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

NC AMENDMENT *(3 of 3)*

The NC AMENDMENT declares that ceiling mounted receptacles installed exclusively for garage door openers are exempt from GFCI requirements.

AMENDMENT 210.8(A)(2)

Exception: Single or duplex receptacles that are located more than 2.44 m (8 ft) above the floor and specifically for connection to permanently installed cord-and-plug garage door openers. A duplex receptacle shall only be permitted under this exception where two cord-and-plug garage door openers utilize both contact devices of the duplex receptacle.

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

(1 of 2)

210.8(A)(3) Outdoors.

No changes in the 2020 NEC to GFCI protection requirements for receptacles installed outdoors of dwellings, but there are NC amendments!

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

NC AMENDMENT *(2 of 2)*

First, what does the 2020 NEC say?

NEC 210.8(A)(3) requires GFCI protection for receptacles installed outside of dwellings—with an exception for ice melting equipment. But NC AMENDMENT 210.8(A)(3) provides an additional exception to this requirement:

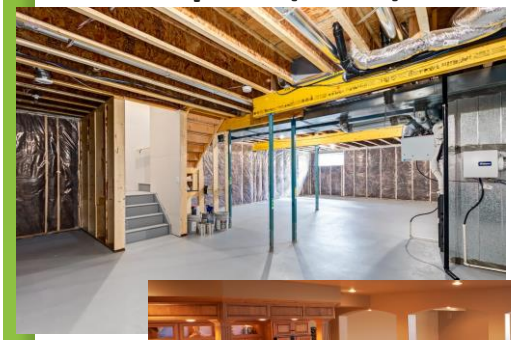
AMENDMENT 210.8(A)(3). Outdoors.

Exception No. 2 to 210.8(A)(3): A single outlet receptacle supplied by a dedicated branch circuit that is located and identified for specific use by a sewage lift pump.

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING
A TPC COMPANY

(1 of 3)



Another change to dwelling unit GFCI protection requirements in the 2020 NEC:

210.8(A)(5). GFCI protection is now required for
ALL AREAS IN A DWELLING UNIT BASEMENT!
FINISHED AND UNFINISHED!

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING
A TPC COMPANY

(2 of 3)

Amended by NC!

Another change to dwelling unit GFCI protection requirements in the 2020 NEC:

GFCI protection is
ALL AREAS IN A DWELLING UNIT
BASEMENT!
FINISHED AND UNFINISHED!

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

NC AMENDMENT *(3 of 3)*

NC AMENDMENT 210.8(A)(5) keeps GFCI requirements for basements the same as the 2017 Code cycle!

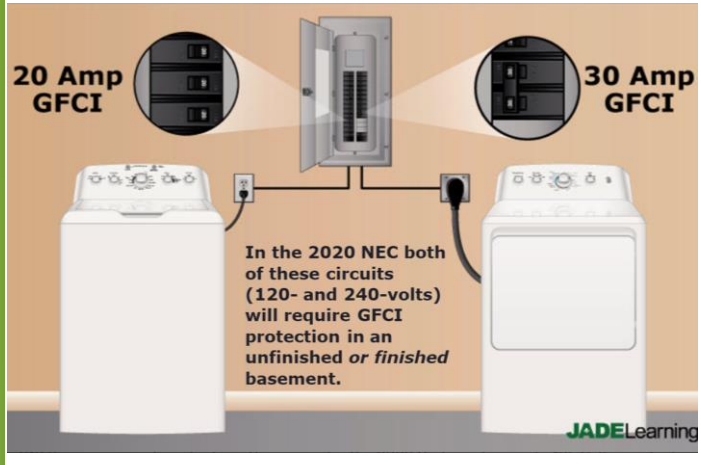
AMENDMENT 210.8(A)(5). Unfinished portions or areas of the basement not intended as habitable rooms

The NC amended version of 210.8(A)(5) requires GFCI protection for unfinished and uninhabitable areas of a dwelling unit basement only. The new 2020 NEC requirement to GFCI protect receptacles in all areas of the basement, even finished areas is not in force.

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

JADE LEARNING A TPC COMPANY

(1 of 3)

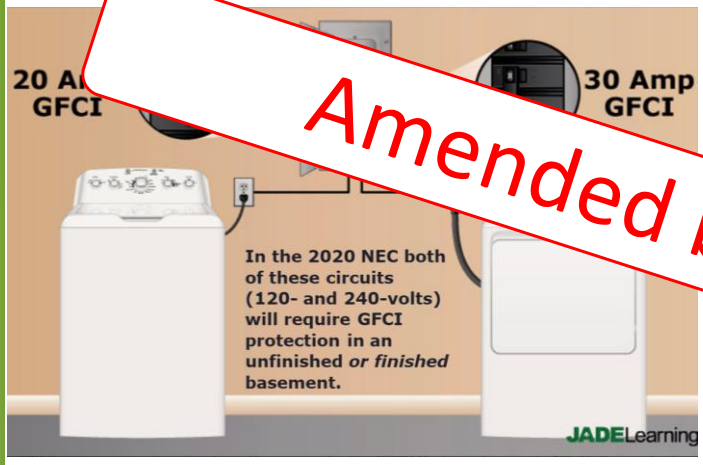


What else is new concerning GFCI protection in a dwelling unit?

In the 2020 NEC all dwelling unit receptacles rated up to ***250-volts*** shall be GFCI protected in the ***11 locations*** specified in 210.8(A).

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

(2 of 3)



Amended by NC!

What else is new concerning GFCI protection in a dwelling unit?

2020 NEC all dwelling
nted up to
250
protected in ***ions***
specified in 210.8(A).

210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.

NC AMENDMENT

(3 of 3)

AMENDMENT 210.8(A). ***Exception: A 250-volt receptacle installed specifically for supplying a clothes dryer, range, oven, counter-mounted cooking unit, or similar household cooking appliance fastened in place shall not be required to have ground-fault circuit-interrupter protection.***

GFCI Protection

Locations Other Than Dwelling Units

Important Changes in the 2020 NEC

67

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

(1 of 3)

Let's begin with a note about previous North Carolina Amendments and NEC Section 210.8(B) that addresses GFCI protection for *other than dwelling units.*

The requirement for three-phase receptacles to be GFCI protected was introduced in the 2017 NEC and it was removed by the 2017 NC Amendments. The 2017 NC Amendment however has not been renewed. Therefore, GFCI protection **does** apply to three-phase receptacles required by Section 210.8(B) in the 2020 State Electrical Code.

68

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

JADE LEARNING A TPC COMPANY

(2 of 3)

Here are four new locations in *Other than Dwelling Units* where GFCI protection is now required for single-phase, 125- to 250-volt receptacles rated 50-amps or less, and 3-phase (except 480-volt) receptacles rated 100 amps or less:

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

JADE LEARNING A TPC COMPANY

(3 of 3)

- **210.8(B)(2).** Not just kitchens but any area *with a sink and permanent provisions for food prepping or cooking.*
- **210.8(B)(6).** Not just indoor wet locations but *damp locations* too!
- **210.8(B)(11).** *Laundry Areas.*
- **210.8(B)(12).** *Bathtubs and Shower Stalls- where receptacles are installed within 6 feet of the outside edge of the bathtub or shower stall.*

North Carolina offers no amendments.

210.8(B) GFCI Protection for Personnel.

JADE LEARNING
A TPC COMPANY

(1 of 2)

Next is an amendment from NC that applies to the GFCI protection of sewage lift pumps in locations *Other than Dwelling units*:

This amendment may sound familiar. It also applies to DWELLING UNITS—previously discussed.

210.8(B) GFCI Protection for Personnel.

JADE LEARNING
A TPC COMPANY

NC AMENDMENT *(2 of 2)*

AMENDMENT 210.8(B)(4): GFCI—sewage lift pumps—*Other than Dwelling units*:

First, what does the 2020 NEC say?

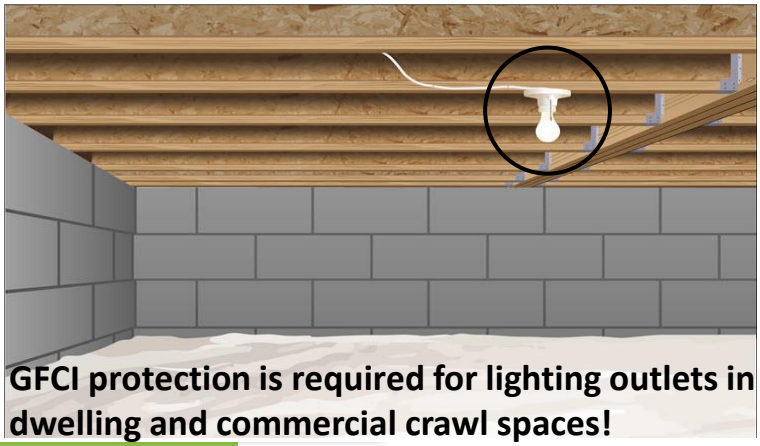
NEC Section 210.8(B)(4) requires GFCI protection for receptacles installed outdoors *at other than dwelling units* except when used for snow melting equipment and at supervised industrial locations.

The North Carolina Amendment adds one more exception!

AMENDMENT 210.8(B)(4). *Exception No. 3: A single outlet receptacle supplied by a dedicated branch circuit that is located and identified for specific use by a sewage lift pump*. **[Does not require GFCI protection per NC]**

210.8(C) Crawl Space Lighting Outlets.

In the 2020 NEC, GFCI protection for crawl space lighting outlets (120-volts or less) has been moved from Section 210.8(E) to 210.8(C).



GFCI protection is required for lighting outlets in dwelling and commercial crawl spaces!

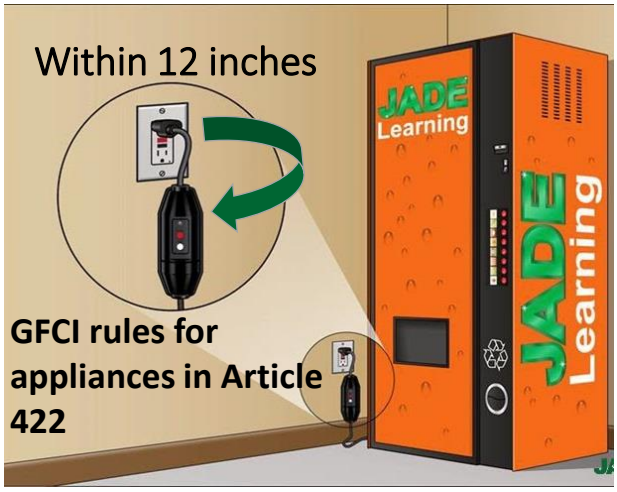
No change to the Code otherwise.

210.8(D) Branch Circuits. Ground-Fault Circuit-Interrupter Protection for Personnel. **Specific Appliances.**

In the 2020 NEC—
GFCI protection requirements for dishwashers moved from Section 210.8(D) to **Article 422. *Appliances*.**

- **Note: The 2017 State Electrical Code did not require GFCI protection for dishwashers per NC Amendment 210.8. This amendment has NOT been renewed in the 2020 State Electrical Code.**

210.8(D) Branch Circuits. Ground-Fault Circuit-Interrupter Protection for Personnel. **Specific Appliances.**



In the 2020 NEC—

210.8(D) serves as a roadmap pointing electricians to Article 422 for determining GFCI protection requirements for all six appliances named in Article 422.

210.8(E) Equipment Requiring Servicing.

In the 2020 NEC— GFCI protection is now required for all 125-volt, single-phase receptacles required within 25' of equipment according to 210.63(A) & (B).

GFCI PROTECTION IS REQUIRED IN ATTICS NEAR HVAC!

- 210.63(A) requires a 125-volt receptacle within 25 feet of all HVAC and refrigeration equipment **including in attics!**
- 210.63(B) requires a 125-volt receptacle in *other than dwellings* in the same room as any service equipment, and in the same room as any dedicated equipment.

210.8(F) GFCI Protection for Personnel.

JADE LEARNING
A TPC COMPANY

NC AMENDMENT

Here is another NC AMENDMENT that applies to ground-fault protection.

NEC Section 210.8(F) is *NEW* in the 2020 NEC. North Carolina Amendment 210.8(F) deletes that new Section!

NEC Section 210.8(F) requires GFCI protection for all outdoor outlets at dwellings, other than those covered in 210.8(A)(3), Exception to (3), that are supplied by single-phase branch circuits rated 150-volts to ground or less, 50-amps or less.

AMENDMENT 210.8(F). *DELETED*

77

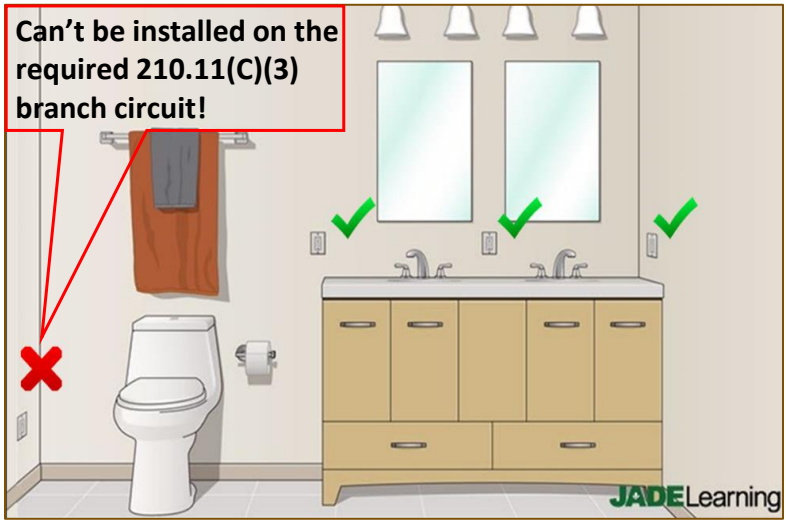
JADE LEARNING
A TPC COMPANY

Bathroom Branch Circuits & Garage Branch Circuits

Important Changes in the 2020 NEC

78

210.11(C)(3) Bathroom Branch Circuits.



NEW in the 2020 NEC—

- The 20-amp branch circuit required for bathrooms is now limited to feeding only countertop receptacle outlets in bathrooms.
- Other wall receptacles must be fed from a different branch circuit.

210.11(C)(4) Garage Branch Circuits.

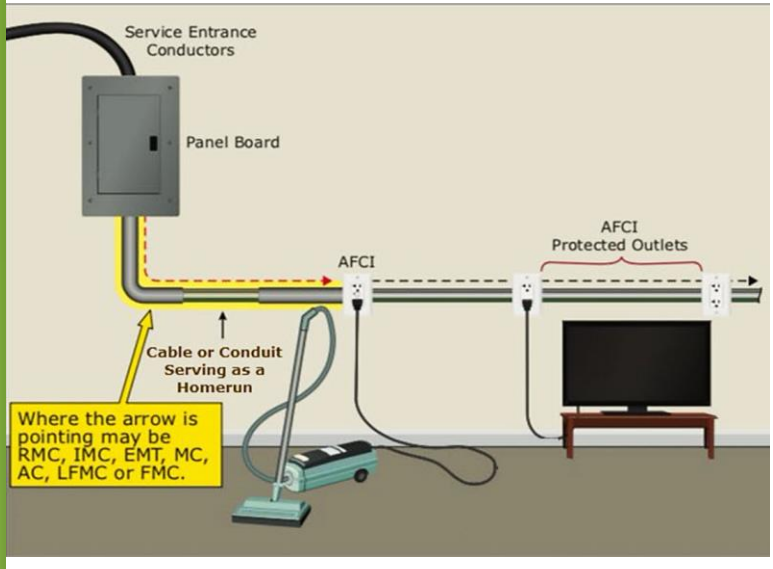
NEW in the 2020 NEC—

- The required 20-amp garage branch circuit is permitted to supply only receptacles covered in Section 210.52(G)(1); not all garage receptacles.
- Section 210.52(G)(1) requires at least one receptacle outlet in each vehicle bay installed no more than 5 ½ feet above the floor.

AFCI Protection

Important Changes in the 2020 NEC

210.12(A)(5) AFCI- Dwelling Units (C), (D).



When AFCI protection is in the form of a receptacle at the first outlet of a branch circuit, a metal raceway is required between the panel and that first outlet.

The 2020 NEC expanded the list of approved metal raceways and now includes:

LFMC

&

FMC

210.12(C). AFCI Protection for Guest Rooms, Suites, *and Now Patient Sleeping Rooms in Nursing Homes and Limited Care Facilities.*

JADE LEARNING
A TPC COMPANY

A note regarding previous North Carolina Amendments and 210.12(C) in the NEC:

The 2017 State Electrical Code deleted AFCI requirements for guest rooms and suites in the form of an Amendment.

Not only has NC not renewed that 2017 Amendment, but the requirement has expanded in the 2020 NEC to include patient sleeping rooms in nursing homes and limited care facilities!

(1 of 2)

210.12(D). AFCI for Extended Branch Circuits

NEC Section 210.12(D) in the 2020 NEC states the following:

(D) Branch Circuit Extensions or Modifications — Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites. Where branch circuit wiring for areas specified in 210.12(A), (B), or (C) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch circuit conductors is not more than (6 ft) and does not include any additional outlets or devices, other than splicing devices.

(2 of 2)

210.12(D). AFCI for Extended Branch Circuits

NC AMENDMENT

AMENDMENT 210.12(D) is underlined below:

(D) Branch Circuit Extensions or Modifications — Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites. Where branch circuit wiring for areas specified in 210.12(A), (B), or (C) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch circuit conductors is not more than **(50 ft)** and does not include any additional outlets or devices, other than splicing devices.

JADE LEARNING
A TPC COMPANY

Reconditioned Equipment

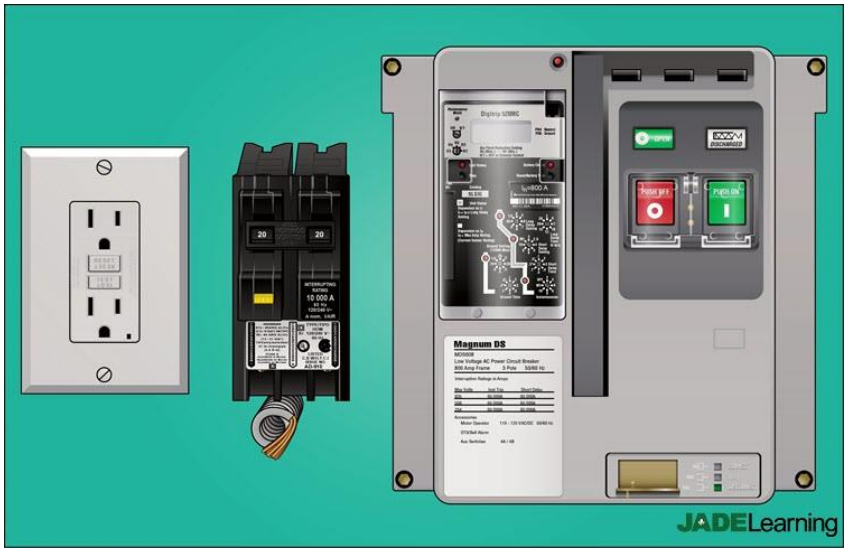
Important Changes in the 2020 NEC

210.15 Reconditioned Equipment.

JADE LEARNING

NEW in the 2020 NEC- The following equipment is expressly prohibited from being reconditioned:

- GFCIs
- AFCIs
- Ground-Fault Protection for Equipment (GFPE)



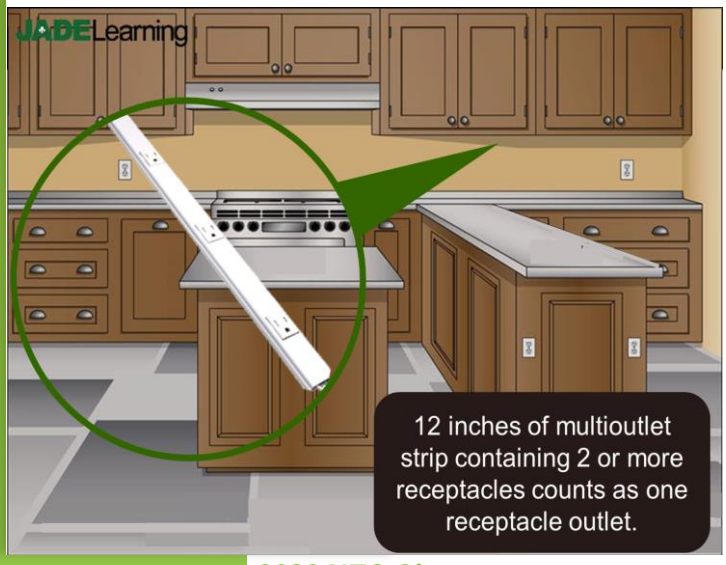
JADE LEARNING
A TPC COMPANY

Receptacle Outlets

Important Changes in the 2020 NEC

210.52(C) Countertop and Work Surfaces.

(1 of 3)



NEW in the 2020 NEC—

At countertops, each 12-inch length of multioutlet receptacle assembly containing two or more receptacles shall be considered one receptacle outlet.

210.52(C) Countertop and Work Surfaces.

(2 of 3)

Example-

This UL-listed plug strip is NOT considered a *Multioutlet Receptacle Assembly.*

210.52(C) Countertop and Work Surfaces.

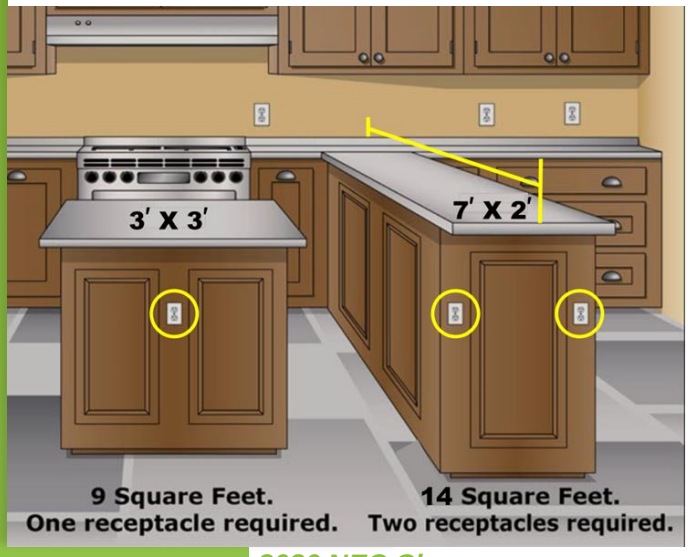
(3 of 3)

Example-

Multioutlet Receptacle Assembly is cut to fit and field-installed by a licensed professional.

210.52(C)(2) Island and Peninsular Countertops and Work Surfaces.

(1 of 6)



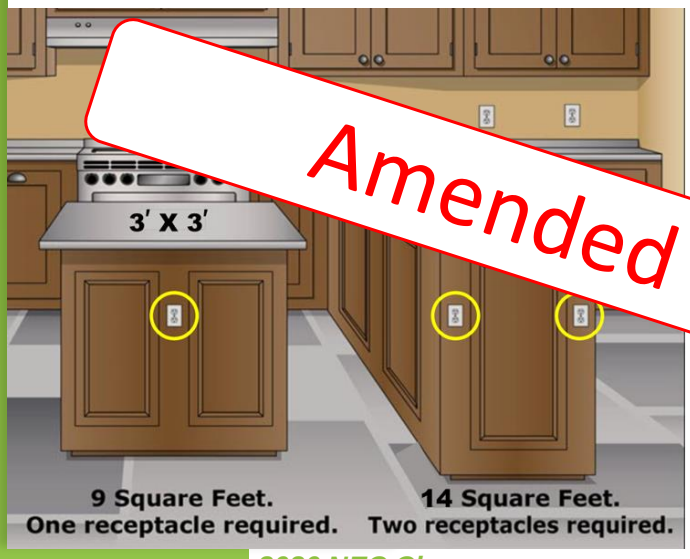
NEW in the 2020 NEC—

- At least one receptacle outlet must serve the first 9 square feet of countertop.
- An additional outlet is then required for each additional 18 square feet of countertop.
- One receptacle must be located within 2 feet of the outer peninsula end.

210.52(C)(2) Island and Peninsular Countertops and Work Surfaces.

JADE LEARNING
A TPC COMPANY

(2 of 6)



Amended by NC!

NEW in the 2020 NEC—

- At least one receptacle outlet must serve the first 9 square feet of countertop.
- ...dditional outlet is then ...ch additional ...ertop.
- One receptac... located within 2 feet of the outer peninsula end.

210.52(C)(2) Island and Peninsular Countertops and Work Surfaces.

JADE LEARNING
A TPC COMPANY

NC AMENDMENT

(3 of 6)

NC AMENDMENT 210.52(C)(2) keeps kitchen receptacle requirements the same as in the 2017 code cycle! Well….*almost*.

AMENDMENT 210.52(C)(2). Island and Peninsular Countertops and Work Surfaces: Receptacle outlets shall be installed in accordance with 210.52(C)(2)(a), 210.52(C)(2)(b), 210.52(C)(2)(c), and 210.52(C)(2)(d).

210.52(C)(2)(a). Island Countertop Spaces. At least one receptacle shall be installed at each island 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(C)(2) Island and Peninsular Countertops and Work Surfaces.

JADE LEARNING A TPC COMPANY

NC AMENDMENT *(4 of 6)*

210.52(C)(2)(b). Peninsular Countertop Spaces. At least one receptacle outlet shall be installed at each peninsular countertop long dimension space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. A peninsular countertop shall be measured from the connecting perpendicular wall. **At least one receptacle outlet shall be located within 600 mm (2 ft) of the outer end of the peninsular countertop.**

This is New!

210.52(C)(2) Island and Peninsular Countertops and Work Surfaces.

JADE LEARNING A TPC COMPANY

NC AMENDMENT *(5 of 6)*

210.52(C)(2)(c). Required and Additional Receptacles. Receptacle outlets required by 210.52(C)(2) shall be in accordance with 210.52(C)(3). Additional receptacle outlets shall be permitted to be located outside the provisions of 210.52(C)(3).

210.52(C)(2) Island and Peninsular Countertops and Work Surfaces.

JADE LEARNING
A TPC COMPANY

NC AMENDMENT

(6 of 6)

210.52(C)(2)(d). Separate Spaces. Countertop spaces separated by range-tops, refrigerators, or sinks shall be considered as separate countertop spaces in applying the requirements of 210.52(C)(2). If a range, counter-mounted cooking unit, or sink is installed in an island or peninsular countertop and the depth of the countertop behind the range, counter-mounted cooking unit, or sink is less than 300 mm (12 in.), the range, counter-mounted cooking unit, or sink shall be considered to divide the countertop space into two separate countertop spaces. Each separate countertop space shall comply with the applicable requirements in 210.52(C).

210.52(E)(3) Receptacle Outlet for Balconies, Decks, and Porches.

JADE LEARNING
A TPC COMPANY

NEW in the 2020 NEC—

- Any deck within 4 inches horizontally of a dwelling unit must have a receptacle outlet accessible from the deck.
- Previously, decks with even a ½" air gap were not technically attached to the dwelling and were exempt from this requirement.

Calculations

Important Changes in the 2020 NEC

220.12 and Table 220.12- Lighting Load for Non-Dwelling Occupancies.

TABLE 220.12 GENERAL LIGHTING LOADS BY NON-DWELLING OCCUPANCY		
TYPE OF OCCUPANCY	UNIT LOAD	
	Volt-amperes/m2	Volt-amperes/ft2
Automotive facility	16	1.5
Convention center	15	1.4
Courthouse	15	1.4
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasiuma	18	1.7
Health care clinic	17	1.6
Hospital	17	1.6
Hotels and motels, including apartment houses without provisions for cooking by tenants	18	1.7
Library	16	1.5.
Manufacturing facilityc	24	2.2
Motion picture theater	17	1.6
Museum	17	1.6
Office	14	1.3
Parking garage	3	0.3
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility	24	2.2
Restaurant	16	1.5
Retail	20	1.9
School/university	33	3
Sports arena	33	3
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13	1.2
Workshop	18	1.7

NEW in the 2020 NEC—

- 2020 NEC moved all dwelling unit info from NEC 220.12 to NEC 220.14(J).
- 220.12 expanded to 29 occupancies.
- Motors less than 1/8 hp and connected to lighting circuits are now considered part of the general lighting load of a service calculation.

220.14(J) Unit Loads for Dwelling Units.

- In the 2020 NEC, 220.14(J) contains all dwelling unit information for performing a service calculation.
- The general lighting load for dwellings is still 3 VA for each square foot, excluding porches, garages, and unused or unfinished spaces not adaptable for future use.
- Motors less than 1/8 hp and powered by lighting circuits (such as bath fans) are now included in the general lighting load of the dwelling service calculation.

220.53 Appliance Load - Dwelling Units.

- In the 2020 NEC, the demand factor of 75% can only be applied to four or more appliances when they are rated ¼ hp or 500 watts or more, each.
- The 2017 NEC had no such restriction for applying the appliance demand factor of 75%.

Outdoor Wiring & Services

Important Changes in the 2020 NEC

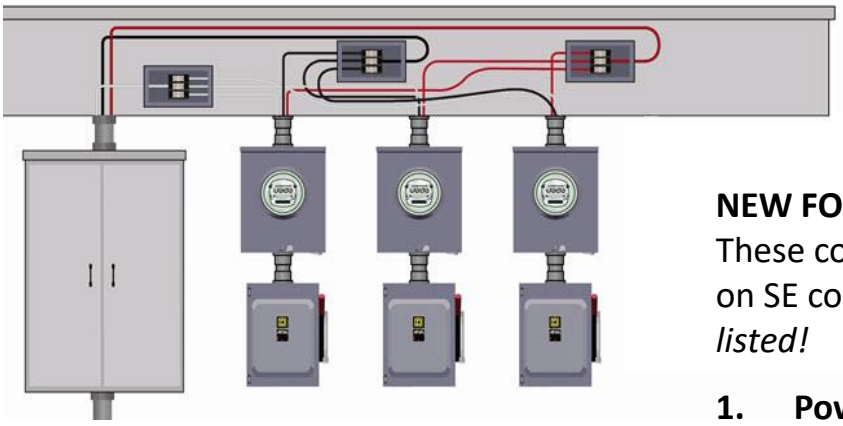
225.10 Wiring on Buildings (or Other Structures).

- In the 2020 NEC the term “multiconductor cable” has been replaced with the specific cable Types: Type SE and Type TC-ER Cable.
- Both SE (Service-Entrance) and TC-ER (Tray-Cable with Crush-Proof Outer Jacket) are now approved as outdoor wiring methods.

230.46 Spliced and Tapped Conductors.

JADE LEARNING
A TPC COMPANY

(1 of 3)



NEW FOR 2020 NEC-
These components when used on SE conductors must now be *listed!*

1. **Power distribution blocks**
2. **Pressure connectors**
3. **Devices for splices and taps**

230.46 Spliced and Tapped Conductors.

JADE LEARNING
A TPC COMPANY

(2 of 3)

Example of Power Distribution Blocks

Square D 9080 Power Distribution Blocks USA

NEW FOR 2020 NEC-
These components when used on SE conductors must now be *listed!*

1. **Power distribution blocks**
2. **Pressure connectors**
3. **Devices for splices and taps**

230.46 Spliced and Tapped Conductors.

(3 of 3)

Example: Underground Pressure Connector Splice Kit.

FACT: Purple is often used to indicate copper and aluminum conductors can be joined using this connector.

NEW FOR 2020 NEC-
These components when used on SE conductors must now be *listed!*

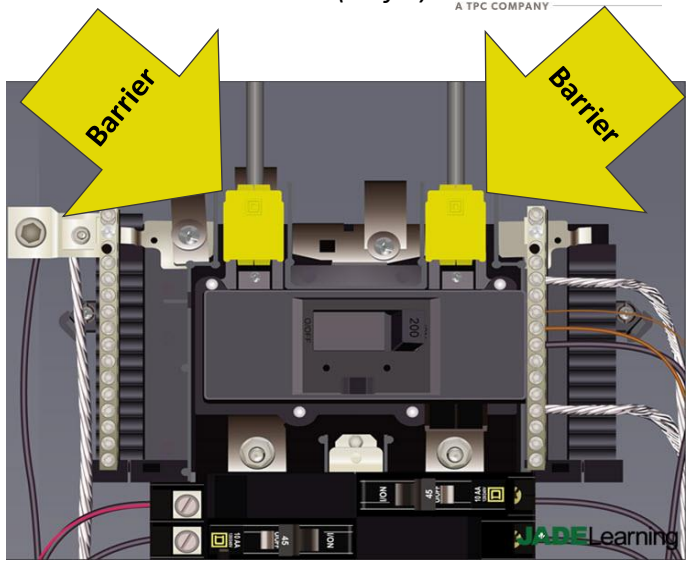
1. **Power distribution blocks**
2. **Pressure connectors**
3. **Devices for splices and taps**

230.62(C) Service Equipment- Enclosed or Guarded. Barriers.

(1 of 2)

New for 2020 NEC—

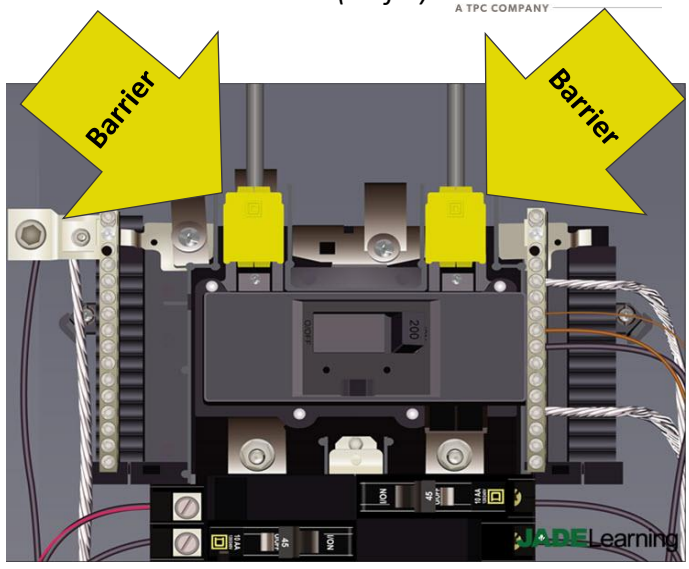
- Barrier requirements were revised and moved from Article 408 to Section 230.62(C).
- Barriers are required inside **ALL SERVICE EQUIPMENT** (meaning panels/enclosures that include a **main disconnect**) but they are NOT required inside sub-panels.



230.62(C) Service Equipment- Enclosed or Guarded. Barriers.

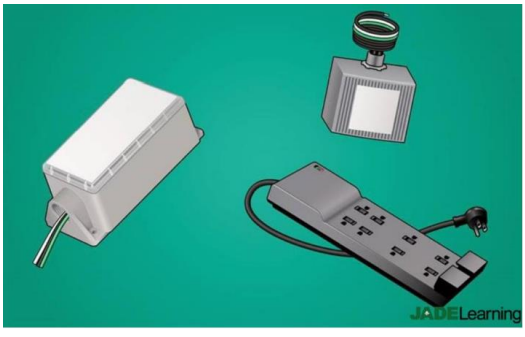
(2 of 2)

New 2020 Code Language:
230.62(C) Barriers. *Barriers shall be placed in service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.*



230.67. Surge Protection

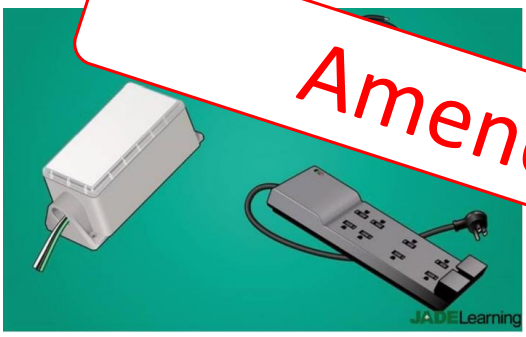
(1 of 3)



- In the 2020 NEC, brand-new Section 230.67 requires surge protection for *ALL SERVICES SUPPLYING DWELLING UNITS*.
- The location and type of surge protection required is covered in the Section.

230.67. Surge Protection

(2 of 3)



Amended by NC!

- In the 2020 NEC, brand-new Section 230.67 requires surge protection for *ALL ... SUPPLYING DWELLING UNITS*.
- ... of surge protect... the Section.

230.67. Surge Protection

NC AMENDMENT *(3 of 3)*

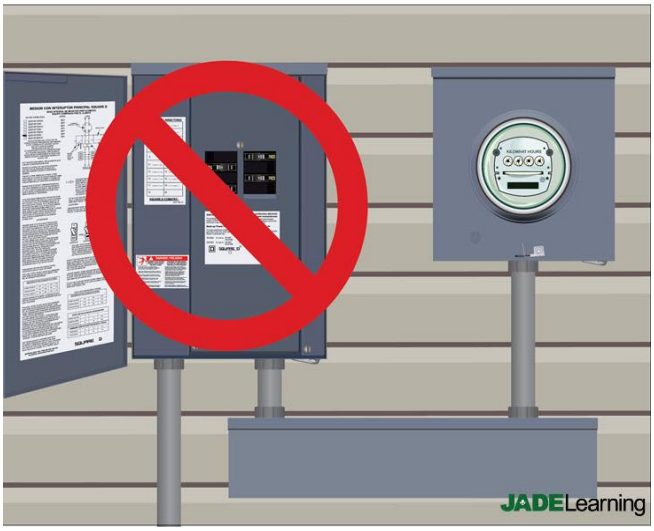
NC AMENDMENT 230.67 removes this new requirement altogether.

AMENDMENT 230.67. Surge Protection: Deleted.

230.71 Maximum Number of Disconnects.

JADE LEARNING A TPC COMPANY

(1 of 3)



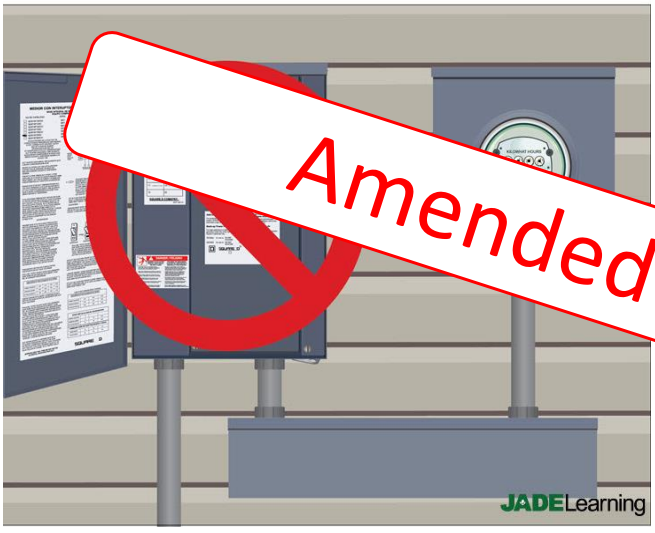
In the 2020 NEC-

- 230.71(B) says six switches are no longer allowed inside one enclosure to function as a building's service disconnect.
- Six switches can still serve as a building's service disconnect, but the switches must now occupy separate enclosures according to four approved installation methods.

230.71 Maximum Number of Disconnects.

JADE LEARNING A TPC COMPANY

(2 of 3)



Amended by NC!

In the 2020 NEC-

- 230.71(B) says six switches are no longer allowed inside one enclosure to function as a building's service disconnect.
- ...itches can still serve as a ...e disconnect, ...W occupy se...s according to four a...d installation methods.

230.71 Maximum Number of Disconnects.

JADE LEARNING
A TPC COMPANY

NC AMENDMENT

(3 of 3)

NC AMENDMENT 230.71(B) adds one more (a fifth) approved installation for installing (up to) six switches as a single disconnect.

AMENDMENT 230.71(B)(5). Panelboard that is temporary (a saw service pole) at a construction site if it complies with the following:

a. Ungrounded circuits do not exceed 150 volts to ground.

b. The sum of the ratings of the overcurrent devices that serve together as the disconnecting means do not exceed 100 amps.

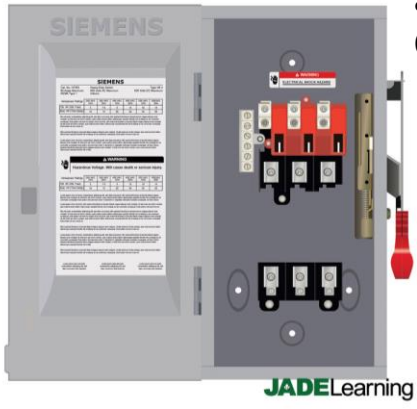
c. The number of circuit breaker handles, identified handle ties, or combination of both that operate as the service disconnecting means do not exceed six throws of the hand.

JADE LEARNING
A TPC COMPANY

Overcurrent Protection & Overvoltage Protection

Important Changes in the 2020 NEC

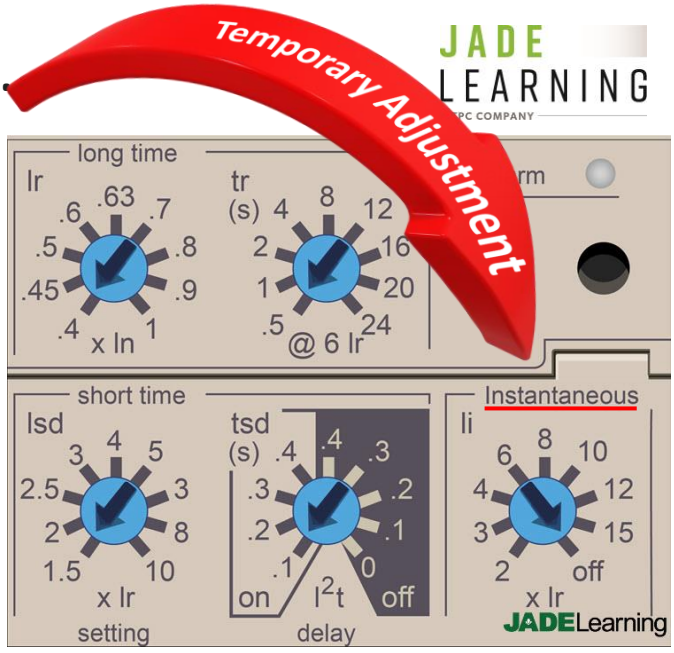
240.62, 240.88, 240.102 Reconditioned Equipment (Overcurrent Protection Equipment).



Sections *240.62, 240.88, & 240.102* have been added to the 2020 NEC to address RECONDITIONED OVERCURRENT PROTECTION EQUIPMENT

- Low-voltage (1000 volts or less) and medium-voltage (over 1000 volts) fuseholders and nonrenewable fuses are NOT permitted to be reconditioned.
- Molded-case circuit breakers are NOT permitted to be reconditioned, but low- and medium power circuit breakers, as well as high-voltage circuit breakers are permitted to be reconditioned.

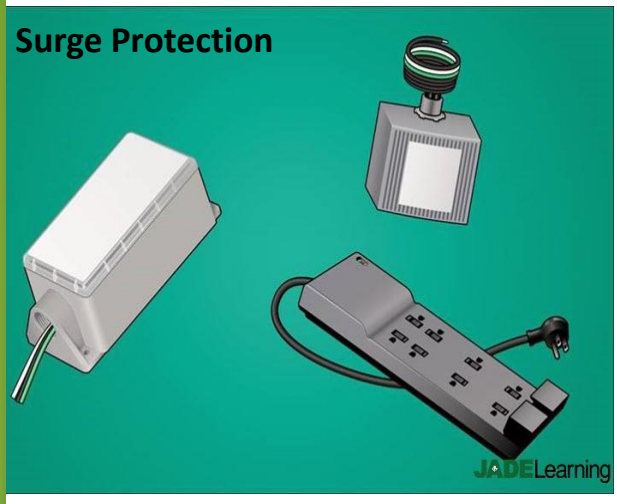
240.87 Arc Energy Reduction.



In the 2020 NEC-

- Arc energy reduction systems must be set to operate at less than the available arcing current of the circuit.
- But temporary adjustment of the instantaneous trip setting is not permitted as a means of compliance.
- Documentation of the system and performance testing must be made available to the AHJ.

242 Overvoltage Protection.



In the 2020 NEC-

Brand-new Article 242 replaces the surge protection Code requirements previously found in 2017 NEC Articles 280 and 285.

Four types of **Surge-Protective Devices** are covered in this new 2020 NEC Article:

1. **Line side of service disconnect.**
2. **Load side of service disconnect.**
3. **Portable equipment (multi-outlet plug strip).**
4. **Built into the equipment.**

Grounding & Bonding

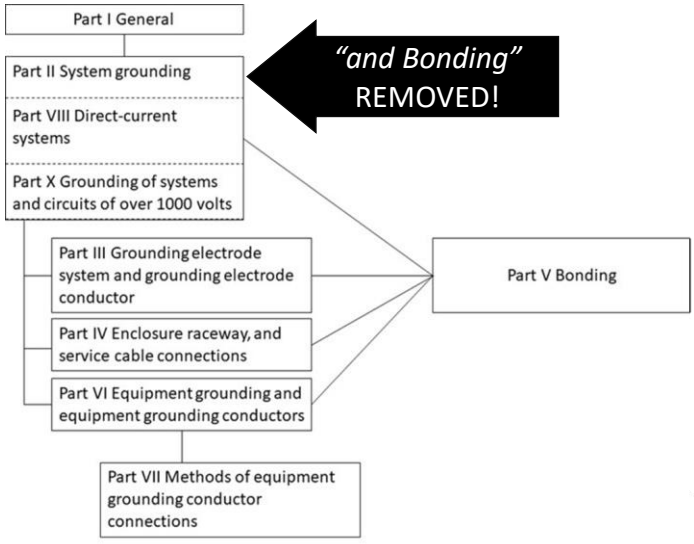
Important Changes in the 2020 NEC

250 Grounding and Bonding.

JADE LEARNING
A TPC COMPANY

In the 2020 NEC-

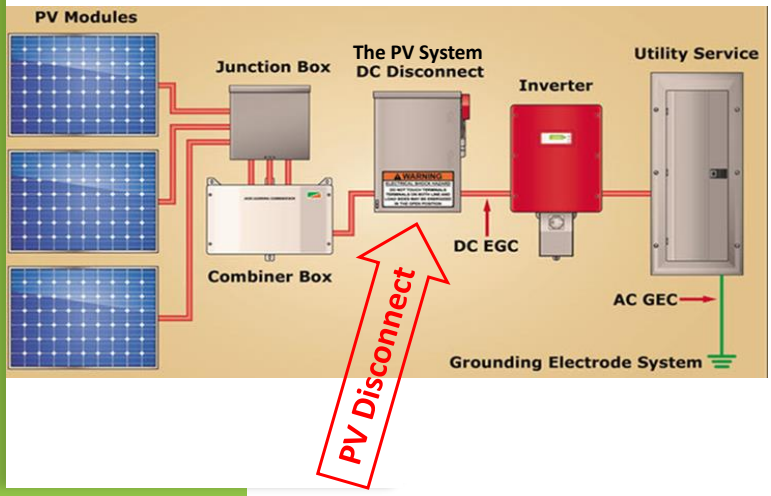
- Figure 250.1 was revised to better reflect the contents of Article 250.
- The definition for "Supply-Side Bonding Jumper" was moved from NEC 250.2, to Article 100 *Definitions*.
- The phrase "*and Bonding*" was removed from Article 250 Part II because it is covered in Part V.



121

250.25 Grounding of Systems Permitted to be Connected to the Supply Side of the Disconnect.

JADE LEARNING
A TPC COMPANY



In the 2020 NEC-

PV system (and similar type) disconnects acting as service equipment for add-on systems, when connected to the supply-side of a utility-fed electrical system now require grounding and bonding according to new NEC Section 250.25.

Previous editions of the NEC failed to require grounding & bonding for supply-side connected disconnects!

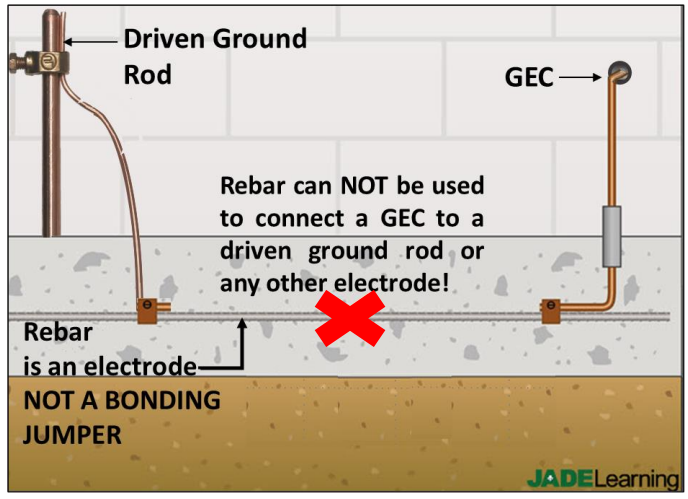
122

122

250.53(C) Grounding and Bonding. Grounding Electrode System Installation. Bonding Jumper.

In the 2020 NEC-

- Rebar in a concrete foundation must be used as a grounding electrode but the rebar cannot be used as a bonding jumper to tie together other electrodes.
- A separate bonding jumper (not rebar) must be used to interconnect the electrodes of the grounding electrode system.



250.64(A) Grounding Electrode Conductor. Aluminum or Copper-Clad Aluminum Conductors.

Within 18 inches of earth is OK when the aluminum grounding conductor is terminated INSIDE a listed enclosure

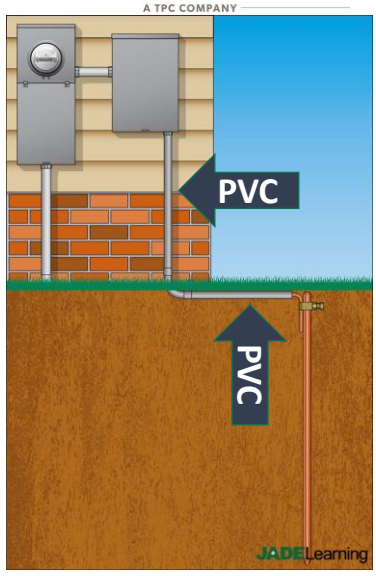
In the 2020 NEC-

- Outdoor aluminum or copper-clad aluminum conductors are still not permitted to terminate within 18 inches of the earth.
- However, the 2020 NEC makes it clear that aluminum conductors terminated **inside of outdoor enclosures** listed for their environment **are** permitted to terminate within 18 inches of the earth.

250.64(B)(2) & (B)(3) Grounding Electrode Conductor Protection for Physical Damage.

- Size 6 AWG and larger grounding electrode conductors (GECs) must be protected by an approved raceway when exposed to physical damage.
- GECs smaller than 6 AWG must be protected even when NOT exposed to physical damage.

New in the 2020 NEC:
Schedule 80 PVC is now specified as the ONLY type of PVC approved for protecting a GEC from physical damage.

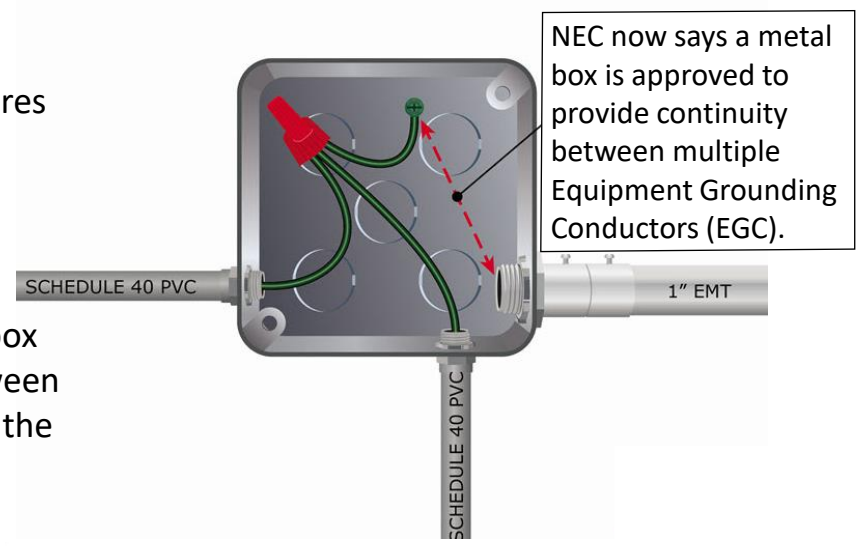


250.109 Metal Enclosures.

In the 2020 NEC-

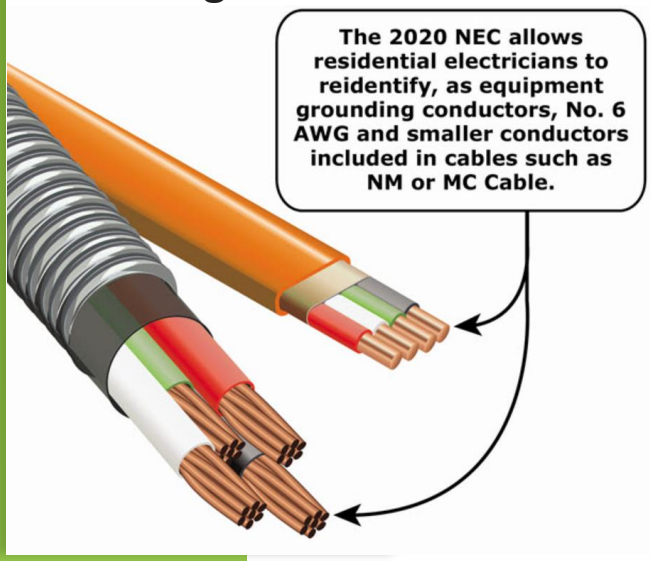
The 2020 NEC now declares a metal box can provide continuity between equipment grounding & bonding conductors.

In this image the metal box provides continuity between the bonding jumper and the 1-inch EMT.



250.119 Identification of Equipment Grounding Conductor.

JADE LEARNING
A TPC COMPANY



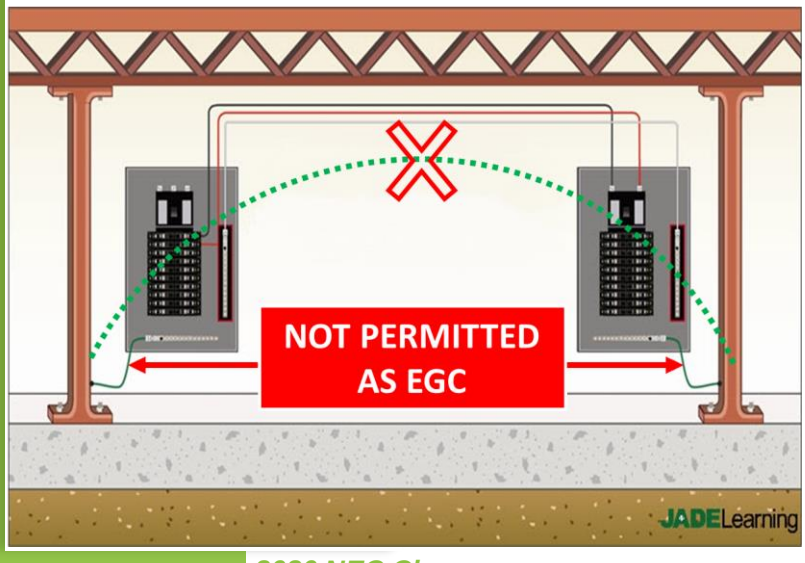
In the 2020 NEC-

Electricians are no longer prohibited from reidentifying size 6 AWG and smaller conductors as equipment grounding conductors (EGC).

In previous Code cycles, reidentifying an EGC was only permitted in a <u>supervised</u> location.

250.121(B) Restricted Use of Metal Frames.

JADE LEARNING
A TPC COMPANY



In the 2020 NEC-

250.121(B) says the structural metal framing of a building or structure shall not be used as an equipment grounding conductor (EGC).

The NEC means that metal buildings are not allowed as electrical paths for fault current.

250.122 Size of Equipment Grounding Conductors.

In the 2020 NEC-

Equipment grounding conductors no longer have to be upsized when installing conductors in high ambient temperatures— or when installing four or more conductors in a conduit.

However, they must be upsized if voltage drop is present due to using especially long conductors. In the 2020 NEC the size increase can be calculated by a qualified person instead of by the NEC!

TABLE 250.122 MINIMUM SIZE EQUIPMENT GROUNDING CONDUCTORS FOR GROUNDING RACEWAY AND EQUIPMENT

RATING OR SETTING OF AUTOMATIC OVERCURRENT DEVICE IN CIRCUIT AHEAD OF EQUIPMENT, CONDUIT, ETC., NOT EXCEEDING (AMPERES)	Size (AWG or kcmil)	
	COPPER	ALUMINUM OR COPPER-CLAD ALUMINUM
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1250
6000	800	1250

Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment.

In the 2020 NEC-

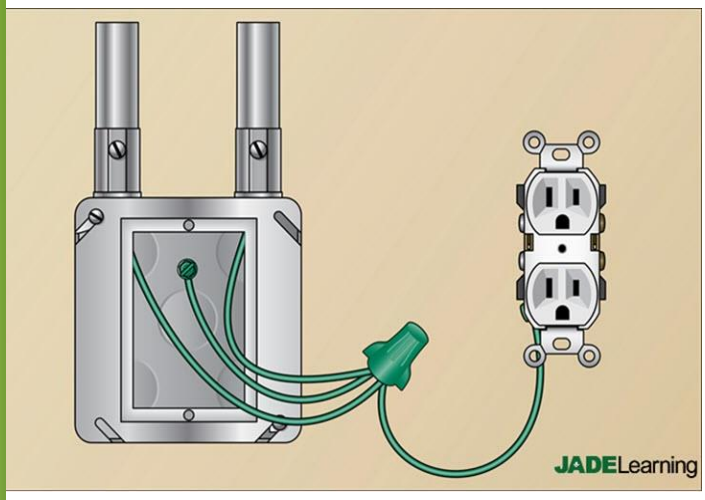
Table 250.122 has increased the required size of an Aluminum or Copper-Clad Aluminum EGC from **1200 kcmil to 1250 kcmil** when the circuit is protected by a 5000- or 6000-amp overcurrent device.

TABLE 250.122 MINIMUM SIZE EQUIPMENT GROUNDING CONDUCTORS FOR GROUNDING RACEWAY AND EQUIPMENT

RATING OR SETTING OF AUTOMATIC OVERCURRENT DEVICE IN CIRCUIT AHEAD OF EQUIPMENT, CONDUIT, ETC., NOT EXCEEDING (AMPERES)	Size (AWG or kcmil)	
	COPPER	ALUMINUM OR COPPER-CLAD ALUMINUM
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1250
6000	800	1250

JADELearning

250.148 Continuity of Equipment Grounding Conductors. Attachment in Boxes.



In the 2020 NEC-

- The 2020 NEC has removed the restriction that prohibits solder as the means for connecting EGCs.
- 2020 NEC also makes it clear: Only wire-type EGCs are required to adhere to ALL bonding requirements in this Code section.

JADE LEARNING
A TPC COMPANY

10 Minute Break

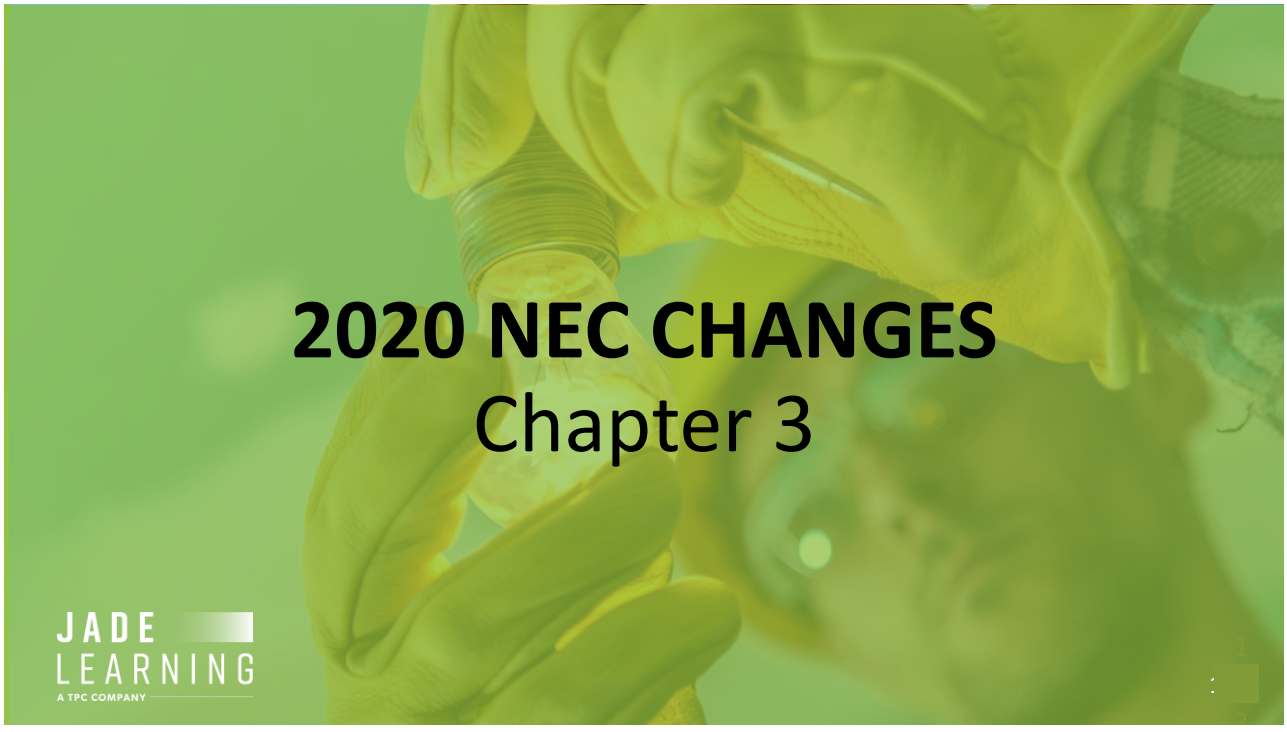
Electrician Talk:

All white conductors are not neutrals.

A two-wire 120-volt circuit with one white and one black conductor has no neutral—the white conductor there is simply a *grounded conductor.*

A "neutral" is the white wire included with 2 or more ungrounded conductors.

JADE Learning



133

JADE
LEARNING
A TPC COMPANY

What is CHAPTER-3 of the 2020 NEC?

WIRING METHODS AND MATERIALS

Chapter 3 covers the following requirements for *Wiring Methods and Materials:*

- General Requirements.
- Conductors
- Enclosures
- Types of cables
- Types of raceways
- Cable and conductor support systems (Cable Trays)
- Open wiring types including low voltage above drop ceilings

134

Let's Begin Chapter 3 with

Approved Fittings

Important Changes in the 2020 NEC

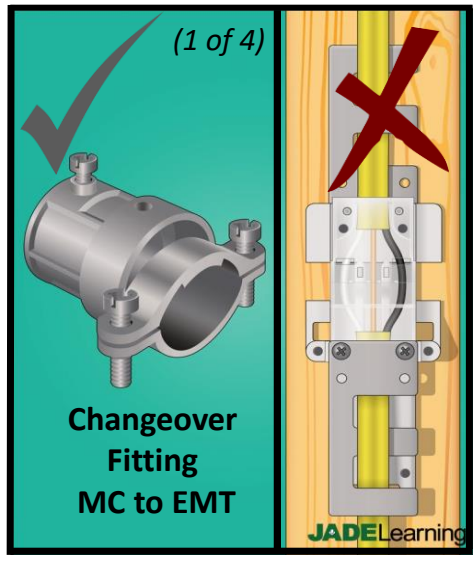
135

300.15(F) Boxes, Conduit Bodies, or Fittings – Where Required. Fitting.

In the 2020 NEC-

Section 300.15(F) of the 2020 NEC states:
A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. The fitting shall be accessible after installation, unless listed for concealed installation.

But what is new for the 2020 Code cycle?



136

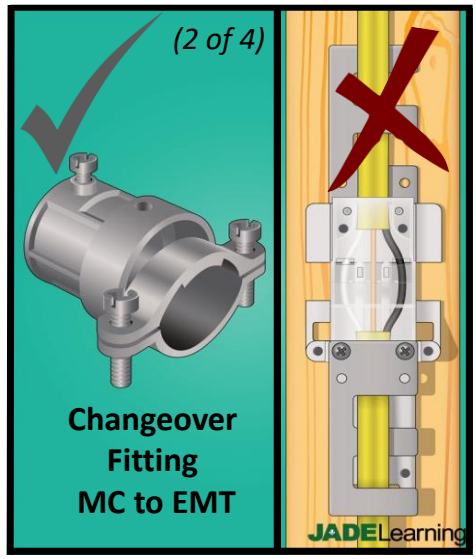
300.15(F) Boxes, Conduit Bodies, or Fittings – Where Required. Fitting.

JADE LEARNING
A TPC COMPANY

Section 300.15(F) of the 2020 NEC states:
A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. The fitting shall be accessible after installation, unless listed for concealed installation.

But what is new in the 2020 NEC?

In the 2017 NEC, these types of fittings were required to always be accessible - they could never be concealed!

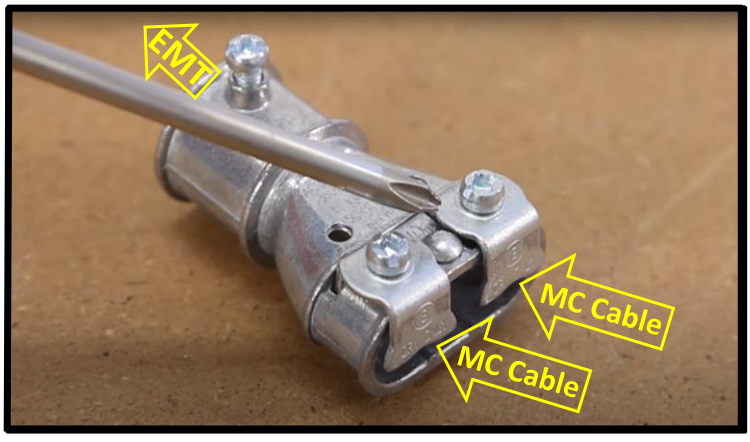


300.15(F) Boxes, Conduit Bodies, or Fittings – Where Required. Fitting.

JADE LEARNING
A TPC COMPANY

Example of approved fitting-

Two MC Cables transition into One EMT

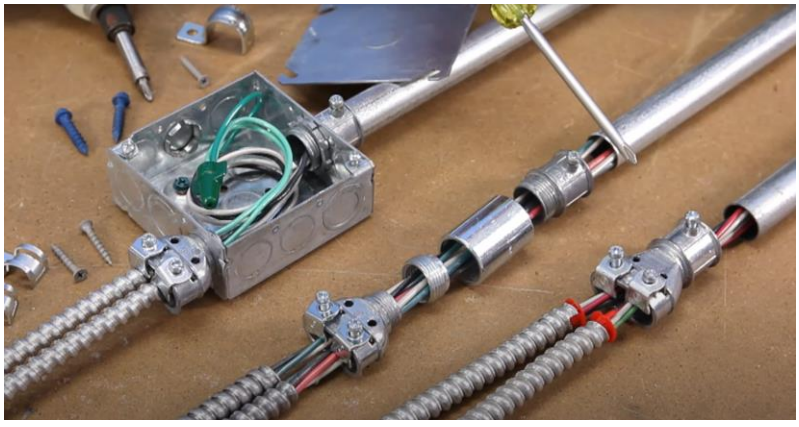


300.15(F) Boxes, Conduit Bodies, or Fittings – Where Required. Fitting.

JADE LEARNING
A TPC COMPANY

(4 of 4)

Example of approved fitting-



MC cables are often equipped with **changeovers** so EMT can protect the conductors in areas where they are exposed to physical damage.

JADE LEARNING
A TPC COMPANY

Building Exits & Danger Signs

Important Changes in the 2020 NEC

300.25 Exit Enclosures (Stair Towers).

BRAND NEW for the 2020 NEC is Code section 300.25-

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 in that exit enclosure.

300.45 Danger Signs.

Systems Over 1000-volts Require Danger Signs

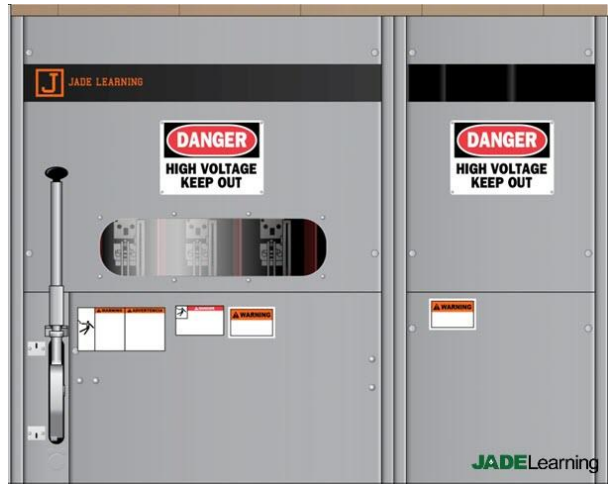
(1 of 2)

Newly revised in the 2020 NEC- The Code now requires the word *DANGER* where it once required "Warning."

Section 300.45 states:

Danger Signs. *Danger signs shall be conspicuously posted at points of access to conductors in all raceway systems and cable systems. The sign(s) shall meet the requirements in 110.21(B), shall be readily visible, and shall state the following:*

DANGER—HIGH VOLTAGE—KEEP OUT



300.45 Danger Signs.
Systems Over 1000-volts Require Danger Signs

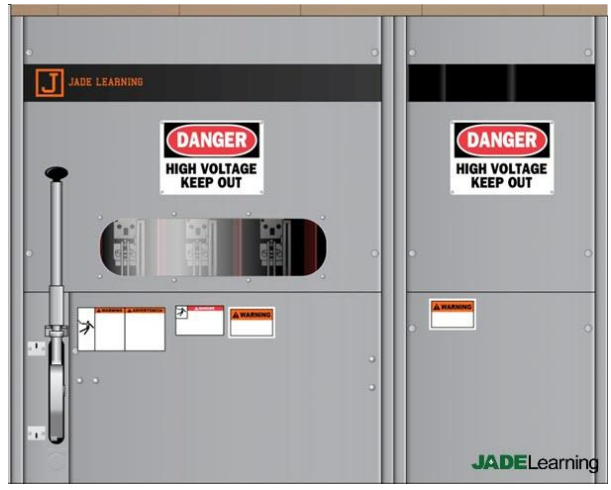
JADE LEARNING
A TPC COMPANY

(2 of 2)

In the 2020 NEC: "Warning" signs are now referred to as ***"Danger"*** signs which aligns with sign requirements from other classification systems such as OSHA.

OSHA Classifications:

1. **Warning means:** If sign is not heeded, it **can** cause death or serious injury.
2. **Danger means:** If sign is not heeded, it **will** cause death or serious injury.

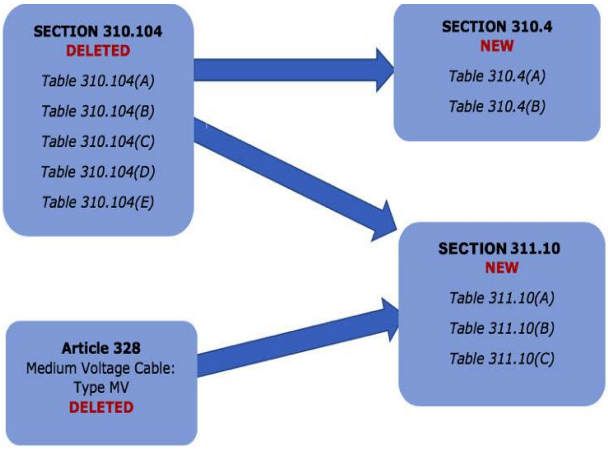


JADE LEARNING
A TPC COMPANY

Conductors, Boxes & Cables

Important Changes in the 2020 NEC

310.4 Conductor Constructions and Applications.



In the 2020 NEC:

Section 310.104 *Conductor Constructions & Applications* has been deleted and its contents (Code text) divided between two brand-new Code sections:

310.4: *Conductor Constructions and Applications.*

&

311.10: *Medium Voltage Conductors and Cable.*

Table 310.12 Dwelling Unit Service and Main Power Feeder Conductors. *(1 of 2)*

In the 2020 NEC-

The 83% Table for sizing dwelling unit service conductors and feeders (when they carry 100% of the load) is back in the main NEC text!

Previously known as Table 310.15(B)(7), it has returned as Table 310.12 in the new 2020 NEC!

TABLE 310.12 SINGLE-PHASE DWELLING SERVICES AND FEEDERS

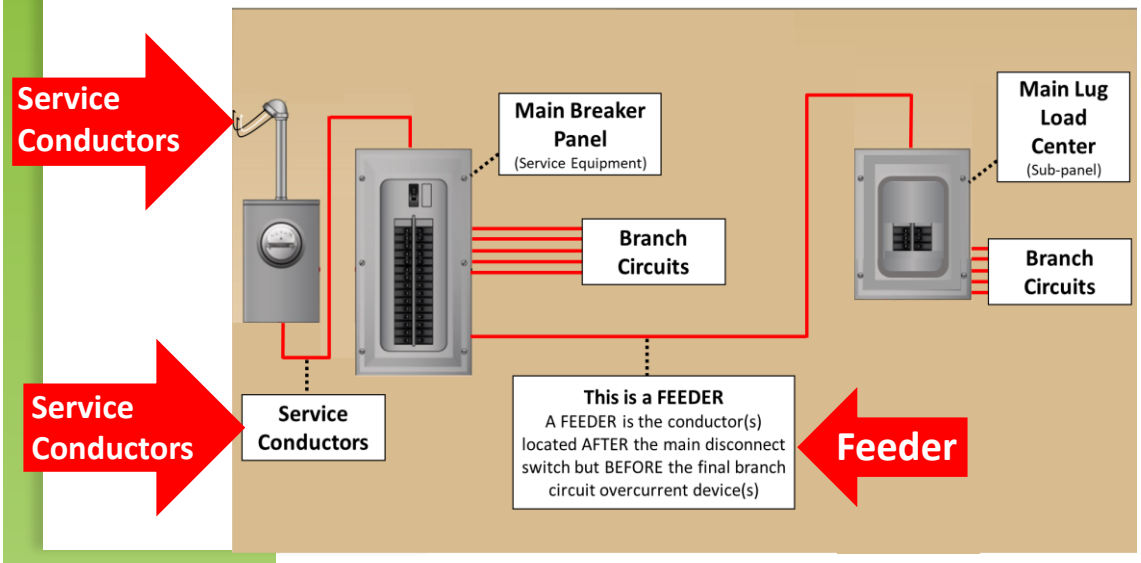
SERVICE OR FEEDER RATING (AMPERES)	CONDUCTOR (AWG or kcmil)	
	COPPER	ALUMINUM OR COPPER-CLAD ALUMINUM
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

Note: If no adjustment of correction factors are required, this table shall be permitted to be applied.

EXAMPLE: This feeder does not carry the entire load of the dwelling and the previous Table cannot be used!

(2 of 2)

JADE LEARNING A TPC COMPANY



310.15 Ampacity Tables.

JADE LEARNING A TPC COMPANY

TABLE 310.16

Ampacities of Insulated Conductors with Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried)

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.4(A).]						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, PFA, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN, Z, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18*	—	—	14	—	—	—	—
16*	—	—	18	—	—	—	—
14*	15	20	25	—	—	—	—
12*	20	25	30	15	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4

In the 2020 NEC-

Table 310.15(B)(16), the electrician's primary wire ampacity Table has been returned to its original home of **Table 310.16**

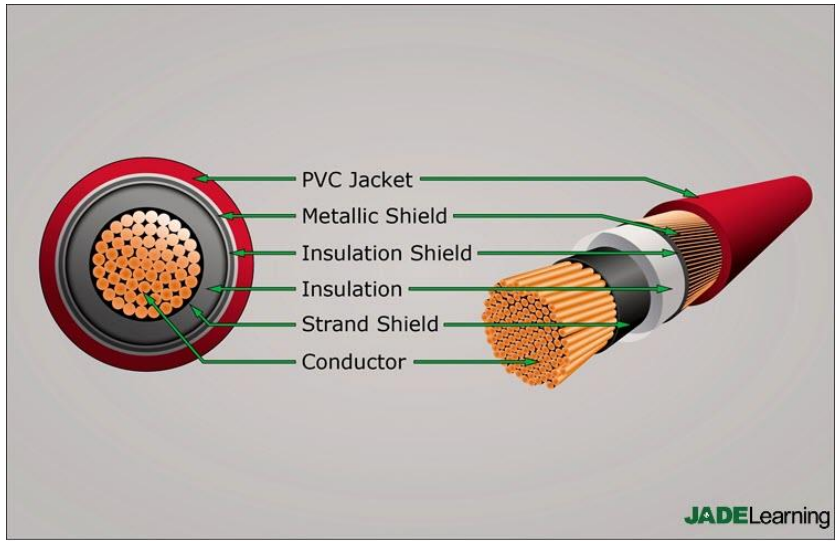
Section 310.15 has been cleaned up in the 2020 NEC to make room for the NEC's many CONDUCTOR AMPACITY DERATING TABLES.

311 Medium Voltage Conductors and Cables.

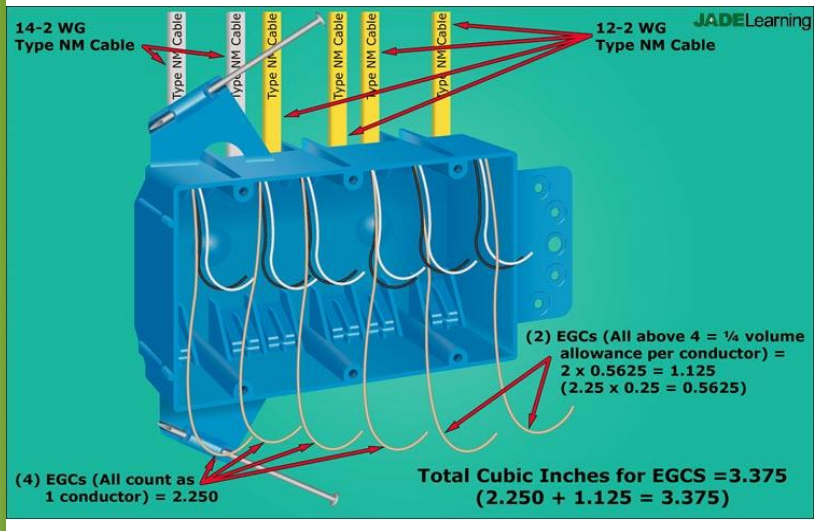
In the 2020 NEC-

Article 311 ***Medium Voltage Conductors and Cables*** is **brand-new** for the 2020 Code cycle.

Rules for medium voltage conductors throughout all the NEC have moved to Article 311.



314.16(B)(5) Equipment Grounding Conductor Fill.



In the 2020 NEC-

There are new EGC fill-count instructions in the 2020 NEC, they state:

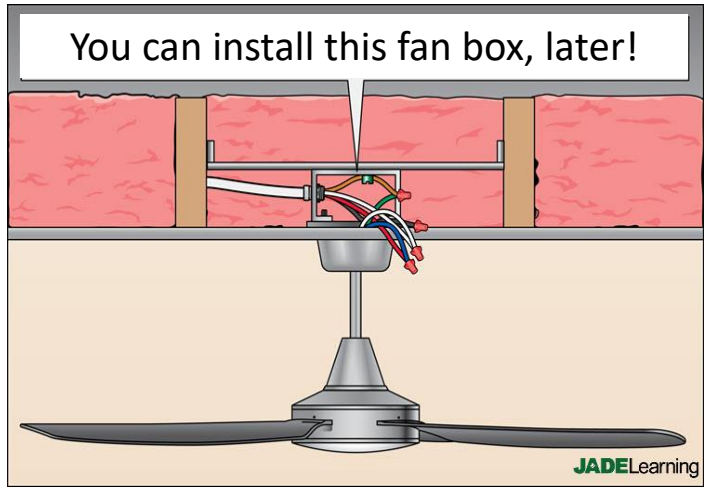
If more than 4 EGCs are in a box, a 1/4 volume allowance is counted for **each additional EGC that enters the box** based on the largest EGC in that box.

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

In the 2020 NEC-

The 2020 NEC now allows you to install a listed ceiling fan-box (capable of carrying a ceiling fan's weight) at a later date—after the initial installation, if—

Structural members in the ceiling **WILL BE ACCESSIBLE LATER** that are capable of supporting a fan and fan-box in each habitable room where this future installation will occur.



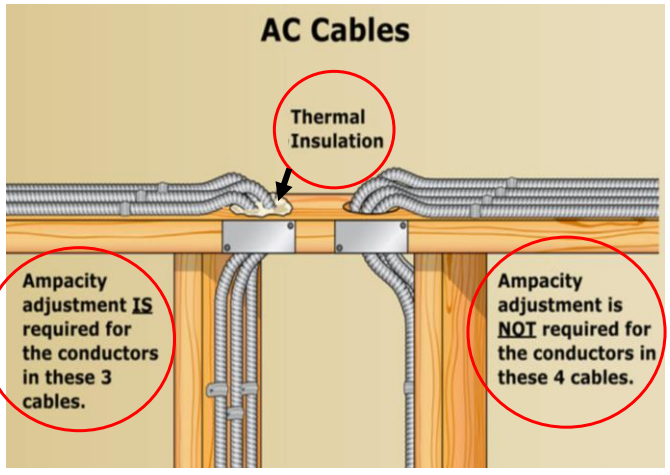
314.29 Boxes, Conduit Bodies, and Handhole Enclosures to be Accessible.

In the 2020 NEC - Better organization of rules governing enclosure accessibility.

Inside Buildings:
Boxes and conduit bodies shall be installed so that the contained wiring can be accessed without removing any part of the building or structure.

Underground:
Underground boxes and handhole enclosures shall be installed so they are accessible without excavating sidewalks, paving, earth, or other substances used to establish the finished grade.

320.80(A) Ampacity. Thermal Insulation.



In the 2020 NEC-

AC cables (armored cables) may require derating according to Table 310.15(C)(1) if more than 2 AC cables containing 2 or more current-carrying conductors each are bundled so they cannot displace their heat.

The installation of "*thermal insulation, caulk, or sealing foam*" and the absence of an air gap between cables becomes the deciding factor in this new 2020 Code cycle.

330.104 Conductors.

In the 2020 NEC-

Section 330.104 has been revised to make a clear distinction between MC cables used as **control and signal** conductors versus MC cable used as normal **power and lighting** conductors in a branch circuit.

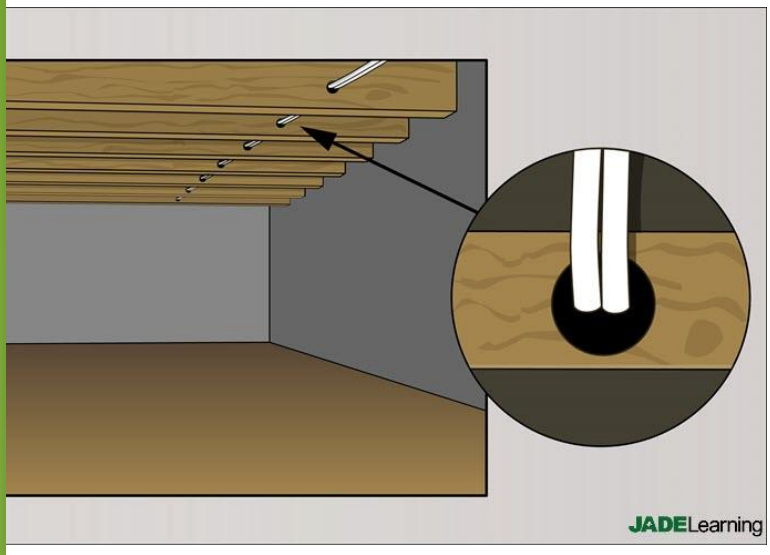
Minimum conductor sizes are different depending on the use of the MC cable.

Ungrounded, Grounded, and Equipment Grounding Conductors		
Copper, Nickel, or Nickel-Coated Copper	Aluminum	Copper-Clad Aluminum
No. 14 AWG	No. 12 AWG	No. 12 AWG

Control and Signal Conductors		
Copper, Nickel, or Nickel-Coated Copper	Aluminum	Copper-Clad Aluminum
No. 18 AWG	No. 12 AWG	No. 14 AWG

JADELearning

334 Nonmetallic-Sheathed Cable: Types NM and NMC.



In the 2020 NEC-

References to Type NMS Cable were removed from Article 334 in the 2020 NEC.

NMS cable consists of insulated (Shielded) power or control conductors but has not been available for years!

337 Type P Cable.

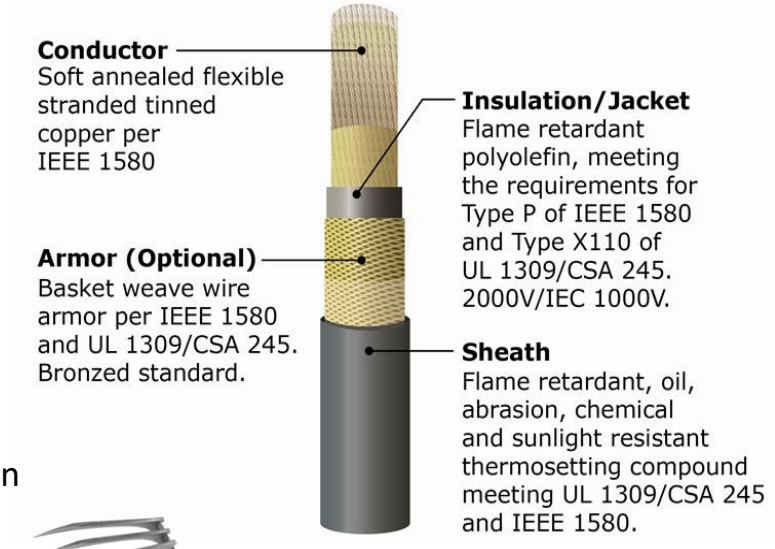
In the 2020 NEC-

Type P Cable is a new addition to the 2020 NEC.

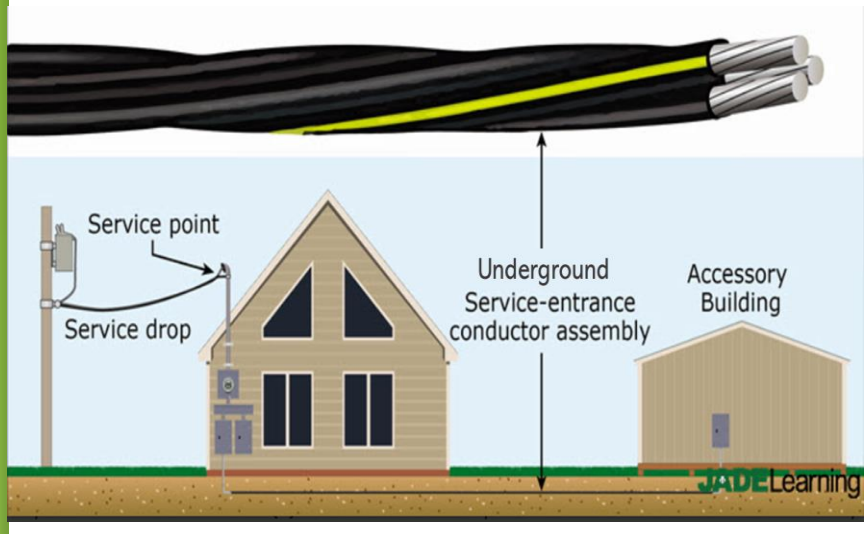
It can withstand various chemicals, abrasives, vibration and extreme temperatures.

It has been used for decades on offshore drilling rigs.

Type P Cable is the Adamantium of electrical cables!



338.100 Construction.



In the 2020 NEC-

Bare copper conductors are no longer permitted as part of USE cables when the cable is buried in the earth.

USE cable with a bare ground is still allowed, but only when installed above ground!

342.10(E) Severe Physical Damage.

In the 2020 NEC-

Section 342.10(E) now permits **Intermediate Metal Conduit (IMC)** to be used in locations subject to severe physical damage.

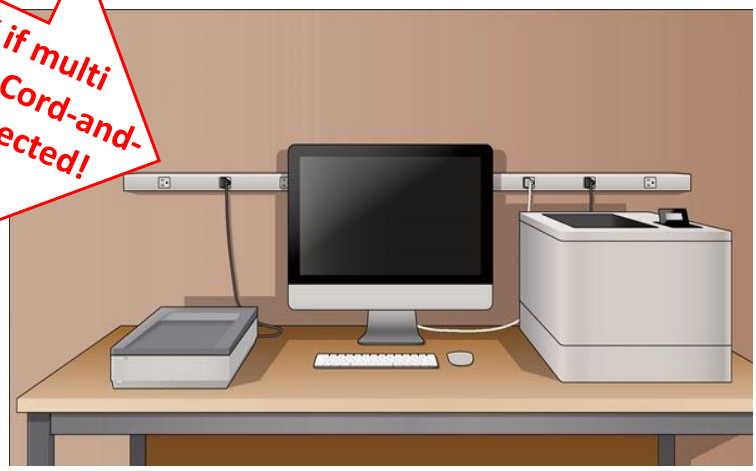
In the 2017 NEC, IMC was not expressly permitted for use where severe physical damage could occur.

380.12(7) Multioutlet Assembly. Uses Not Permitted.

JADE LEARNING
A TPC COMPANY

In the 2020 NEC-

New for the 2020 Code cycle, multioutlet assemblies cannot be installed where cord and plug connected.



159

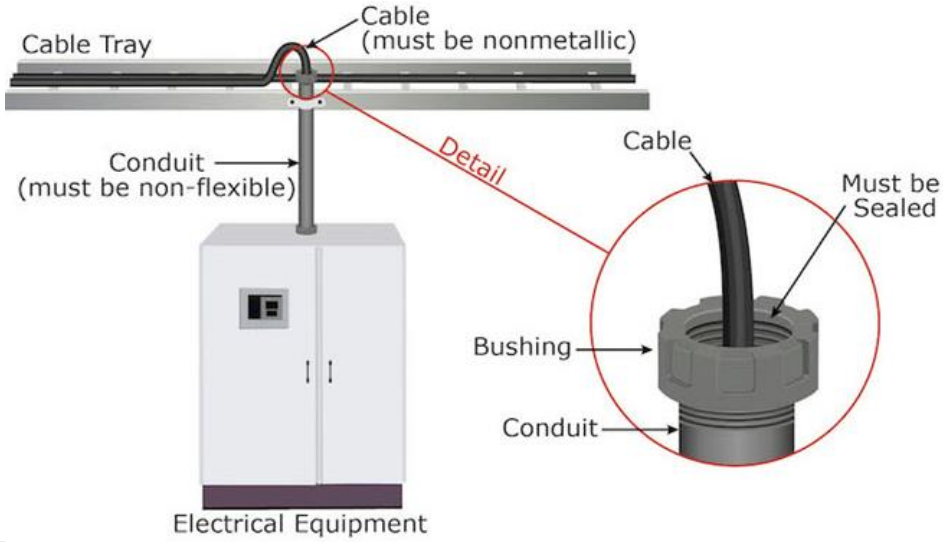
392.46 Bushed Conduit or Tubing.

JADE LEARNING
A TPC COMPANY

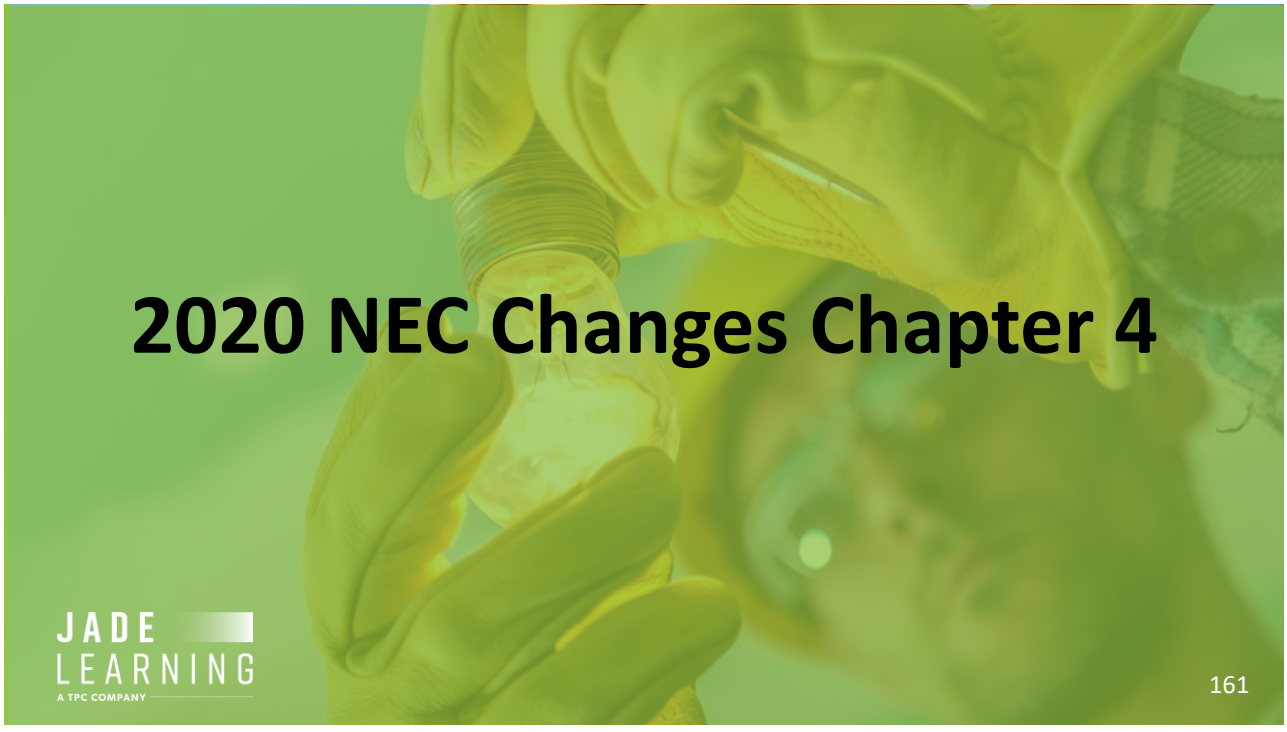
In the 2020 NEC-

Section 392.46 has been expanded to clarify acceptable methods for transitioning from:

(1) A cable tray to conduit, and
(2) A cable tray to equipment.



160



161

JADE LEARNING
A TPC COMPANY

What is CHAPTER-4 of the 2020 NEC?

Equipment for General Use

Chapter 4 covers the following requirements for *Equipment for General Use:*

- Flexible cords, flexible cables, and fixture wires
- Switches and receptacles
- Switchboards, switchgear, and panels
- Luminaires
- Appliances
- Fixed electric space heating, motors, air conditioning, generators, transformers and more.

162

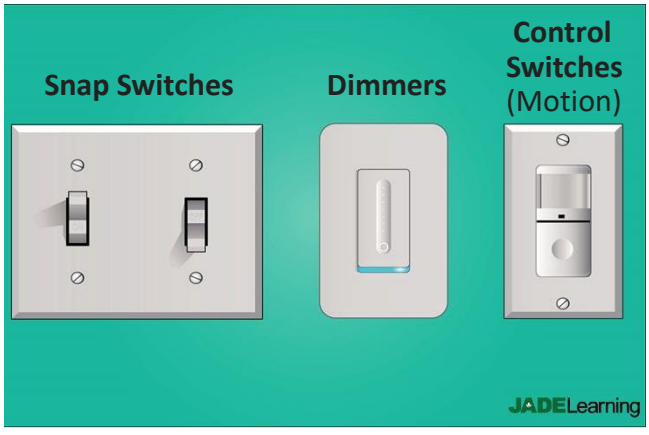
Let's Begin Chapter 4 with

Switches

Important Changes in the 2020 NEC

404.9 General Use Snap Switches, Dimmers, and Control Switches.

(1 of 3)



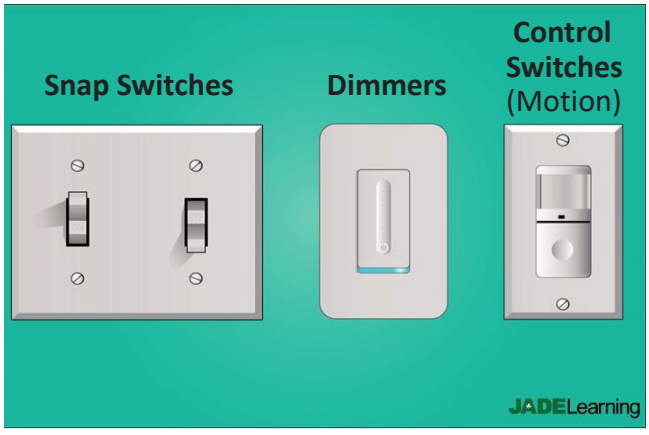
In the 2020 NEC:

2017 Title of Article:
Provisions for General-Use Snap Switches.

2020 Title of Article:
General-Use Snap Switches, Dimmers, and Control Switches.

404.9 General Use Snap Switches, Dimmers, and Control Switches.

(2 of 3)



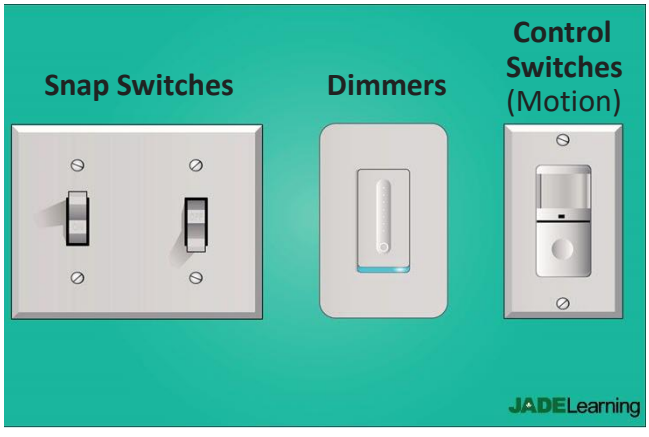
In the 2020 NEC:

404.9(B) Grounding

The grounding requirements in Section 404.9(B) for these devices and their faceplates have been revised for the 2020 Code cycle.

404.9 General Use Snap Switches, Dimmers, and Control Switches.

(3 of 3)



In the 2020 NEC:

404.9(B) Grounding

In the *2017 NEC,* Section 404.9(B) says: *Metal faceplates shall be grounded*.

In the 2020 NEC, Section 404.9(B) says: *Metal faceplates shall be bonded to the equipment grounding conductor.*

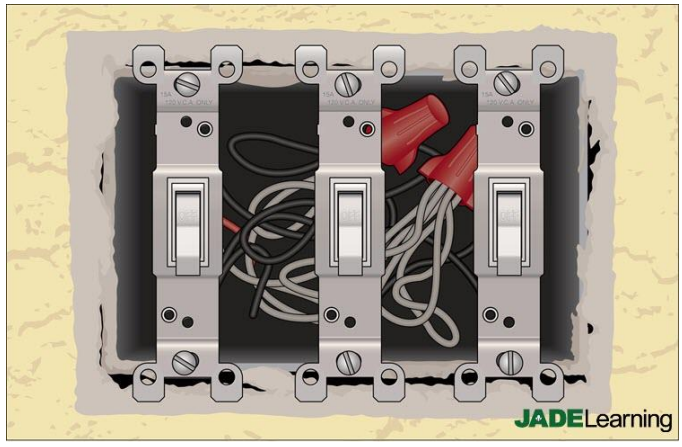
404.14(A), (B), (C), (D) Rating and Use of Switches.

JADE LEARNING
A TPC COMPANY

(1 of 6)

What is a snap switch?

Article 100 of the NEC defines a general-use snap switch as a type of general-use switch made to be installed in device boxes, on box covers, or with other wiring systems permitted in the NEC.
General-use snap switches can use alternating-current (ac) or direct-current (dc) with resistive, inductive, or other types of loads.



404.14(A), (B), (C), (D) Rating and Use of Switches.

JADE LEARNING
A TPC COMPANY

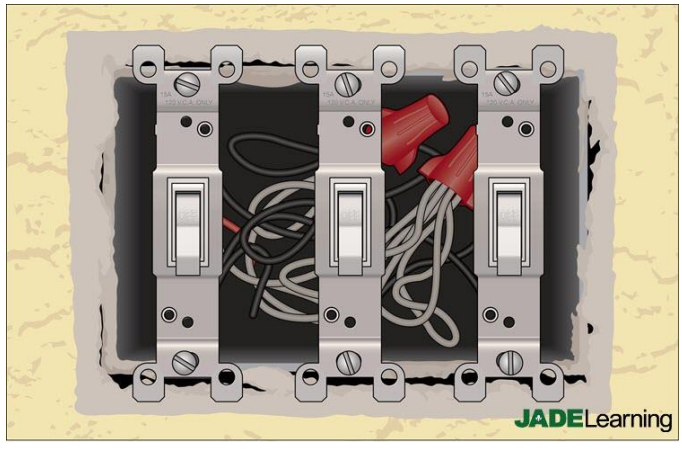
(2 of 6)

Snap Switches can power Resistive and Inductive loads as follows:
Resistive load examples:

- **Incandescent light bulbs**
- **Toasters**
- **Space heaters.**

Inductive load examples:

- **Fans**
- **Vacuum cleaners**
- **Condensers on refrigerators**
- **Motors**



404.14(A), (B), (C), (D) Rating and Use of Switches.

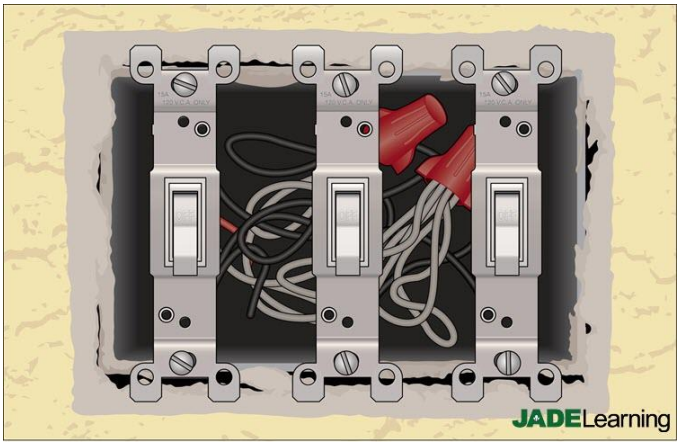
JADE LEARNING
A TPC COMPANY

(3 of 6)

In the 2020 NEC:

The 2020 NEC addresses many types of switches.

Article 404 specifically addresses:
Single-pole, three-way, four-way, single-throw knife, and double-throw knife switches.



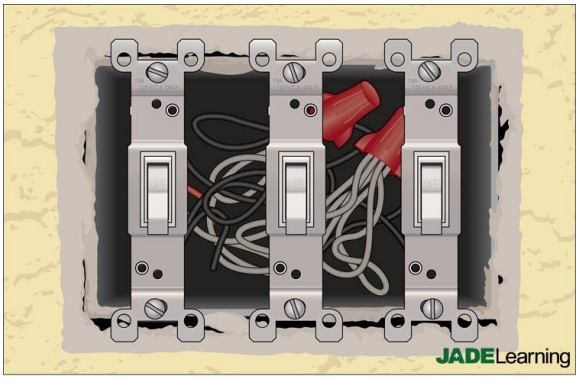
404.14(A), (B), (C), (D) Rating and Use of Switches.

JADE LEARNING
A TPC COMPANY

(4 of 6)

In the 2020 NEC:

New to Section 404.14(A) in 2020 NEC, we find permission for ac snap switches to be used with electronic ballasts, self-ballasted lamps, compact fluorescent lamps (CFLs), and LED lamp loads with their associated drivers. When used with ac snap switches, these loads cannot exceed 20 amperes, and cannot exceed the ampere rating of the switch.



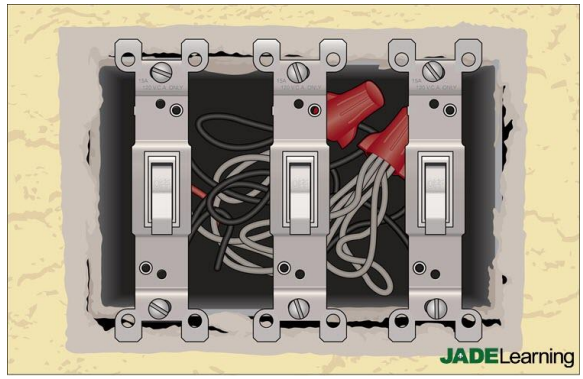
404.14(A), (B), (C), (D) Rating and Use of Switches.

JADE LEARNING
A TPC COMPANY

(5 of 6)

In the 2020 NEC:

New to Section 404.14(C):
The 2017 NEC required switches connected to aluminum conductors and rated 20 amps or less to be *listed* and marked for aluminum wires.
New to the 2020 NEC, these switches must still be marked for aluminum wiring but are no longer required to be listed (such as a UL listing).



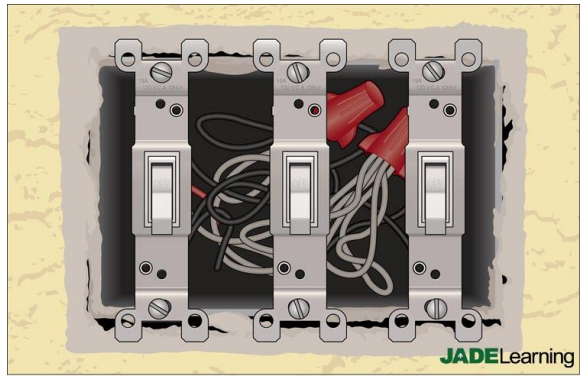
404.14(A), (B), (C), (D) Rating and Use of Switches.

JADE LEARNING
A TPC COMPANY

(6 of 6)

In the 2020 NEC:

New to Section 404.14(D):
New to the 2020 NEC, 347-volt ac snap switches are now permitted to control electronic ballasts, self-ballasted lamps, CFLs, and LED lamps with their associated drivers as long as they do not exceed 20 amps nor the voltage rating of the switch.

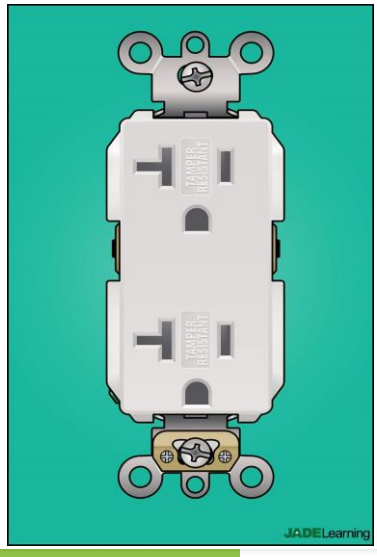


Receptacles & Separable Connectors

Important Changes in the 2020 NEC

406.3(A) Receptacle Rating and Type. Receptacles.

(1 of 5)



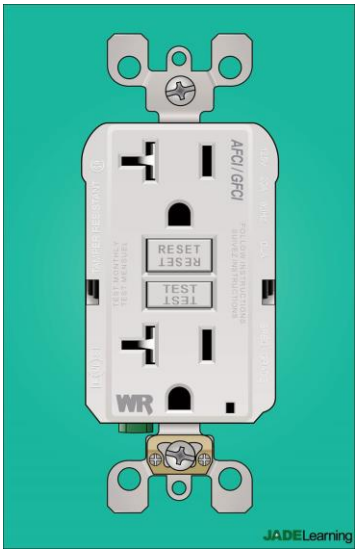
Section 406.3(A) has been revised in 2020 NEC to say:

Receptacles shall be listed and marked with the manufacturer's name or identification and voltage and ampere ratings. Receptacles shall not be permitted to be reconditioned.

406.4(D)(4) Replacements. AFCI Protection.

JADE LEARNING
A TPC COMPANY

(2 of 5)



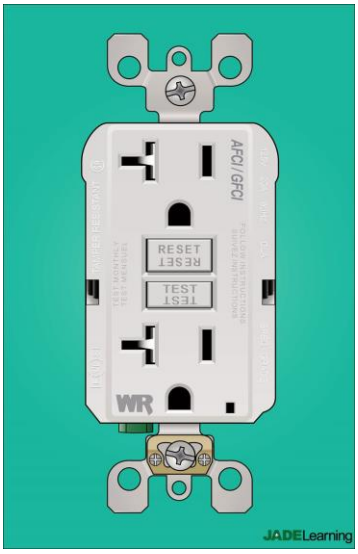
When Replacing Older Receptacles:
When replacing receptacles at older electrical outlets, if the outlet location is named in Section 210.12 of the current edition of the NEC as a location requiring arc-fault (AFCI) protection, the electrician must provide that replacement receptacle with some form of approved arc-fault protection.

- **Four arc-fault methods have been approved for this scenario, and up until the 2020 NEC, two exceptions were approved that allowed electricians to forego providing that AFCI protection.**

406.4(D)(4) Replacements. AFCI Protection.

JADE LEARNING
A TPC COMPANY

(3 of 5)

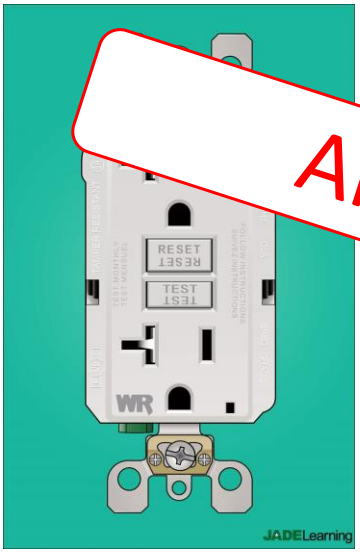


When Replacing Older Receptacles:
The first exception stated where no equipment grounding conductor (EGC) was found at the outlet box and no arc-fault protection device was commercially available to protect such a two-wire replacement receptacle, AFCI protection was not required.
However, in the new 2020 NEC, since AFCI protection is commercially available for these receptacles, *Exception No.1* has been removed from the Code section.

406.4(D)(4) Replacements. AFCI Protection.

JADE LEARNING
A TPC COMPANY

(4 of 5)



When Replacing Older Receptacles:

The first exception stated where no equipment grounding conductor (EGC) was found at the outlet arc-fault protection device was ble to protect such a two-wire protection was not required.

However, in the new 2 tion is commercially available for th *Exception No.1* has been removed from t section.

Amended by NC!

406.4(D)(4) Replacements. AFCI Protection.

JADE LEARNING
A TPC COMPANY

(5 of 5)

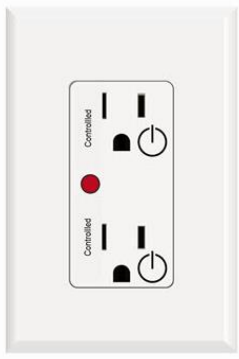
NC AMENDMENT

The AMENDMENT to 406.4(D)(4) simply removes 406.4(D)(4) from the NC Electrical Code so there is no requirement to provide AFCI protection to a replacement receptacle when it previously did not require AFCI protection.

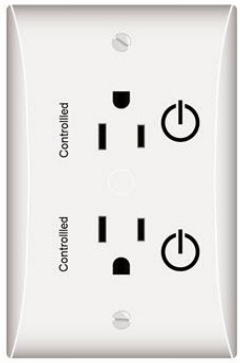
Amendment 406.4(D)(4). Arc Fault Circuit Interruptor Protection. Deleted.

406.4(D)(7) Replacements. Controlled Receptacles.

In the 2020 NEC
406.4(D)(7) states:
Automatically controlled receptacles shall be replaced with equivalently controlled receptacles.
If automatic control is no longer required, the receptacle and any associated receptacles marked in accordance with 406.3(E) shall be replaced with a receptacle and faceplate not marked in accordance with 406.3(E).

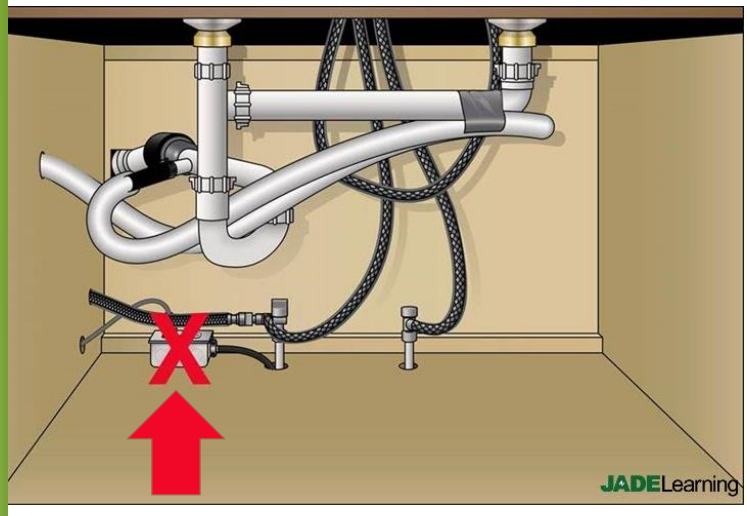


Two Controlled



Two Controlled

406.5(G)(2) Receptacle Orientation. Under Sinks.



In the 2020 NEC:
Receptacles shall not be installed in a face-up position in the area below a sink.

This new directive has no exceptions and applies to all receptacles under all sinks.

406.7 Attachment Plugs, Cord Connectors, and Flanged Surface Devices.

JADE LEARNING
A TPC COMPANY

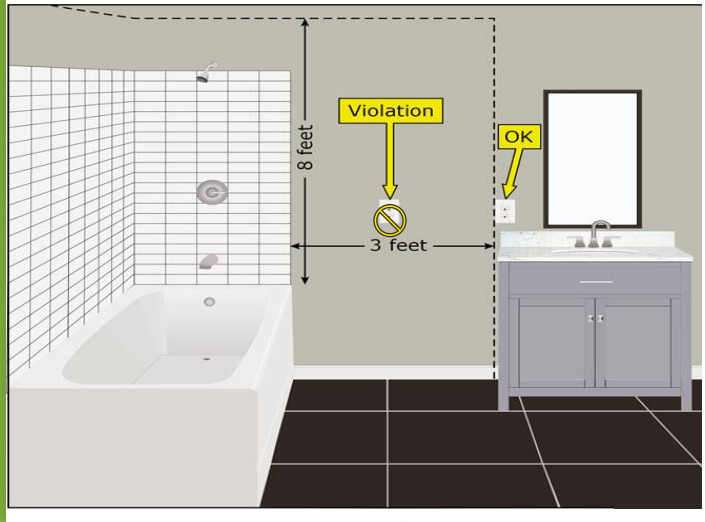
In the 2020 NEC:
Attachment plugs, cord connectors, and flanged surface devices shall not be permitted to be reconditioned.

The term reconditioned is often referred to as rebuilt, refurbished, or remanufactured.

406.9(C) Receptacles in Damp or Wet Locations. Bathtub and Shower Space.

JADE LEARNING
A TPC COMPANY

(1 of 4)



In the 2020 NEC
Where receptacles are to be installed near tubs and showers:

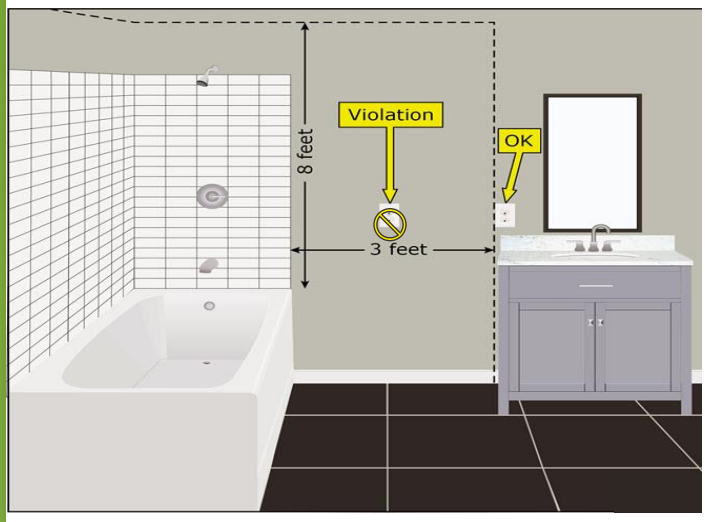
Receptacles are not permitted within 8 feet vertically and 3 feet horizontally of the bathtub rim or shower stall threshold.

Receptacles are still required within 3 feet of the sink!

406.9(C) Receptacles in Damp or Wet Locations. Bathtub and Shower Space.

JADE LEARNING
A TPC COMPANY

(2 of 4)

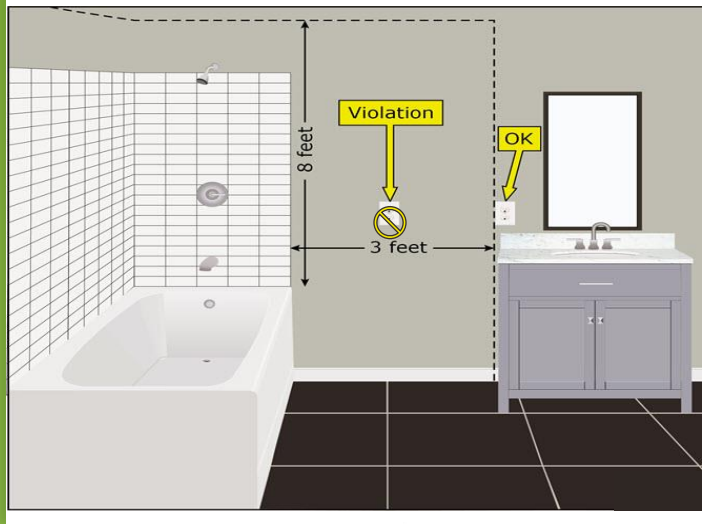


In the 2017 NEC, Section 406.9(C) Bathtub and Shower Space, stated:
Receptacles shall not be installed within or directly over a bathtub or shower stall.

406.9(C) Receptacles in Damp or Wet Locations. Bathtub and Shower Space.

JADE LEARNING
A TPC COMPANY

(3 of 4)

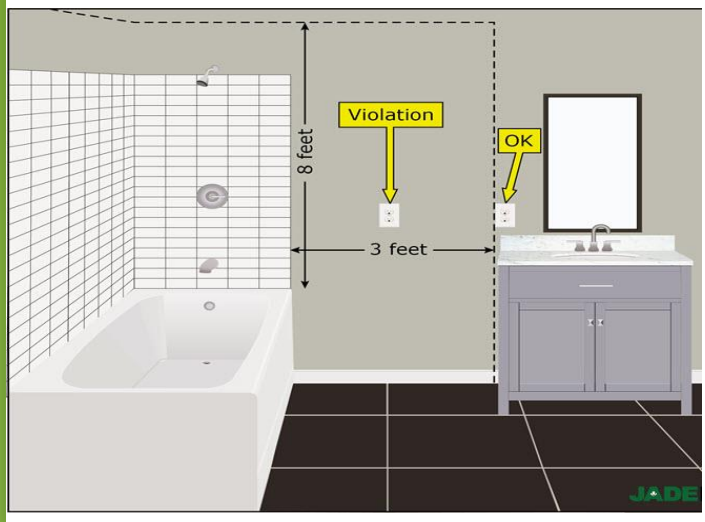


2020 NEC Section 406.9(C) Bathtub and Shower Space says:
Receptacles shall not be installed within a zone measured (3 ft) horizontally and (8 ft) vertically from the top of the bathtub rim or shower stall threshold. The identified zone is all-encompassing and shall include the space directly over the tub or shower stall.

406.9(C) Receptacles in Damp or Wet Locations. Bathtub and Shower Space. (2of2)

JADE LEARNING A TPC COMPANY

(4 of 4)



If a bathroom is too small and a conflict exists between the bathtub/shower space and receptacle(s) being installed, an exception to the 2020 NEC requirement allows the receptacle to be installed on the farthest bathroom wall even if it is too close to the tub or shower.

406.12 Tamper Resistant Receptacles.

(1 of 2) JADE LEARNING A TPC COMPANY

In the 2017 NEC: Tamper-resistant receptacles were required as follows:

- Dwelling units, in all areas specified in Sections 210.52 and 550.13
- Guest rooms and guest suites of hotels and motels
- Child care facilities
- Preschools and elementary education facilities
- Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices, and outpatient facilities
- Locations used for awaiting transportation, gymnasiums, skating rinks, and auditoriums
- Dormitories

406.12 Tamper Resistant Receptacles.

JADE LEARNING

(2 of 2)

In the 2020 NEC: Tamper-resistant receptacles are now **also required in common areas of hotels, assisted-living facilities, and accessory buildings; and detached garages outside of dwellings.**

406.13 Single Pole Separable Connector Type.

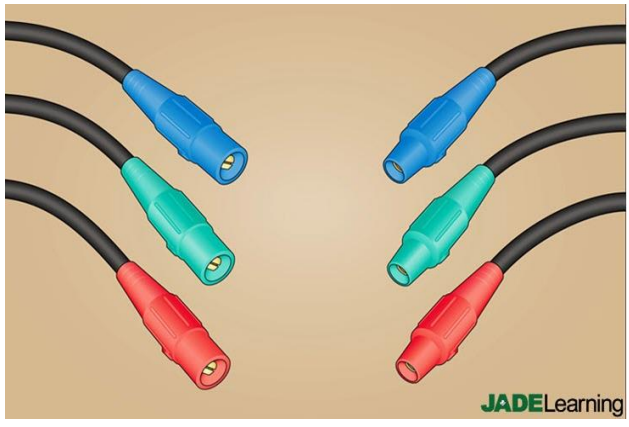
JADE LEARNING
A TPC COMPANY

(1 of 2)

In the 2020 NEC

Single-pole separable-connectors in 406.13 are approved to serve as the ungrounded, grounded, and equipment grounding conductors of a circuit.

Sections 406.13 (A) through (D) have been added to 2020 NEC to provide new guidelines for these unique connectors. We shall focus on 406.13(D).



406.13 Single Pole Separable Connector Type.

JADE LEARNING
A TPC COMPANY

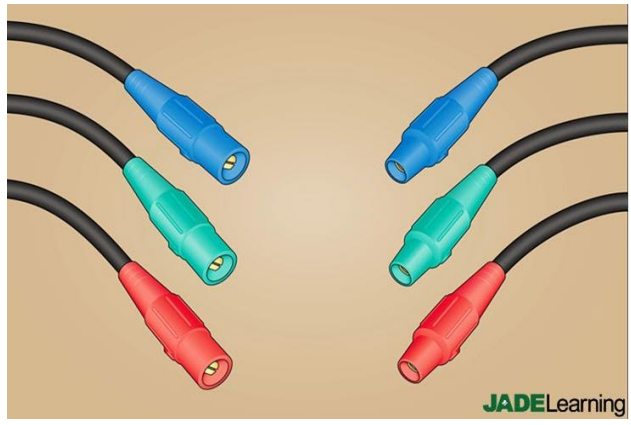
(2 of 2)

In the 2020 NEC

Section 406.13(D) requires this order to be followed when connecting these connectors:

1. **EQUIPMENT GROUND**
2. **GROUNDED CONDUCTOR**
3. **UNGROUNDED CONDUCTOR**

Disconnection must be performed in the reverse order!



JADE LEARNING
A TPC COMPANY

Panels & Enclosures

Important Changes in the 2020 NEC

408.4(A) Field Identification Required. Circuit Directory or Circuit Identification.

JADE LEARNING
A TPC COMPANY

(1 of 2)

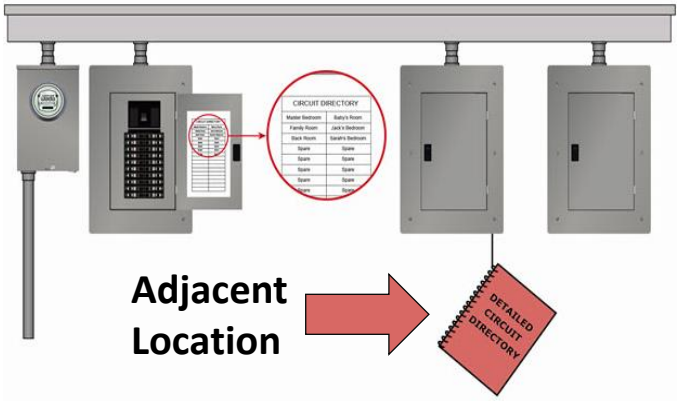
408.4(A) in the 2017 NEC:

- Every circuit must be clearly identified and include an approved amount of detail. Spare circuit positions containing unused overcurrent devices or switches must be described as such.
- The circuit identification must be included in a circuit directory located **on the face or inside the panel door in the case of a panelboard; and at each switch or circuit breaker for a switchboard or switchgear.**
- No circuit shall be described in a manner that depends on transient (changing) conditions of occupancy.

408.4(A) Field Identification Required. Circuit Directory or Circuit Identification.

JADE LEARNING
A TPC COMPANY

(2 of 2)



What's New in 2020 NEC?

A circuit directory can be installed:

- On the face of a panel door.
- Inside a panel door.

  OR
- *In an approved location adjacent to the panel door.*

(This is new for the 2020 NEC!)

But the AHJ must approve all "adjacent" location(s).

408.6 Switchboards/Panelboards. Short-Circuit Current Rating.

JADE LEARNING
A TPC COMPANY

In the 2020 NEC

Section 408.6 extends available fault current marking requirements to all switchboards, switchgear and panelboards in other than one- and two-family dwelling units.

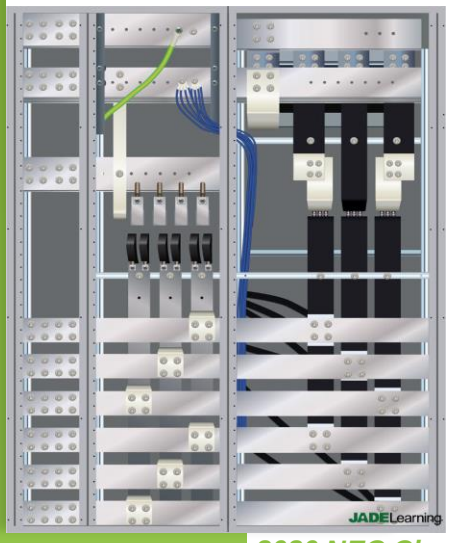
- **The Short Circuit Current Rating (SCCR) on equipment must be no less than the available fault current able to pass through the equipment.**

408.8 Switchboards/Panelboards. Reconditioning of Equipment.

JADE LEARNING
A TPC COMPANY

In the 2020 NEC
If switchboards, switchgear, or panelboards are damaged by fire, fire-related contaminants or water, the equipment must be evaluated by the original manufacturer or a qualified testing lab (UL) before returning to service.

408.18(C)(2) Clearances. Connections. Grounded Circuit Conductors.



In the 2020 NEC

There are NEW rules for the placement of grounded (neutral) lugs inside enclosures.

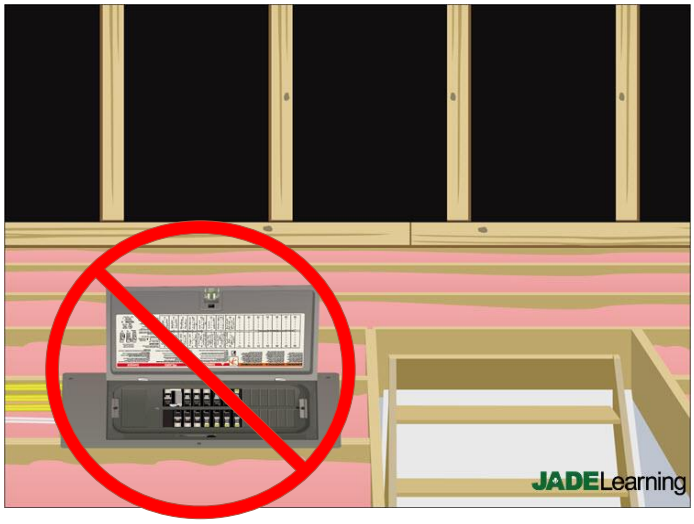
The new rules apply to switchboards and switchgear, but not panelboards.

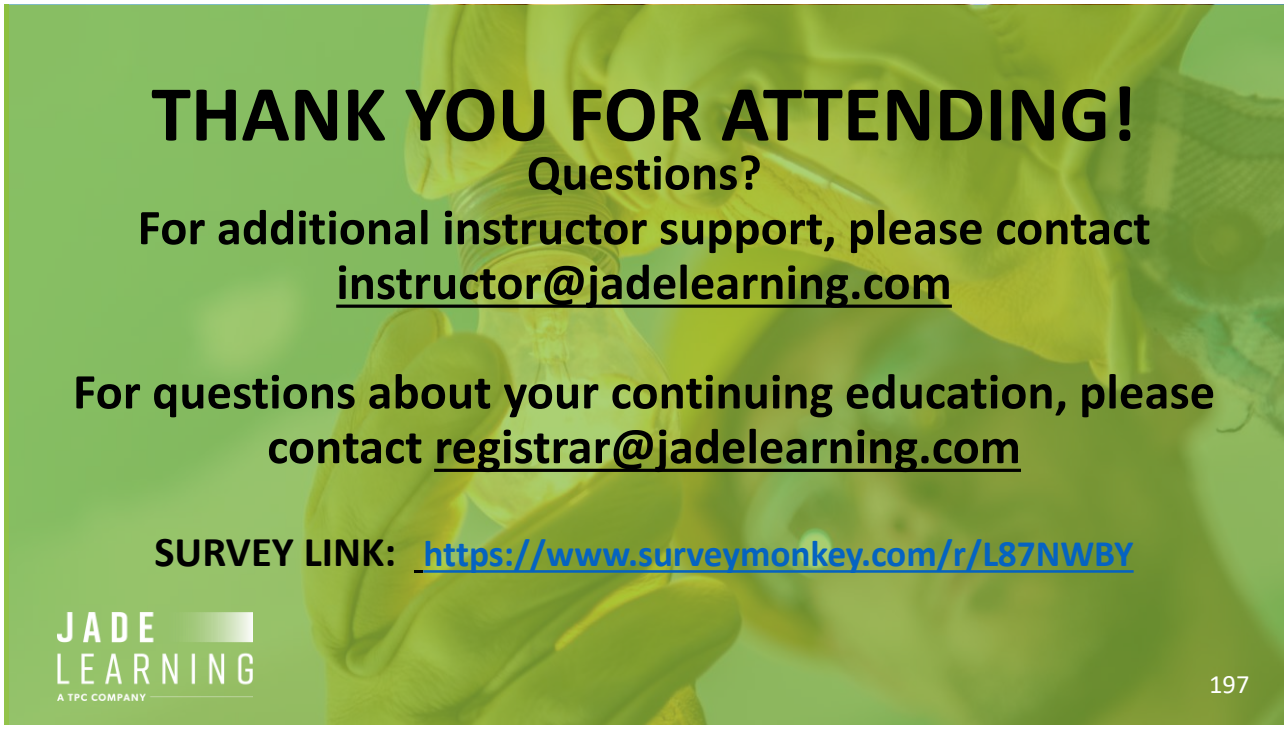
408.43 Panelboard Orientation.

In the 2020 NEC

Panelboards are now prohibited from being installed on their backs, facing up.

- **An interesting fact: Panelboards may be placed horizontally (on their side), but all the breaker handles must be up when "on" which means one side of the panel can't be used!**




THANK YOU FOR ATTENDING!
Questions?
For additional instructor support, please contact instructor@jadelearning.com
For questions about your continuing education, please contact registrar@jadelearning.com
SURVEY LINK: https://www.surveymonkey.com/r/L87NWBY
JADE LEARNING
A TPC COMPANY
197

197