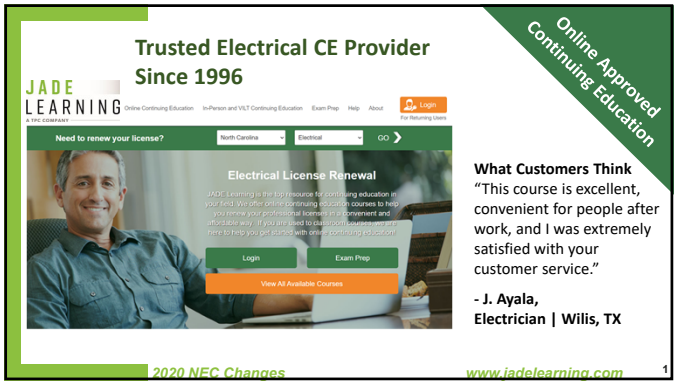
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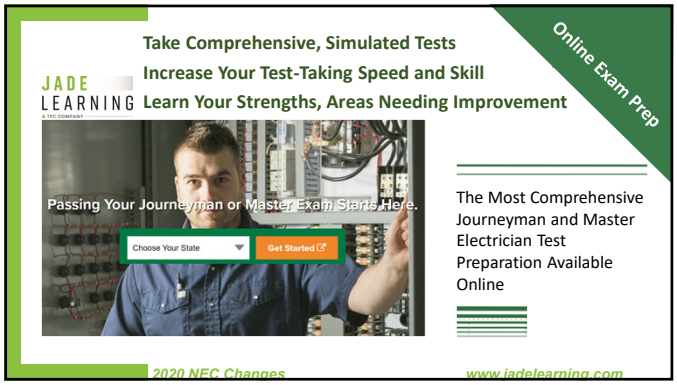
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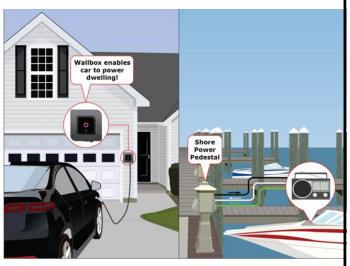
90.2(A) Scope. Covered.

New to the NEC Scope:

- Installations supplying shore power to ships and watercraft in marinas and boatyards, including monitoring of leakage current.
- Installations used to export electric power from vehicles to premises wiring or for bidirectional current flow.



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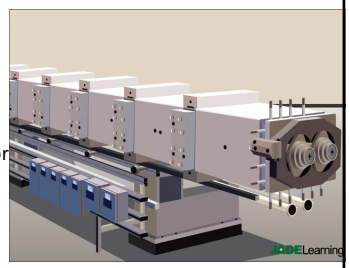
8

100 Definitions- Accessible.

Revised Definition for *Accessible*.

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

Not Equal To: Readily Accessible:
Capable of being reached quickly for operation, renewal, or inspection without employing extraordinary effort, tools, or navigation skills.
(A Condensed Definition)



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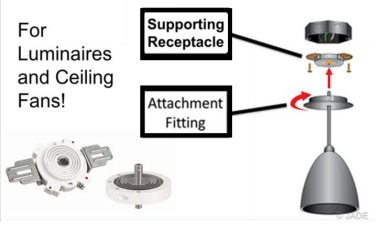
100 Definitions- Attachment Fitting.

Brand-New Definition: *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.

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100 Definitions- Dormitory Unit.

Brand-New Definition: *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.
- Does not have individual cooking facilities.

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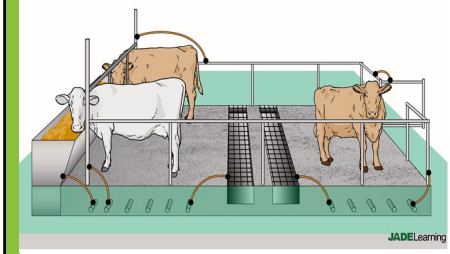
100 Definitions- Equipotential Plane.

Brand-New Definition: *Equipotential Plane*



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

Equipotential means equal voltage.

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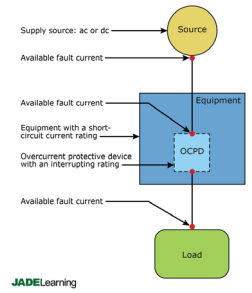
100 Definitions- Fault Current, Fault Current Available.

TWO Brand-New Definitions:

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.



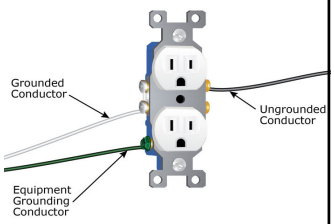
13

100 Definitions- Grounded Conductor. (1of2)

New Informational Note says:

Although an Equipment Grounding Conductor (EGC) is grounded, it is not considered a "grounded conductor" by the NEC. **Note: An EGC is typically green or bare and only carries fault-current.**

However, a "grounded" conductor is a white or gray conductor that IS A CURRENT-CARRYING CONDUCTOR.

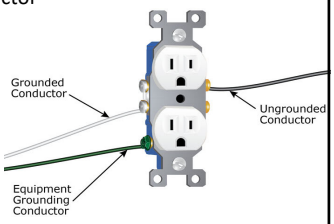


14

100 Definitions- Grounded Conductor. (2of2)

Grounded Conductor:
The white or gray grounded conductor is a return path in a circuit for electrons reading zero-volts.

Grounding Conductor:
The green/bare EGC is the wire or metal-conduit used to carry fault-current, *should a short-to-ground occur.* This path enables the OCPD to trip.



15

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

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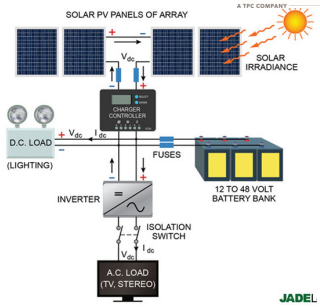
100 Definitions- Island Mode.

Brand-New Definition:
Island Mode
The operational mode for stand-alone power production equipment or an isolated microgrid.

The 2017 NEC referred to this same system condition as *Stand-Alone Mode* or *Islanded Mode*.



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100 Definitions- Labeled.

Equipment or material with a label, symbol, or identifying mark acceptable to the AHJ.

New Informational Note:

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.

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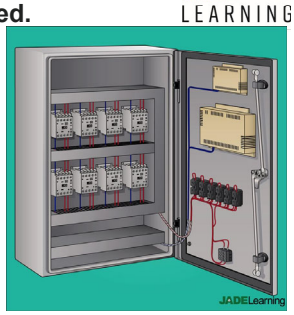
100 Definitions- Reconditioned.

- Electromechanical systems, equipment, apparatus, and components that are restored to operating conditions.
- Also called rebuilt, refurbished, or remanufactured.
- Replacing a damaged circuit breaker with a new circuit breaker is NOT reconditioning the panel.



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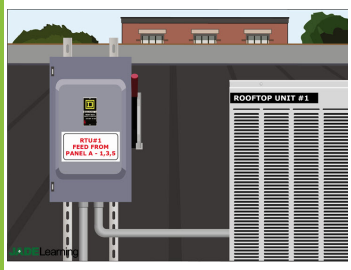
110.22 Requirements for Electrical Installations. Identification of Disconnecting Means.



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

- This directive aligns the marking requirements for disconnects with panels as specified in Section 408.4(B).

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

- Support structures (concrete pads) under the electrical installation may not extend more than 6 inches beyond the front of the equipment.
- Strut channel may be above an electrical panel but may not extend more than 6 inches past the front of the equipment.

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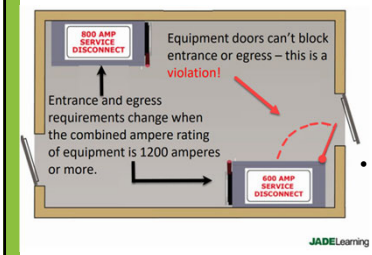
110.26(C)(2) Large Equipment.



- One entrance and one egress is required for disconnecting means with combined ratings of 1200 amps or more, over 6 feet wide, and installed according to Section 230.71
- Open equipment doors may not impede the entry or egress from the working space.

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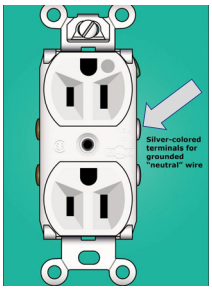
200.10(B) Identification of Terminals.



2017 NEC:
The neutral terminals must be a metal or coating that is substantially white or by the word "white" or the letter "W."

2020 NEC:
The neutral terminals must be a metal or coating that is white or silver in color or by the word "white" or the letter "W."

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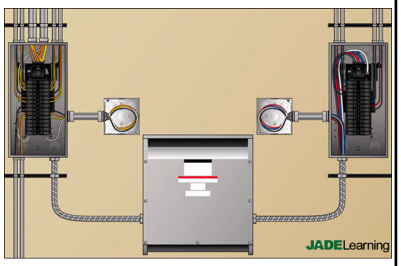
210.5(C)(1) Branch Circuits Supplied From More Than One Nominal Voltage System.

Different systems within the same premises that have the same system voltage class shall be permitted to use the same identification.



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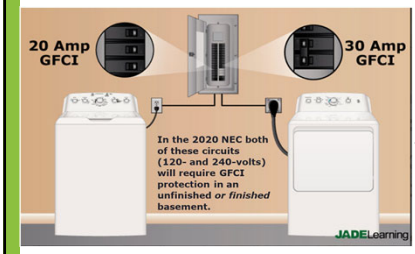
210.8(A) Branch Circuits. Ground Fault Circuit-Interrupter (GFCI) Protection. Dwelling Units.



- Receptacles in dwellings up to 250 volts need GFCI protection in *11 locations* specified in Section 210.8. Including ALL areas of the dwelling basement!
- Indoor damp and wet locations in dwellings must now be GFCI protected in the 2020 NEC.

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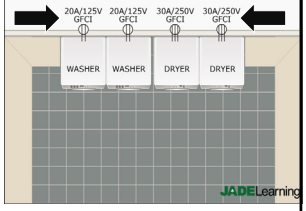
210.8(B) GFCI Protection for Personnel. Other Than Dwelling Units.

- All 125-volt and 250-volt receptacles in laundry rooms need GFCI protection.
- GFCI protection is required in kitchens or *areas with a sink and permanent provisions for either food preparation or cooking.*
- Indoor damp locations (not just wet locations) need GFCI protection.

Single Pole and 2 Pole GFCI protection in laundry rooms



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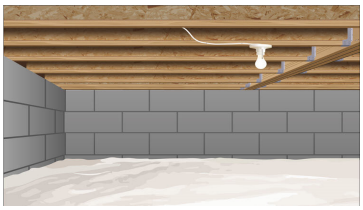
210.8(C) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding 120 Volts installed in crawl spaces.

Lights in all crawl spaces (not just dwelling units) must be GFCI protected.



These GFCI devices must be readily accessible.

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210.8(D) Specific Appliances.

- Dishwasher GFCI requirements were moved to Section 422 in the 2020 NEC.
- Vending machines must now have GFCI protection included in the attachment plug or not more than 12 inches from the attachment plug.

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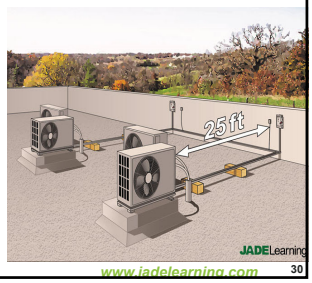
210.8(E) Equipment Requiring Servicing.

GFCI protection is required for 125-volt, single phase receptacles installed in the following locations.

- Within 25 feet of all HVAC and refrigeration equipment addressed in 210.63 **(including in attics!)**

And in *Other* than Dwellings:

- In the same room or area as service equipment.
- In indoor dedicated spaces for other types of equipment.



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210.11(C)(3) Bathroom Branch Circuits.

- The 20-amp branch circuit required for bathrooms is now limited to feeding only countertop receptacles in bathrooms.
- Floor receptacles must be fed from another circuit.

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210.11(C)(4) Garage Branch Circuits.

- The required 20-amp garage branch circuit is permitted to supply only receptacles addressed in Section 210.52(G)(1), not all garage receptacles in this 2020 Code cycle.
- Section 210.52(G)(1) requires one receptacle in each vehicle bay no more than 5 ½ feet above the floor.

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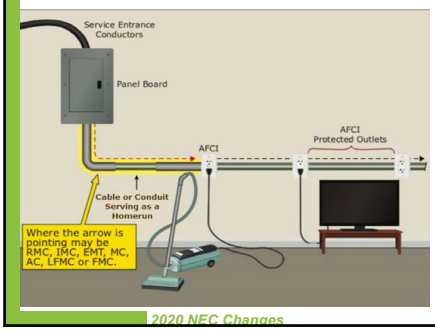
210.12(A)(5) AFCI- Dwelling Units (C), (D).



- When AFCI protection is provided at the first outlet of a branch circuit, a metal raceway is required between the panel and the first outlet.
- A metal raceway is not required if the AFCI protection device is a breaker in the panel.

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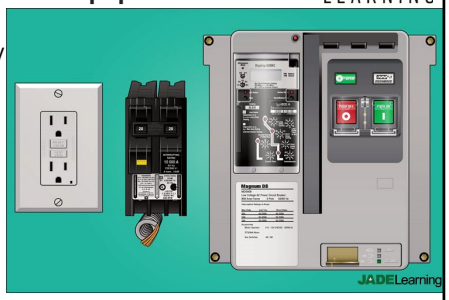
210.15 Reconditioned Equipment.

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

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



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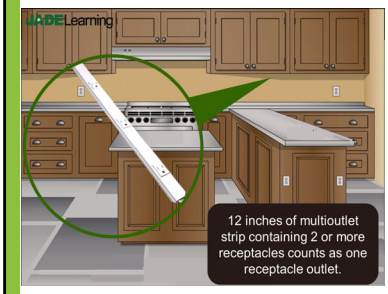
210.52(C) Countertop and Work Surfaces.



- Three new directives in 2020 NEC for 210.52(C).
- Along countertops, each 12-inch length of multioutlet receptacle assembly containing two or more receptacles shall be considered as one receptacle outlet.

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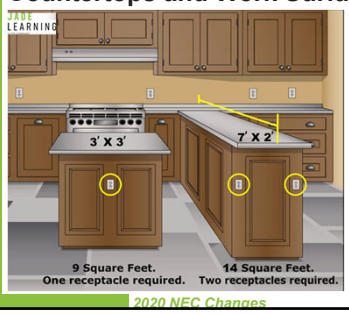
210.52(C)(2) Island and Peninsular Countertops and Work Surfaces.



Brand-new for the 2020 NEC

- At least one receptacle outlet is required for the first 9 square feet of countertop.
- An additional outlet is then required for every 18 square feet of countertop measured beyond the original 9 square feet.
- For peninsulas, no less than one receptacle outlet must be located within 2 feet of the outer end.

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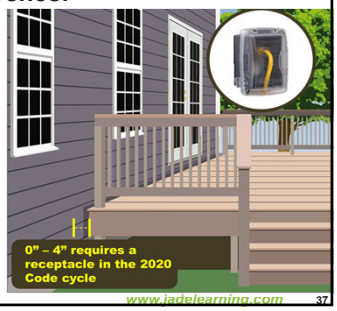
210.52(E)(3) Receptacle Outlet for Balconies, Decks, and Porches.

- 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 the requirement.



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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
Gymnasiums	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 facility	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	1.8
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

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- 2020 NEC moved all dwelling unit info from NEC 220.12 to NEC 220.14(J).
- 220.12 expanded to 29 occupancies.
- The 125% multiplier for continuous loads is now included in Table 220.12.
- Motors less than 1/8 hp and connected to lighting circuits are now part of the general lighting load of a service calculation.

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220.14(J) Unit Loads for Dwelling Units.

- In the 2020 NEC, 220.14(J) now contains all dwelling unit information for performing a service calculation.
- The general lighting load for a dwelling 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 portion of the dwelling service calculation.

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220.53 Appliance Load- Dwelling Units.

- In 2020 NEC, a demand factor of 75% can only be applied to four or more appliances when they are rated ¼ hp or greater, or 500 watts or greater.
- The permission to use a 75% demand factor during service calculations had no such restriction in 2017 NEC.

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220.53 Appliance Load- Dwelling Units.

- In the 2017 NEC it said "**kitchen ranges"** are exempt from the fastened in place portion of the service calculation.
- In the 2020 NEC kitchen ranges has been replaced with "**all household electric cooking equipment that is fastened in place**." This ensures cooktops and similar equipment are included.

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225.10 Wiring on Buildings (or Other Structures).

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

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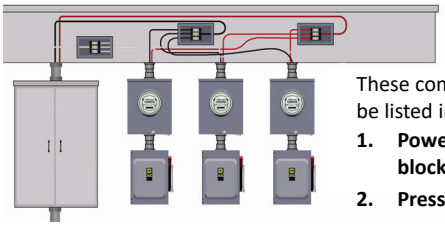
230.46 Spliced and Tapped Conductors.



These components must now be listed in the 2020 NEC:

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

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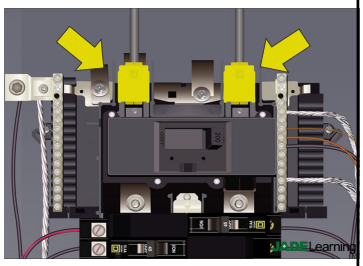
230.62(C) Service Equipment- Enclosed or Guarded. Barriers.

- In 2020 NEC barrier requirements were moved from general requirements in Article 408 to Section 230.62(C) for service equipment only.
- Barriers are required for service equipment (panels that include the main cut-off) but not for sub-panels.



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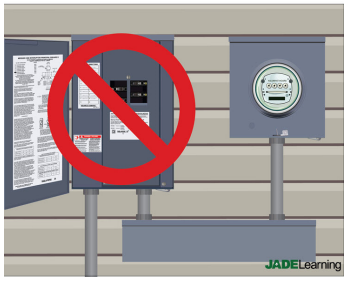
230.71 Maximum Number of Disconnects.



- In 2020 NEC, six switches are no longer allowed inside one enclosure to function as a building's service disconnect.
- Up to six switches are permitted to serve as the one service disconnect, but they must now be in separate enclosures.

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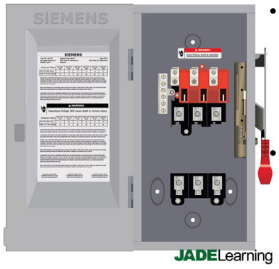
230.85 Emergency Disconnects.

- Brand-new for 2020 NEC, 230.85 requires all one- and two-family homes to have an **exterior emergency disconnect**.
- The normal service equipment (if exterior mounted) can serve as the emergency disconnect if labeled correctly.
- **A meter base with built-in disconnect switch** can serve as this required emergency disconnect.

46

240.62, 240.88, 240.102 Reconditioned Equipment.

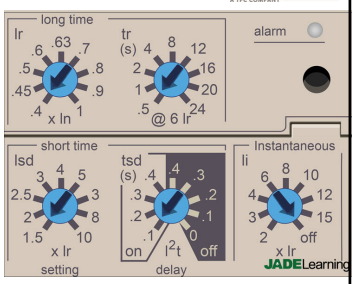


- Low-voltage (1000 volts or less) and medium-voltage (over 1000 volts) fuseholders and nonrenewable fuses are not permitted to be reconditioned.
- Molded-case circuit breakers may not be reconditioned, but low- and medium- power circuit breakers, as well as high-voltage circuit breakers are permitted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

47

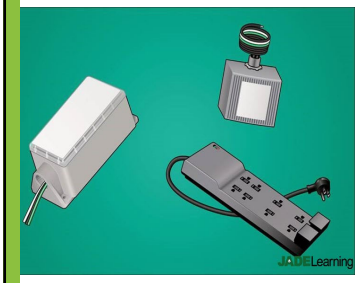
240.87 Arc Energy Reduction.

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



48

242 Overvoltage Protection.



- Brand new Article 242 combines and replaces Articles 280 and 285 in the 2017 NEC.
- Four types of Surge-Protective Devices (SPDs):

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

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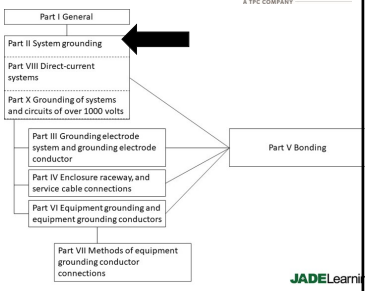
250 Grounding and Bonding.

- Figure 250.1 was revised to more accurately reflect the Article.
- The term “Supply-Side Bonding Jumper” was moved from NEC 250.2, to Article 100.
- The words “and Bonding” were removed from Article 250, Part II.



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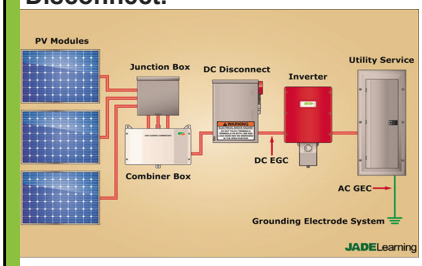
250.25 Grounding Systems Permitted to be Connected on the Supply Side of the Disconnect.



PV system disconnects and similar disconnects that act as service equipment for add-on electrical systems, when connected to the supply-side of utility-fed electrical systems, now require grounding and bonding according to the NEC.

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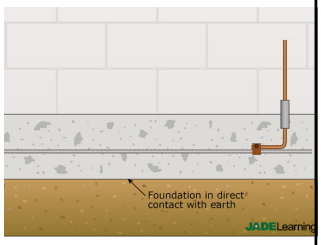
250.53(C) Grounding and Bonding. Grounding Electrode System Installation. Bonding Jumper.

- 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.



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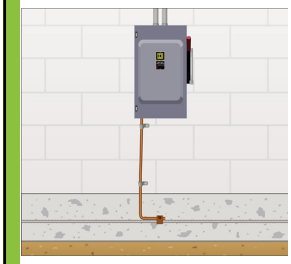
250.64(A) Grounding Electrode Conductor. Aluminum or Copper-Clad Aluminum Conductors.



- Outdoor aluminum or copper-clad aluminum conductors may not be terminated within 18 inches of the earth.
- New 2020 NEC makes it clear: Conductor terminations inside of outdoor enclosures listed for their environment **are** permitted within 18 inches of the bottom of the enclosure, even when installed on earth.

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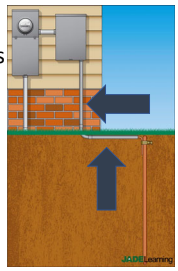
250.64(B)(2) & (B)(3) Grounding Electrode Conductor Protection for Physical Damage.

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



New from the 2020 NEC: PVC is an approved raceway for protecting GECs.

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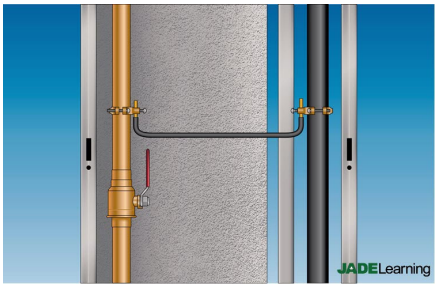
250.104(A)(1) and (A)(3) Bonding Jumpers.

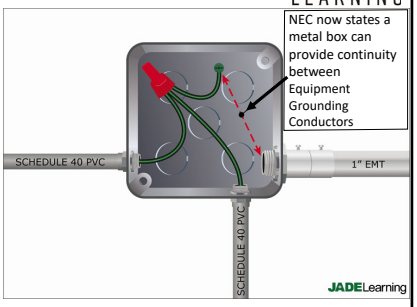


New 2020 NEC exception:
Bonding jumpers not required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum.

55

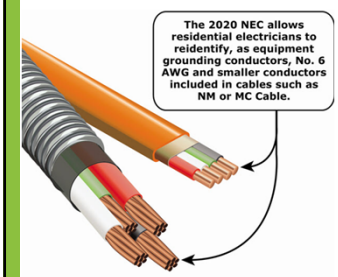
250.109 Metal Enclosures.

2020 NEC now says equipment grounding & bonding conductors can use a metal box as an approved path for continuity. Notice in the image how the bonding jumper is connected to the EMT using the box.



56

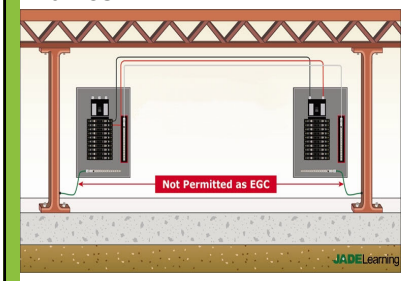
250.119 Identification of Equipment Grounding Conductor.



- Electricians are no longer restricted from reidentifying 6 AWG and smaller conductors as equipment grounding conductors (EGCs).
- Previously, reidentifying EGCs was only permitted in supervised locations.
- Green AC conductors up to 60 volts can be used for purposes other than grounding.

57

250.121(B) Restricted Use of Metal Frames.



- New for 2020 NEC: 250.121(B) says the structural metal framing of a building or structure shall not be used as an equipment grounding conductor. However, a similar requirement existed in the 2017 NEC, in 250.136(A)

58

250.122 Size of Equipment Grounding Conductors.

- EGCs no longer need to be increased in size due to ambient temperature or when bundling 4 or more conductors.
- EGCs may need to be increased for voltage drop and new for 2020 NEC, it can be increased by a qualified person (instead of 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

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

New for 2020 NEC: Table 250.122 has increased the size for Aluminum or Copper-Clad Aluminum EGCs for circuits protected by 5,000- and 6,000-amp overcurrent devices from 1200 kcmil to 1250 kcmil.

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

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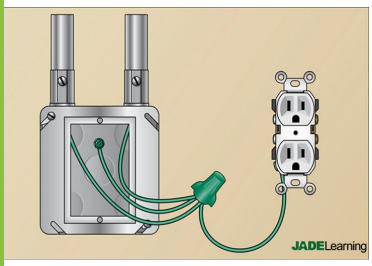
250.148 Continuity of Equipment Grounding Conductors. Attachment in Boxes.



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

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

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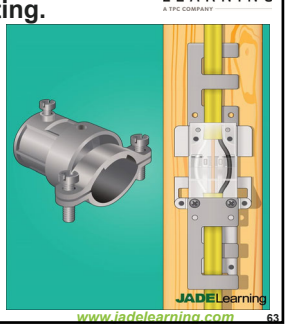
- Transition fittings and interconnector devices are permitted to be installed in concealed locations if listed for concealed installations.
- In the 2017 NEC, these fittings were required to be accessible after installation.



63

300.25 Exit Enclosures (Stair Towers).

A New Code Section for 2020 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.*

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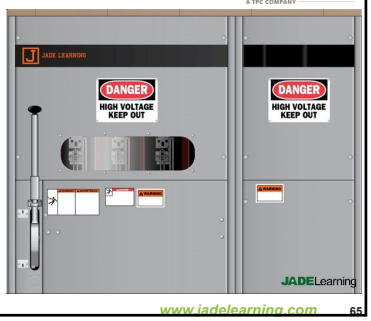
300.45 Danger Signs.

In the 2020 NEC: "Warning" signs are now called "Danger" signs.

OSHA Classifications:

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



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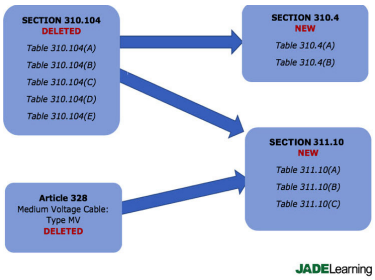
310.4 Conductor Constructions and Applications.



New for 2020 NEC: 310.104 *Conductor Constructions & Applications* has been eliminated and its content divided between two brand-new Code sections:

310.4 & 311.10

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Table 310.12 Dwelling Unit Service and Main Power Feeder Conductors.

The 83% Table for sizing dwelling unit service conductors is back in 2020!

Previously 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.

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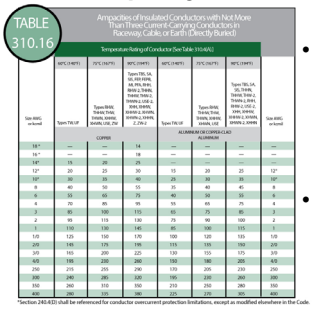
310.15 Ampacity Tables.

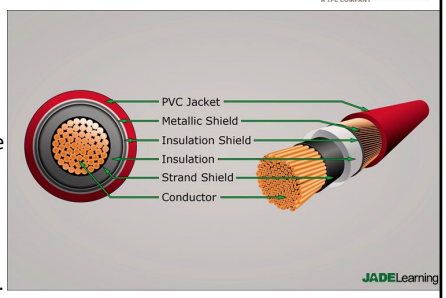


- Table 310.15(B)(16), the electrician's favorite wire ampacity Table has been restored to its original home: Table 310.16.
- Section 310.15 in the 2020 NEC now contains all conductor ampacity derating Tables.

68

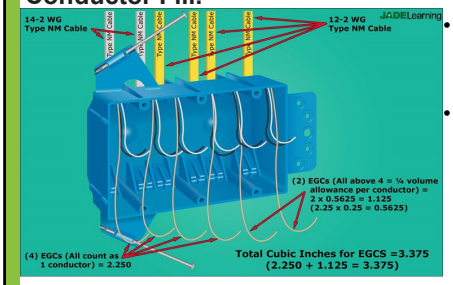
311 Medium Voltage Conductors and Cables.

- Article 311 is brand-new for the 2020 Code cycle.
- Medium voltage rules throughout the NEC moved to new Article 311.
- Medium voltage in this article is 2,001 volts to 35,000 volts.



69

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

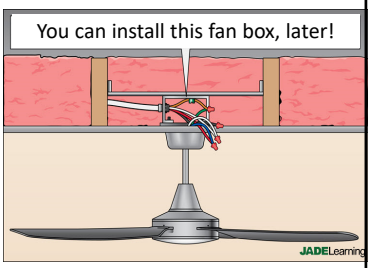


- There are new EGC fill-count instructions in the 2020 NEC.
- If more than 4 EGCs are in a box, a ¼ volume allowance is made for each additional EGC that enters a box based on the largest EGC.

70

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

- The 2020 NEC makes an allowance for installing a listed ceiling fan box, capable of carrying a fan's weight, at a later date, after the initial installation.
- Structural members to support a future box in habitable rooms must be present.



71

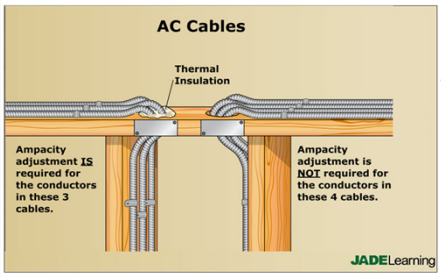
314.29 Boxes, Conduit Bodies, Handhole Enclosures to be Accessible.

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 that they are accessible without excavating sidewalks, paving, earth, or other substance that is to be used to establish the finished grade.*

72

320.80(A) Ampacity. Thermal Insulation.



In the 2020 NEC, AC Cables may need to be derated according to Table 310.15(C)(1) if more than 2 AC Cables containing 2 or more current-carrying conductors are bundled so they cannot displace their heat.

73

330.104 Conductors.

- 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 branch circuit conductors for power and lighting.
- Minimum conductor sizes are different depending on the MC Cable use.

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

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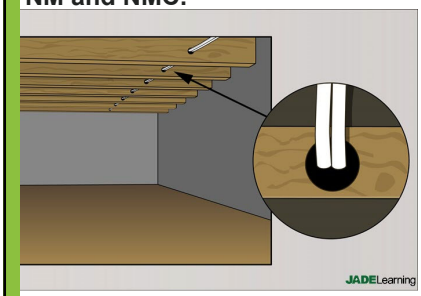
334 Nonmetallic-Sheathed Cable: Types NM and NMC.

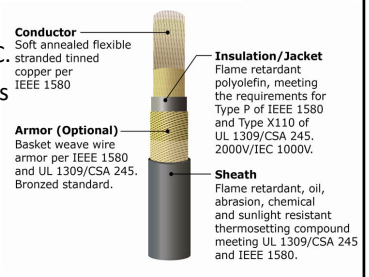


- References to Type NMS Cable was removed from Article 334 in the 2020 NEC.
- NMS cable consists of insulated power or control conductors but has not been available for years.

75

337 Type P Cable.

- Type P Cable is a new addition to the 2020 NEC.
- Able to withstand various chemicals, abrasives, vibration and extreme temperatures.
- Has been used for decades on offshore drilling rigs.



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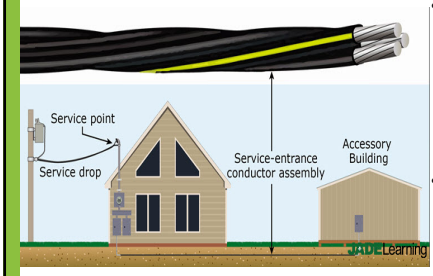
338.100 Construction.



- Bare copper conductors are no longer permitted to be cabled with USE when directly buried in a plexed cable.
- The twisting of single conductors together is called “plexed” cable.

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342.10(E) Severe Physical Damage.

- New for 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.

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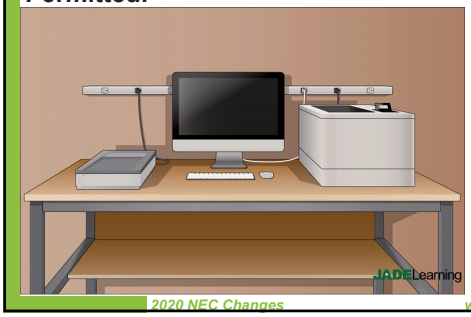
380.12(7) Multioutlet Assembly. Uses Not Permitted.

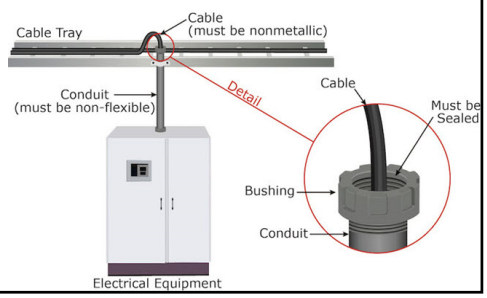


New to the 2020 Code cycle, multioutlet assemblies cannot be installed where cord and plug connected.

79

392.46 Bushed Conduit or Tubing.

Section 392.46 has been expanded to clarify acceptable methods for transitioning from cable tray to conduit, and cable tray to equipment.



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2020 NEC Changes Chapter 4

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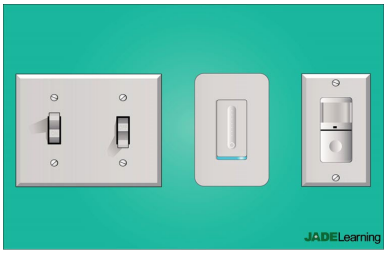
404.9 General Use Snap Switches, Dimmers, and Control Switches.

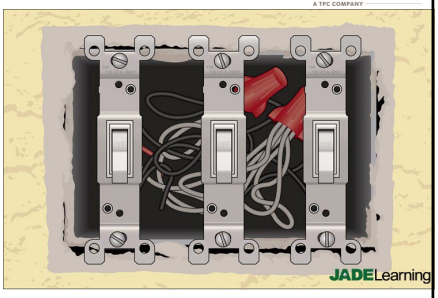


- In 2020 NEC, dimmers and control switches are specifically referenced in Section 404.9.
- The requirements for grounding these devices and their faceplates has been clarified in 2020.

82

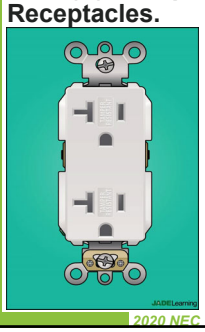
404.14(A), (B), (C), (D) Rating and Use of Switches.

Snap switches are now permitted to be used with new types of loads depending on the switch type (AC, AC/DC, CO/ALR or 347-volt switches) including LEDs and their associated drivers.



83

406.3(A) Receptacle Rating and Type. Receptacles.

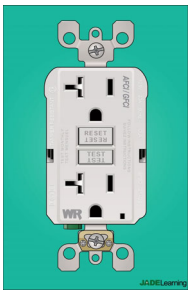


Section 406.3(A) has been revised in 2020 NEC to say:

- *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.*

84

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



When Replacing Receptacles:

- In the 2017 NEC, when no EGC was previously installed and no AFCI device was commercially available for a two-wire receptacle with no ground, an AFCI protected replacement receptacle was not required to be installed.
- Since AFCI protection is commercially available now, this exception was removed from the 2020 NEC.

85

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

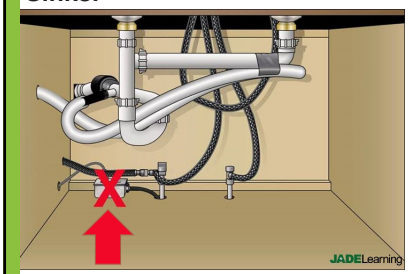
- When replacing a controlled receptacle, an equivalent controlled receptacle must be installed.
- If automatic control is no longer required, the replacement receptacle may then not be identified as controlled.

Two Controlled

Two Controlled

86

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



New for 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.

87

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

New for 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.

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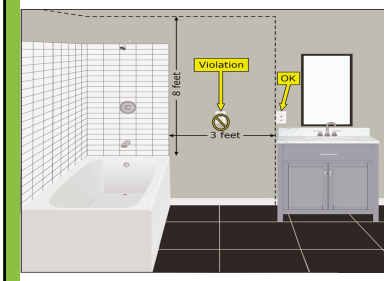
406.9(C) Receptacles in Damp or Wet Locations. Bathtub and Shower Space. (1of2)



Receptacle Locations in 2020

- 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.

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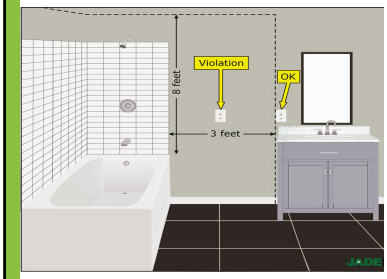
406.9(C) Receptacles in Damp or Wet Locations. Bathtub and Shower Space. (2of2)



If a bathroom is too small and conflict exists between the bathtub/shower space and receptacle(s) being installed, an exception allows the receptacle to be installed on the farthest wall in the bathroom.

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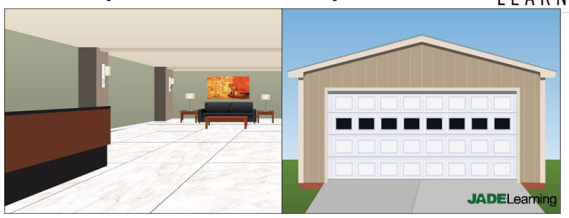
406.12 Tamper Resistant Receptacles.

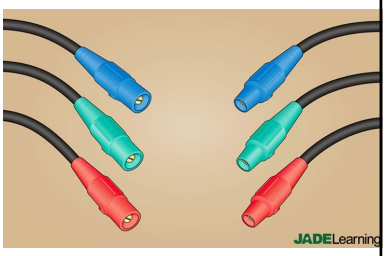


In the 2020 NEC, tamper-resistant receptacles are now required in additional locations including common areas of hotels, assisted-living facilities, accessory buildings, and detached garages.

91

406.13 Single Pole Separable Connector Type.

- Single-pole separable-connectors individually carry the ungrounded, grounded and equipment grounding conductors.
- Section 406.13(A) through (D) was added to 2020 NEC to provide new guidelines for these connectors.



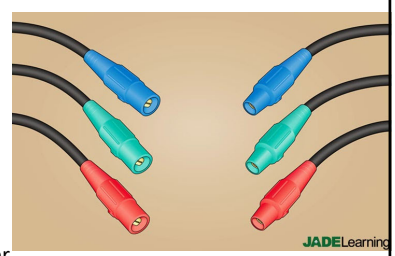
92

406.13 Single Pole Separable Connector Type.

- Section 406.13(D) requires a specific order to attach these connectors:

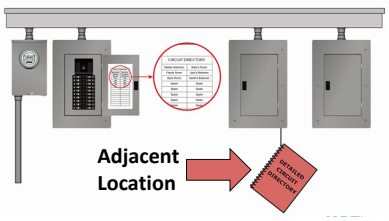
1. Equipment Ground
2. Grounded Conductor
3. Ungrounded Conductor

- Disconnections must be done in the reverse order.



93

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



- Directories may be located on the face, inside of, or now *in **an approved location** adjacent to* the panel door.
- The AHJ must approve any adjacent location(s).

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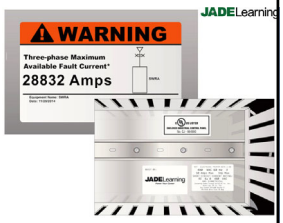
408.6 Switchboards/Panelboards. Short-Circuit Current Rating.

- 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 that may be able to pass through the equipment.



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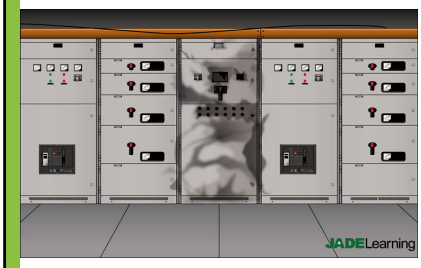
408.8 Switchboards/Panelboards. Reconditioning of Equipment.



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.

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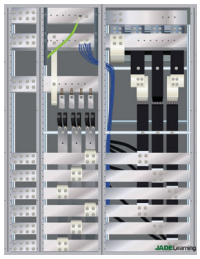
408.18(C)(2) Clearances. Connections. Grounded Circuit Conductors.



- New rules for the placement of grounded (neutral) lugs.
- Applies to switchboards and switchgear, but not panelboards.
- Different requirements for when single or multiple grounded terminals are installed.

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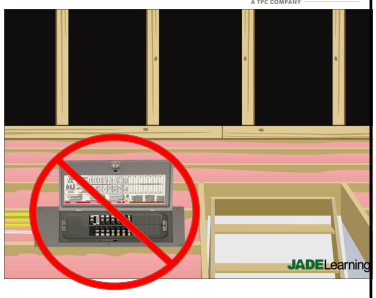
408.43 Panelboard Orientation.

- Panelboards are now prohibited from being installed on their backs, facing up.
- Panelboards may be placed horizontally, but all the breaker handles must be up when "on."



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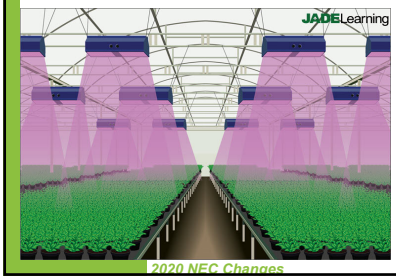
410 Luminaires, Lampholders and Lamps. Part XVI. Special Provisions for Horticultural Lighting Equipment.



- Horticulture lighting equipment is now regulated by the NEC.
- Locations include greenhouses & nurseries.
- Listing, installation, location, fittings, flexible cord, and GFCI requirements are provided.

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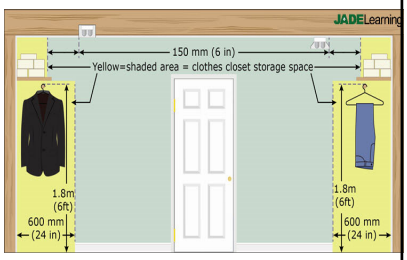
410.2 and 410.16 Luminaires, Lampholders, and Lamps. Luminaires in Clothes Closets.

- The term "Closet Storage Space" has been updated to "Clothes Closet Storage Space."
- Permitted locations of fixtures and dimensions of closet space is provided in Sections 410.16.



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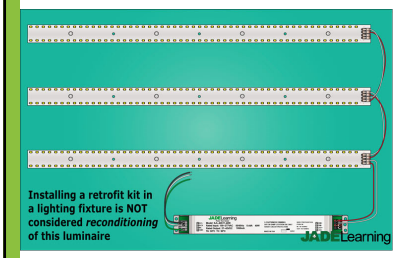
100

410.7 Luminaires, Lampholders and Lamps. Reconditioned Equipment.



Luminaires, lampholders, and retrofit kits are **not** permitted to be reconditioned.

Installing a retrofit kit to a luminaire is **not** considered "reconditioning" when installed in accordance with instructions.

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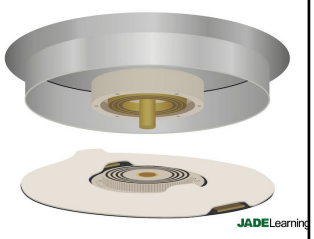
410.36(A) Luminaires Supported by Outlet Boxes.

Section 410.36 in the 2020 NEC now clarifies that locking support & mounting receptacle outlets used to connect luminaires *are* considered lighting outlets and can be used to satisfy lighting outlet requirements found in *Section 210.70(A), (B), and (C).*



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410.42 Luminaire(s) with Exposed Conductive Parts. (1of2)

Revised for 2020 NEC, 410.42 states:

If accessible to unqualified persons, exposed conductive parts of any light fixture must either:

1. Be connected to an equipment grounding conductor.
2. Be separated from all live parts by a listed double insulation system.

103

410.42 Luminaire(s) with Exposed Conductive Parts. (2of2)

Revised for 2020 NEC, 410.42 also states:

Portable luminaires with a polarized attachment plug shall not require connection to an equipment grounding conductor.

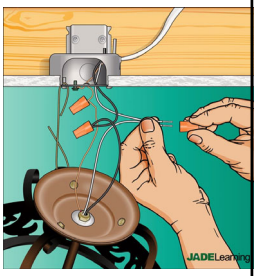
104

410.44 Methods of Grounding.

Grounding of Luminaires & Equipment at Outlets:

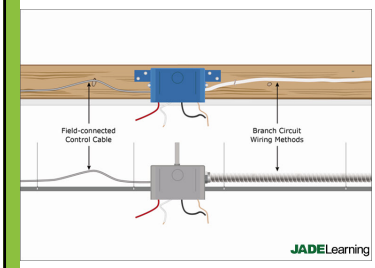
There are two revised exceptions for this 2020 Code cycle.

- Replacement luminaires are permitted to connect to an EGC in the same manner as replacement receptacles.
- If no EGC exists, luminaire must be GFCI protected or replacement luminaire must not have conductive exposed parts.



105

410.69 Luminaires/Lamps. Identification of Control Conductor Insulation.



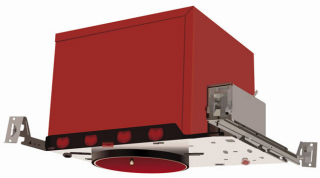
Brand-New for 2020 NEC: Beginning January 1, 2022, field-installed control conductors in the same enclosure as branch-circuit conductors must have an insulation color other than colors reserved for neutral conductors or EGCs.

106

410.116(C) Installation in Fire-Resistant Construction.

Brand-new for 2020:

- 410.116(C) prohibits installing recessed luminaires marked "FOR USE IN NON-FIRE-RATED INSTALLATIONS" in fire-rated installations.
- Section 410.116(C) provides three ways that recessed luminaires may be installed in locations with fire ratings.



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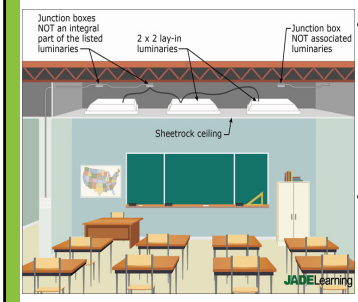
410.118 Luminaire Access to Other Boxes.



- Recessed luminaires are prohibited from being used as access points for outlet boxes, pull boxes, junction boxes or conduit bodies unless an integral part of the luminaire.
- Electricians may not modify recessed luminaires to make boxes an integral part of the luminaire.

108

422.5(A) GFCI Protection for Personnel.

- In the 2017 NEC, Section 422.5(A) required GFCI protection for personnel for equipment 250 volts or less.
- In the 2020 NEC, the voltage requirement is now 150 volts or less to ground.

- Dishwashers and sump pumps are now listed in this section- and will require GFCI protection if 150 volts or less to ground and 60 amps or less.

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422.16(A),(A)(1),(A)(2) Appliances. Flexible Cords.

Section 422.16(A) was reorganized for clarity.

2017 NEC Section 422.16(A)		2020 NEC Section 422.16(A)
Flexible cord shall be permitted (1) for the connection of appliances to facilitate their frequent interchange or to prevent the transmission of noise or vibration or (2) to facilitate the removal or disconnection of appliances that are fastened in place, where the fastening means and mechanical connections are specifically designed to permit ready removal for maintenance or repair and the appliance is intended or identified for flexible cord connection.	2017 → 2020	*Flexible cord shall be permitted as follows:* *(1) To connect appliances to facilitate their frequent interchange or to prevent the transmission of noise or vibration or* *(2) To facilitate the removal or disconnection of appliances that are fastened in place, where the fastening means and mechanical connections are specifically designed to permit ready removal for maintenance or repair and the appliance is intended or identified for flexible cord connection.*

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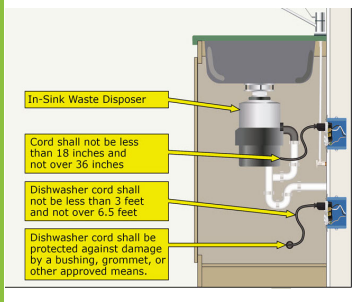
422.16(B) Specific Appliances.



2017 NEC said flexible cords shall terminate with a grounding type plug.

2020 NEC says flexible cords shall have an EGC **AND** be terminated with a grounding type plug.

For dishwashers and trash compactors, cords that pass through a hole must be protected by a bushing, grommet, or other approved means.

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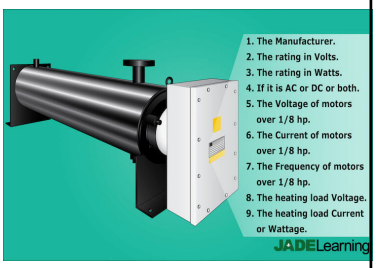
425.28(B) Marking of Heating Equipment. Nameplate. Location.

- The nameplate must list the manufacturer (previously required the identifying name).
- The word “normal” was removed from normal rating in volts and watts.
- The 2020 NEC requires the label to be permanent.



112

430.2 Definitions. Electronically Protected.

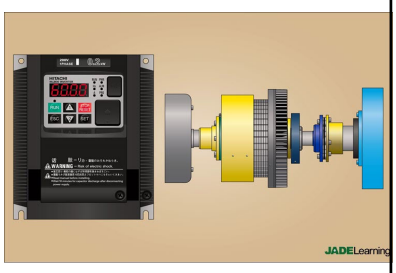
The 2020 NEC has a new definition for electronically protected when applied to motors:

A motor that is provided with electronic control that is an integral part of the motor and protects the motor against dangerous overheating due to failure of the electronic control.

113

430.122(B) Conductors- Minimum Size and Ampacity. Output Conductors.

- The 2020 NEC now distinguishes between branch circuit/feeder and output conductors.
- Output conductors are now generally required to have an ampacity equal to or larger than 125% of the motor full-load current.



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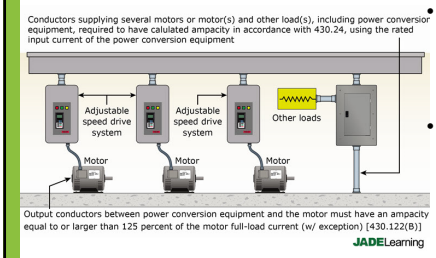
430.122(D) Conductors- Minimum Size and Ampacity. Several Motors or a Motor and Other Loads.

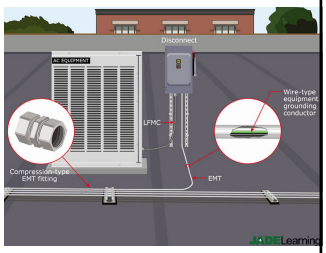


- Section 430.122(D) is new in 2020 NEC and sends electricians to Section 430.24.
- Motor circuit conductors must be chosen based on the sum of the motor and non-motor loads listed in Section 430.24.

115

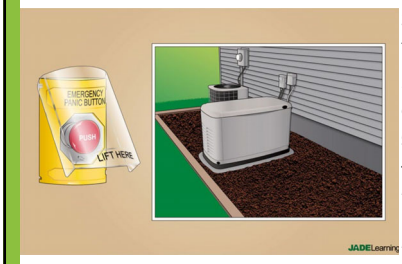
440.9 Air Conditioning and Refrigeration Equipment. Grounding and Bonding.

- New wording for this Section omits the phrase "non-threaded fittings" and adds "compression-type fittings," for improved clarity.
- An EGC of the wire type must be installed in outdoor portions of metallic raceway systems that use **compression-type fittings** for HACR equipment on a roof.



116

445.18(D) Generators. Disconnecting Means and Emergency Shutdown.



Section 445.18(D) is new in the 2020 NEC and states:

For other than cord-and-plug connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location.

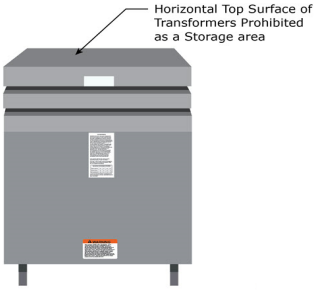
117

450.9 Transformers. Ventilation.

The 2020 NEC States:

Transformer top surfaces that are horizontal and readily accessible shall be marked to prohibit storage.

These new markings are meant to prevent storage on top of flat-top transformers.



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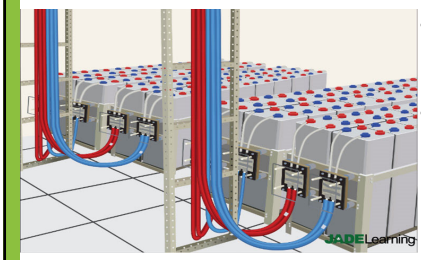
480.2 Storage Batteries. Definitions. Storage Battery.



- The 2020 NEC provides an updated definition for a *Storage Battery*.
- The 2020 NEC clarifies that batteries may be linked together in series or parallel and may be single or multiple cells.

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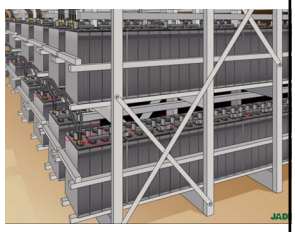
480.7(B),(C),(F),(G) Storage Batteries. DC Disconnect Methods. (1of2)

- 480.7(B): Storage battery systems in one- and two-family dwellings must have a marked emergency disconnect in a readily accessible location outside of the building.
- 480.7(C): The 2020 NEC now requires series battery strings to have disconnecting means installed between strings when exceeding 240 volts.



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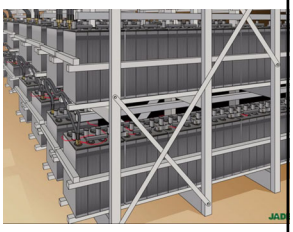
480.7(B),(C),(F),(G) Storage Batteries. DC Disconnect Methods. (2of2)

- 480.7(F): The phrase "available fault current" now replaces "maximum available short-circuit current" on notification labels.
- 480.7(G): Provides new identification requirements for power sources in facilities that have storage battery disconnects.



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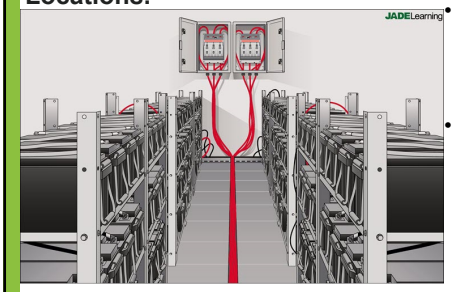
480.10(A) Storage Batteries. Battery Locations.



- Section 480.10(A) addresses the venting requirements of storage batteries.
- NFPA 1 (The *Fire Code)* requires the concentration of gasses to be 25% or less of the lower flammable limit of gas.

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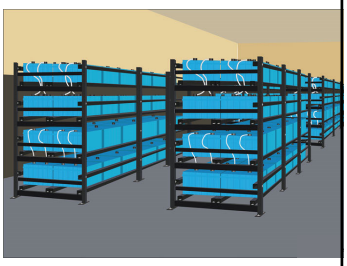
480.10(C) Storage Batteries. Battery Locations. Spaces About Battery Systems.

- Battery systems of 1000 volts or less must adhere to the working space requirements in Section 110.26.
- Battery systems over 1000 volts must now follow the more stringent working space requirements in Section 110.34.



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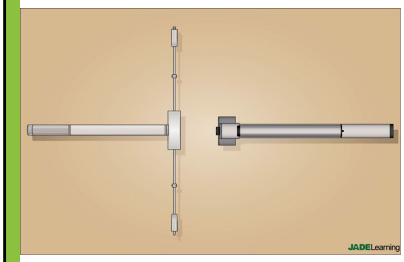
480.10(E) Storage Batteries. Battery Locations. Egress.



Section 410.10(E) now lists two types of hardware permitted to be installed on doors for storage battery rooms:

1. Listed panic hardware
2. Listed fire exit hardware (new in the 2020)

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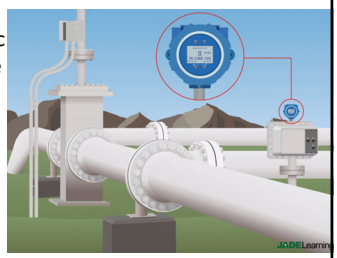
500.7 (L),(M),(N),(O) Hazardous Locations. Protection Techniques.

Four new techniques for protecting electrical and electronic equipment were introduced in the 2020 NEC:

1. Inherently Safe Optical Radiation
2. Protected Optical Radiation
3. Optical System With Interlock
4. Protection by Skin Effect Trace Heating



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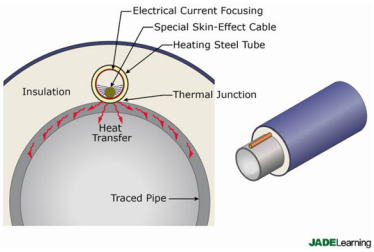
500.7(O) Hazardous Locations. Protection Techniques.



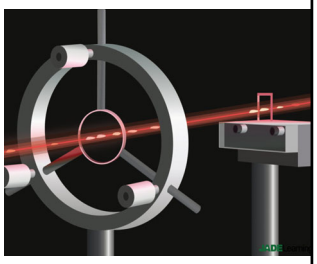
Skin Effect Trace Heating is now an approved protection technique in the following hazardous locations:

1. Class I Division 2
2. Class II Division 2
3. Class III Division 2

127

500.8(G) Hazardous (Classified) Locations. Equipment. Equipment Involving Optical Radiation.

- The risk of ignition must be considered for all electrical parts and circuits that may be exposed to optical radiation, both inside and outside of the optical equipment.
- All luminaires (fixed, portable, transportable, etc.) including LEDs are exempt from this requirement.



128

501.10(A)(2) Hazardous (Classified) Locations. Class I Division 1 Locations. Flexible Connections.

Type TC-ER-HL Cable

Type P Cable

- Type TC-ER-HL is permitted in Class I, Division 1 locations when installed according to Section 336.10.
- Type P Cable is permitted in Class I, Division 1 locations when installed according to Section 337.10.

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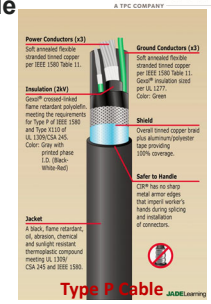
502.10(A)(2) Class II Locations. Wiring Method. Class II Division 1. Flexible Connections.

- Motors in hazardous locations may need a flexible cable to avoid premature loosening or damage to electrical equipment.
- Just like Class I, Division 1 locations, Type TC-ER-HL and Type P cables are also permitted in Class II, Division 1 locations.
- Additional installation requirements are listed in Section 502.10(A)(2).



130

502.10(B)(1) Hazardous (Classified) Locations. Class II, Division 2 Locations. Wiring Methods. General.

Three new wiring methods for Class II, Division 2 locations have been added to the 2020 NEC when metal conduit will not provide acceptable corrosion-resistance:

1. PVC-coated RMC
2. PVC-coated IMC
3. Type P cable

131

503.10(A) Hazardous (Classified) Locations. Class III Locations. Wiring Methods.

- Section 503.10(A) now requires EGCs for several types of Class III approved cables even when a drain (shield) wire is present.
- A drain wire cannot serve as an EGC because it is not connected at both ends.
- EGCs are now required for PLTC and PLTC-ER, ITC and ITC-ER, MV, TC, and TC-ER cable types.

132

505.9(C)(2) Zone 0, 1, and 2 Locations. Equipment. Marking. Zone Equipment.

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TABLE 505.9(C) MARKING OF EQUIPMENT IN HAZARDOUS LOCATION		
TYPE OF PROTECTION	MARKING	PERMITTED LOCATION
Associated Apparatus for Zone 0	[ia]	Unclassified[1]
Associated Apparatus for Zone 1	[ib]	Unclassified[1]
Associated Apparatus for Zone 2	[ic]	Unclassified[1]
Associated Pressurization Equipment	[ip]	Unclassified[1]
Equipment Suitable for Use in Zone 0		
Equipment Suitable for Use in Class I, Division 1		
Flameproof Enclosure	d; db	
Intrinsic Safety	ib	
Increased Safety	e; eb	
Pressurized Enclosure	p; px, pxb, py, pyb	
Powder Filling	m; mb	Zone 1
Liquid Immersion	q; qb	
Electrical Resistance Trace Heating	o; ob	
Skin Effect Trace Heating	60079-30-1, *with EPL Gb*[2]	
Optical Radiation, Inherently Safe	IEEE 844.1, *with EPL Gb*[2]	
Optical Radiation, with Interlock	op is, *with EPL Gb*[2]	
Optical Radiation, Protected	op sh, *with EPL Gb*[2]	
EPL Gb, *with Suitable Type of Protection*[3]	op pr, *with EPL Gb*[2]	

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- Zone markings are a legal alternative to the Class and Division marking requirements in Section 500.8(C).
- Zone 0, 1, and 2 locations contain flammable gas, vapors and liquids.
- If a location is a Zone 0, 1 or 2, then it is a Class I location.

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506.15(A) Zone 20, 21, and 22 Locations. Wiring Methods. Zone 20.

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- Zone 20 locations have concentrations of combustible dust and ignitable fibers for long periods of time.
- Section 506.15(A) was revised to refer to specific NEC sections rather than entire Articles for Zone 20 wiring methods.

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511.3 Commercial Garages, Repair and Storage. Area Classification, General.

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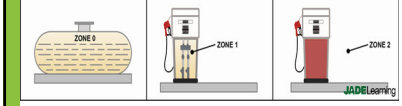
ZONE - NATURE AND PROBABILITY OF HAZARD MATERIAL		
ZONE 0	ZONE 1	ZONE 2
Ignitable concentrations of flammable gases or vapors which are present continuously or for long periods of time.	Ignitable concentrations of flammable gases or vapors which are likely to occur under normal operating conditions.	Ignitable concentrations of flammable gases or vapors which are not likely to occur under normal operating conditions and do so only for a short period of time.



Zone 0, Zone 1, and Zone 2 only apply to flammable gases, vapors, or liquids so the "Class I" prefix is redundant and has been deleted, except for text that is extracted from other documents or to remain consistent throughout this article.

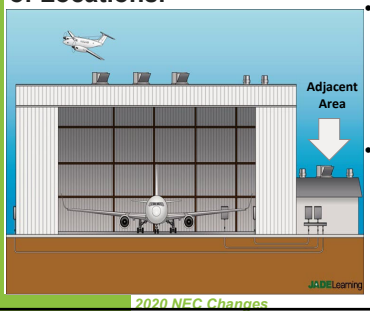
135

511.12 Commercial Garages, Repair and Storage. GFCI Protection for Personnel.

- In the 2020 NEC, Section 511.12 (addressing commercial garages) now refers to Section 210.8(B) for GFCI protection requirements.
- Section 210.8(B)(8) requires GFCI protection in garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls.

136

513.3(D) Aircraft Hangers. Classification of Locations.

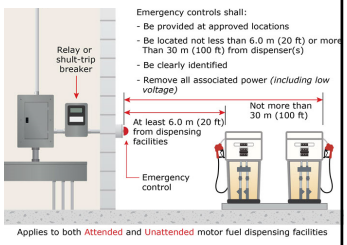


- 2017: permitted areas adjacent to hangars to be declassified if the area was cut off and adequately ventilated.
- 2020: clarified "adequately ventilated" as *mechanically ventilated at a rate of four or more air changes per hour, or designed with positive air pressure.*

137

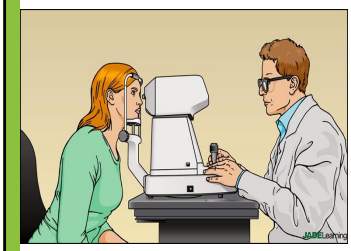
514.11(A) Motor Fuel Dispensing Facilities. Emergency Electrical Disconnects.

- In 2020 NEC, all ungrounded & grounded conductors must now be simultaneously disconnected when the emergency disconnect is activated.
- Conductors must be disconnected from the source of supply.
- EGCs must remain connected.



138

517.10(B)(3) Health Care Facilities. Applicability. Not Covered.



New patient care spaces were added to the 2020 NEC that are **not** required to adhere to Article 517 Part II wiring methods:

1. Intramuscular Injections (Immunizations)
2. Psychiatry and Psychotherapy
3. Alternative Medicine
4. Optometry

139

517.17(D) Health Care Facilities. Ground-Fault Protection of Equipment. Testing.

- Section 517.17(D) in the 2020 NEC requires the ground-fault protection system to be performance tested when first installed.
- The testing must be performed by qualified person(s) according to the manufacturer's requirements.
- A written record of the test must be made, and must be available to the authority having jurisdiction (AHJ).

140

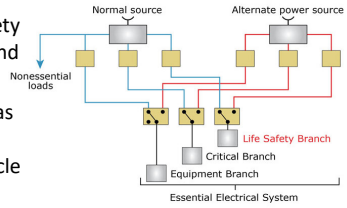
517.21 Health Care Facility. GFCI Protection for Personnel in Category 2 (General Care) and Category 1 (Critical Care) Spaces.

- The permission to forego GFCI protection for receptacles near a patent's bed was moved from Section 210.8(B)(5) to Section 517.21.
- Bathrooms containing receptacles in Category 1 & 2 spaces are **not** exempt from normal GFCI requirements.

141

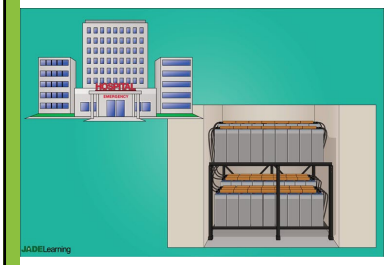
517.26 Health Care Facilities. Essential Electrical System. Application of Other Articles.

- Essential Electrical Systems (EES) are divided into Life Safety Branches, Critical Branches, and Equipment Branches.
- The Life Safety Branch now has four amendments, which indicate what sections in Article 700 do and do not apply.



142

517.30(B)(3) Sources of Power. Types of Power Sources. Battery Systems.



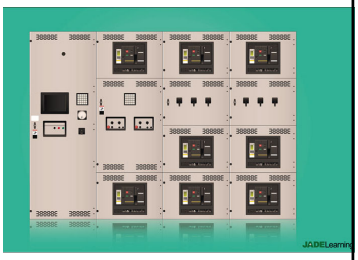
Section 517.30(B)(3) is new in the 2020 Code cycle:

Battery systems shall be permitted to serve as the alternate source for all or part of an essential electrical system.

143

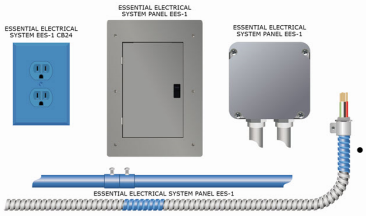
517.31(B) Requirements for the Essential Electrical System. Transfer Switches.

- Section 517.31(B)(2) in the 2020 NEC changed the phrase “maximum demand” to “continuous load.”
- Both informational notes have changed the term “hospital” to “Type 1 Essential Electrical System.”



144

517.31(C)(1) Requirements for the Essential Electrical System. Separation from Other Circuits.



- Section 517.31(C)(1)(b) states that conductors of the life safety branch and critical branch must be separate from other wiring systems.
- In the 2020 NEC, emergency systems were reidentified as essential electrical systems.

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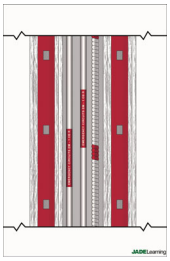
517.31(C)(3) Requirements for the Essential Electrical System. Mechanical Protection of the Essential Electrical System.

- The 2020 NEC now requires life safety and critical branches to be mechanically protected by raceways.
- Several different wiring methods are permitted for this application, including RMC, IMC, EMT, Type MI Cable, RTRC-XW, Schedule 80 PVC, and flexible raceways in locations listed in Section 517.31(C)(3)(3).



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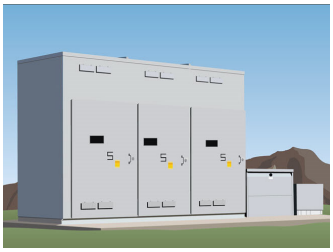
518.6 Assembly Occupancies. Illumination.



- Workspaces for fixed service equipment installed outdoors at “assembly occupancies” must be provided with illumination.
- Control **only** by automatic means is **not** permitted.
- This lighting is not required if illumination comes by an adjacent light source.

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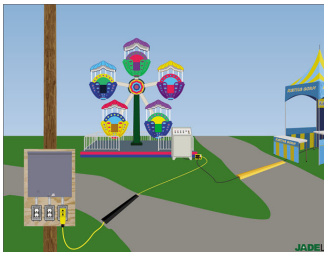
525.20(G) Wiring Methods for Carnivals, Circuses, Fairs, Similar. Protection.

- Flexible cables may be buried (with no minimum depth) to keep people from tripping.
- If using a nonconductive matting, it must be secured to the walkway surface.
- Other approved methods may be used to help prevent people from tripping on cables.



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545.24(A), (B). Manufactured Buildings and Relocatable Structures. Disconnecting Means and Branch-Circuit Overcurrent Protection.

- A new Part II *Relocatable Structures* has been added to Article 545.
- New Section 545.24 helps distinguish between requirements for mobile homes and other portable buildings.

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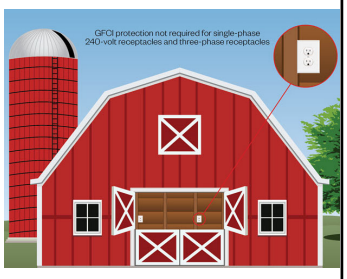
547.5(G) Agricultural Buildings. Wiring Methods. Receptacles.

At agricultural buildings, GFCI protection is **not** required for receptacles other than the 125-volt, 15- and 20-amp receptacles installed in these areas:

1. Equipotential plane areas
2. Outdoors
3. Damp or wet locations
4. Dirt confinement areas for livestock.



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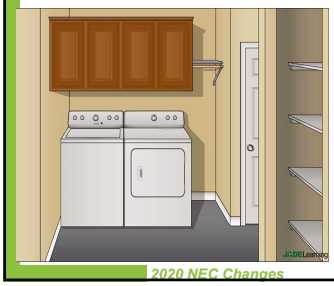
550.13(B) Mobile Homes, Manufactured Homes, Mobile Home Parks. Receptacle Outlets. GFCI.



In mobile & manufactured homes, GFCI protection is now required for these new areas:

1. Garages & accessory buildings
2. Crawl spaces
3. Basements
4. Boathouses
5. Bathtubs and shower stalls (within 6 feet)
6. Laundry area(s)

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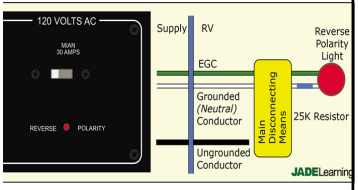
551.40(D) RVs and RV Parks. 120 & 240V Systems. Reverse Polarity Device.

- The 2020 NEC now requires every new recreational vehicle (RV) to have a device that provides a continuous audible or visible signal when connected in reverse polarity.



- When polarity is reversed (such as from incorrectly wired RV pedestals), any exposed metal in the RV in contact with the normally grounded side of the electrical system becomes energized.

152

551.72(E)&(F) RVs and RV Parks. Distribution System. Connection to Recreational Vehicle Site Equipment.

- New Section 551.72(E) prohibits the use of autotransformers.
- Autotranformers are used to boost lower voltages in RV parks when the electrical system is overloaded, and may cause voltage drops to other RV park sites.

153

551.72(E)&(F) RVs and RV Parks. Distribution System. Connection to Recreational Vehicle Site Equipment.

- Section 551.72(F) now requires RVs to be powered by only one 30- or 50-amp supply cord.
- A 15- or 20-amp convenience receptacle may be used in addition to the supply cord.

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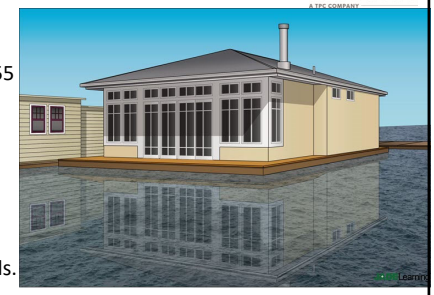
555 Part III. Floating Buildings.

- Article 553 (Floating Buildings) was moved to Part III of Article 555 (Marinas, Boatyards, etc.).
- A floating building is not a watercraft, but shares many water requirements with marinas and boatyards.



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555.2 Marinas, Boatyards, Floating Buildings and Commercial and Noncommercial Docking Facilities. Definitions.

- Section 555.2 in the 2020 NEC is the new home for 14 terms and definitions used to navigate Article 555 on water-based structures.
- In the 2017 NEC, only 2 definitions were provided.

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555.9 Marinas, Boatyards, Floating Buildings and Commercial and Noncommercial Docking Facilities. Boat Hoists.

- GFCI requirements for boat hoists and residential boat docks was moved from Section 210.8(C) to Section 555.9.
- GFCI protection for personnel is required for outlets up to 240 volts that supply boat hoists at dwelling unit docking facilities.

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555.35(A) Marinas, Boatyards: Ground-Fault Protection of Equipment (GFPE) and GFCI Protection.

- Receptacles for shore power must have GFPE protection that trips at 30 mA or less.
- For other than shore power, GFCI receptacles must trip between 4 to 6 mA.
- Feeders must have GFPE protection not exceeding 100 mA.

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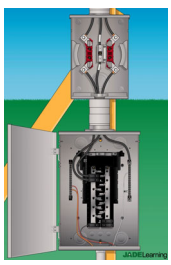
590.8 Temporary Installations. Overcurrent Protective Devices.

- Section 590.8(A) in the 2020 NEC now requires examination of used OCPDs to make sure that they have been installed properly with no evidence of impending failure.
- Breakers must be replaced when there is evidence of impending failure; meaning arcing, overheating, loose parts, bound parts, or visible damage or deterioration.



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600.2 Electric Signs and Outline Lighting. Definitions.

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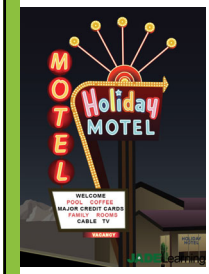

- Four new definitions were provided in the 2020 NEC for the retrofitting of signs.

1. **Host sign:** A sign already installed in the field that is designated for field conversion with a retrofit kit.
2. **Retrofit Kit, General Use:** A kit consisting of primary parts (not all parts) and a list of required parts for subassembly in the field.

(CONT')

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600.2 Electric Signs and Outline Lighting. Definitions.

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3. **Retrofit Kit, Sign Specific:** A kit consisting of all parts, hardware, and instructions necessary for field installation in a host sign.
4. **Subassembly:** Component parts or a segment of a sign, retrofit kit, or outline lighting system that, when assembled, forms a complete unit or product.

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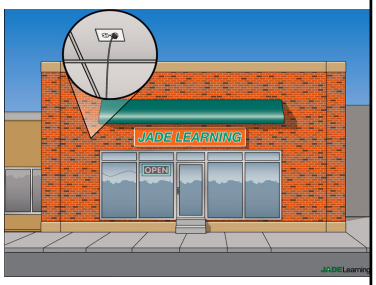
600.5(A) Electric Signs and Outline Lighting. Required Branch Circuit.

- Section 600.5 now clarifies which entrances must have required sign outlet(s).
- Sign outlets are not required *at entrances for deliveries, service corridors, or service hallways that are intended to be used only be service personnel or employees.*



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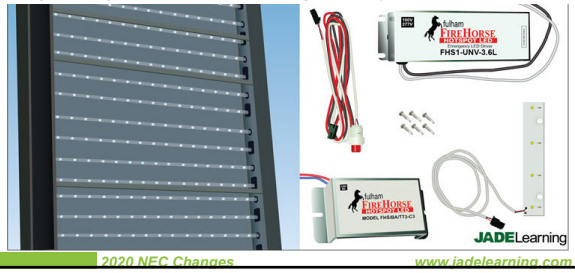
600.35 Electric Signs and Outline Lighting. Retrofit Kits.

Newly created Section 600.35 provides requirements for installing, marking, wiring methods, and damaged components in retrofit kits.



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605.1 Office Furnishings. Scope.

In the 2020 NEC, *605.1* has been split into *Section-A*, items that are covered, and *Section-B*, items that are not covered.

Article 605 does not cover *individual office furnishings not connected to a system such as chairs, freestanding desks, tables, storage units, and shelving units.*

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625 and 625.1 Electric Vehicle Power Transfer System. Scope. (1of2)

The scope of Article 625 was revised in the 2020 NEC.

- Electric vehicles are now recognized as capable of sending stored energy from their on-board batteries to the electrical system of a home or business.

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625 and 625.1 Electric Vehicle Power Transfer System. Scope. (2of2)

Electric Vehicle Power Export Equipment (EVPE) is:

The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30 Vac or 60 Vdc to loads external to the vehicle, using the vehicle as the source of power.

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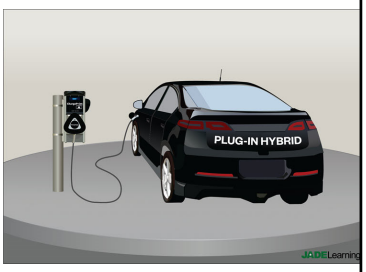
625.2 Electric Vehicle Power Transfer System. Definitions.

- Four definitions were eliminated in the 2020 Code cycle.
- EVPE definition was added.
- The updates to the definitions reflect changes to the current electric vehicle technology.



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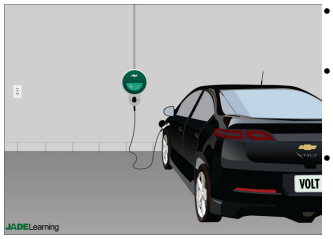
625.44 Electric Vehicle Power Transfer System. Equipment Connection.



- Section 625.44 now offers two new charger connection types.
- The term “Stationary Equipment” was replaced with “Fastened-in-place.”
- The term “Equipment” was replaced with the more specific terms “Electric Vehicle Supply Equipment” and “Wireless Power Transfer Equipment.”

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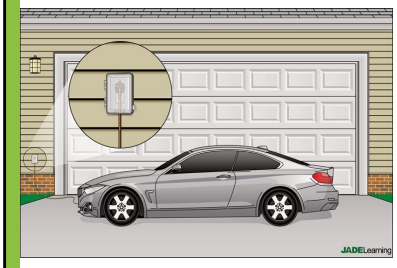
625.54 Electric Vehicle Power Transfer System. GFCI Protection for Personnel.

- GFCI protection is now required for **ALL** outlets used for electric vehicle power transfer.
- In the 2017 NEC, GFCI protection was required only for single-phase receptacles rated 150 volts to ground or less and 50 amps or less.

170

625.56 Electric Vehicle Power Transfer System. Receptacle Enclosures.



- In 2020 NEC, all electric vehicle charging receptacles in wet locations must be protected by a weatherproof enclosure.
- The hood of the enclosure must be listed and identified as extra duty.

171

625.60 Electric Vehicle Power Transfer System. AC Receptacle Outlets Used for EVPE.

- Section 625.60 is new and ensures that vehicle power export installations are safe.
- This section covers the types and ratings of receptacles used, overcurrent protection, and GFCI requirements.

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680.2 Swimming Pools, Fountains, and Similar Installations. Definitions.

- The definition of "fountain" was revised to clarify its meaning and intended application in Article 680 of the 2020 NEC.
- The term fountain in the 2017 NEC could cause confusion whether the term meant water coolers.
- The 2020 NEC explains that water coolers, used for dispensing potable water, are not the types of water fountains addressed in Article 680.

2020 NEC Changes www.jadelearning.com 173

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680.4 Swimming Pools, Fountains, & Similar Installations. Inspections After Installation.

Section 680.4 in 2020 NEC states: *The authority having jurisdiction shall be permitted to require periodic inspection and testing.*

- This section allows for periodic electrical inspections **indefinitely** of pool, fountain, and similar installations, even after installation is complete.

2020 NEC Changes www.jadelearning.com 174

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680.21(C) Swimming Pools, Fountains, and Similar Installations. Motors. GFCI Protection.

- GFCI protection for motors is now 150 volts or less to ground and 60 amps or less (previously 120 through 240 volts).
- Three-phase motors will now need GFCI protection when in the voltage and amperage range above.

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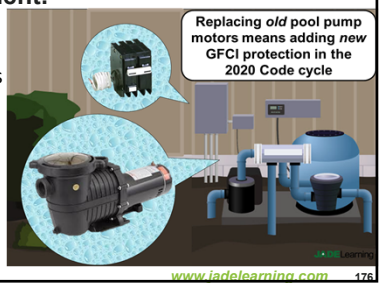
680.21(D) Swimming Pools, Fountains, and Similar Installations. Motors. Pool Pump Motor Replacement.

- Section 680.21(D) is new, and requires GFCI protection for pool motors when replaced for maintenance or repair.
- This applies to any pool motor 150 volts or less to ground, 60 amps or less, single- or 3-phase.



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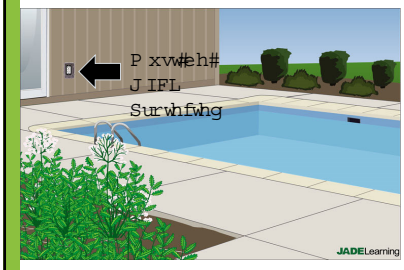
680.22(A)(4) Swimming Pools, Fountains, and Similar Installations. Receptacles.



All 15- and 20-ampere, single-phase, 125-volt receptacles located within 20 feet of the inside walls of a pool shall be protected by a Class A ground-fault circuit interrupter (GFCI).

2020 NEC Changes www.jadelearning.com 177

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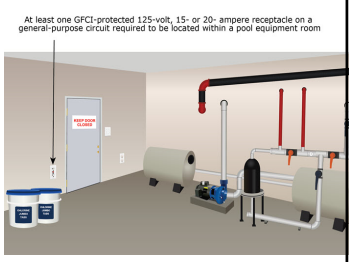
680.22(A)(5) Swimming Pools, Fountains, and Similar Installations. Receptacles.

- At least one GFCI-protected 125-volt, 15- or 20-amp general-purpose receptacle must be located within a pool equipment room.
- All other receptacles 150 volts or less to ground in a pool equipment room must be GFCI protected.



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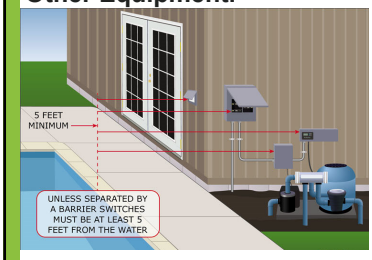
680.22(C) Swimming Pools, Fountains, and Similar Installations. Switching Devices. Other Equipment.



- Switching devices must be located at least 5 feet horizontally from the inside walls of a pool unless separated by a permanent barrier.
- Switches listed as being acceptable for use within 5 feet of a pool are permitted.

2020 NEC Changes www.jadelearning.com 179

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680.22(E) Swimming Pools, Fountains, and Similar Installations. Switching Devices. Other Equipment.

- Equipment other than circulation pumps and pump motors must be located at least 5 feet horizontally from the inside walls of a pool.
- The requirement does not apply if separated by a permanent barrier or under the low-voltage contact limit.

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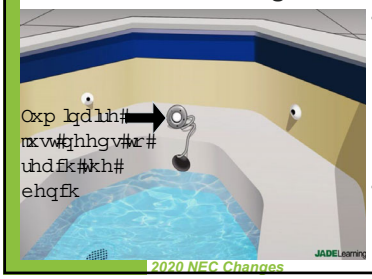
180

680.23(B)(6) Swimming Pools, Fountains, and Similar Installations. Wet Niche Luminaires. Servicing.

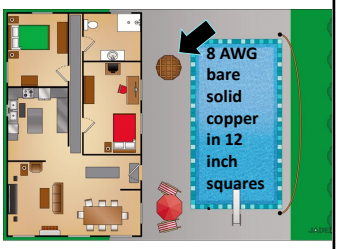


- In the 2020 NEC, electricians & manufacturers no longer have to conceal extra cable allowing service of the spa luminaire on the dry surface above the rim of the spa.
- Spas may now be drained & luminaires can be serviced down low on the spa bench.

181

680.26(B)(2) and (B)(5) Swimming Pools, Fountains, and Similar Installations. Equipotential Bonding.

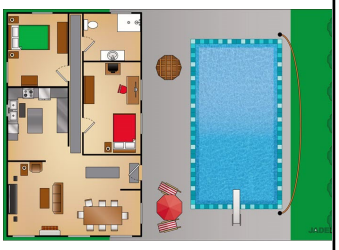
- New for 2020, a **copper grid** is permitted to be built around the pool to bond the walking surfaces if reinforcing steel is not available.
- If used, the copper grid must be solid, bare 8 AWG copper conductors arranged in a network of 12-inch squares.



182

680.26(B)(2) and (B)(5) Swimming Pools, Fountains, and Similar Installations. Equipotential Bonding.

- In the 2020 NEC, 680.26(B)(5) requires all metal fittings, except isolated fittings measuring 4 inches or less, to be bonded.
- Small metal pool cover anchors are exempt from this bonding requirement.



183

680.35 Swimming Pools, Fountains, and Similar Installations. Storable and Portable Immersion Pools.

Article 680 in NEC 2020 now covers storable/portable immersion pools and includes new requirements.

- An immersion pool is:

A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged.

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680.45 Swimming Pools, Fountains, and Similar Installations. Permanently Installed Immersion Pools.

- Section 680.45 is new and covers **permanently installed** immersion pools.
- The section details the requirements for cord-and-plug connections, pumps, heaters, audio equipment, and equipotential bonding.

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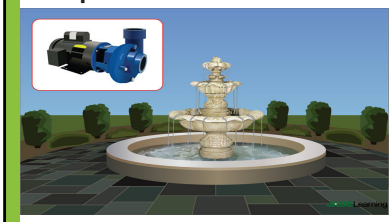
680.59 Swimming Pools, Fountains, and Similar Installations. GFCI Protection for Permanently Installed Nonsubmersible Pumps.



Section 680.59 is new to the 2020 NEC and requires all outlets that supply single-phase or 3-phase pump motors to have GFCI protection if 250 volts or less and 60 amps or less.

2020 NEC Changes www.jadelearning.com 186

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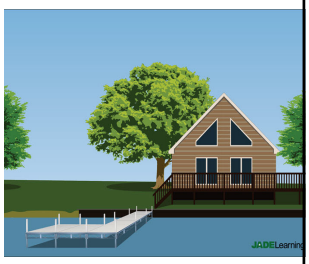
682.33(C) Natural and Artificially Made Bodies of Water. Bonding of Equipotential Planes.

- Section 682.33(C)(2) provides new equipotential bonding requirements for certain types of outdoor service equipment near bodies of water *other* than pools.
- Walking surfaces below or within 3 feet of the services mentioned above must also be bonded to the equipotential plane.



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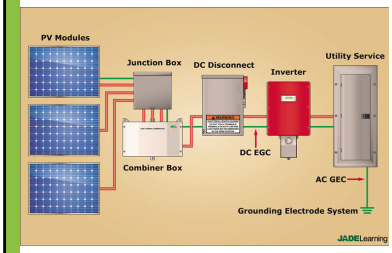
187

690.2 Solar PV Systems. Definitions. Grounded, Functionally. (1of2)



Section 690.2 provides a revised definition for **Grounded, Functionally**:

A system that has an electrical ground reference for operational purposes that is not solidly grounded. **(CONT')**

2020 NEC Changes www.jadelearning.com 188

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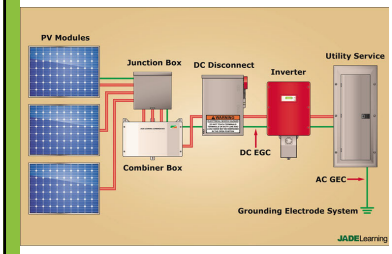
690.2 Solar PV Systems. Definitions. Grounded, Functionally. (2of2)



The informational note under the revised term **Grounded, Functionally** has been updated to explain how the definition applies to Solar PV Systems.

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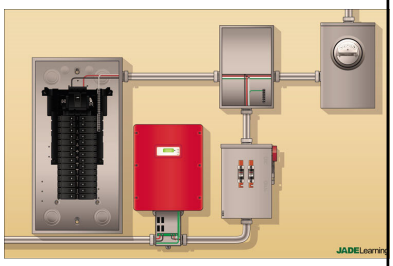
690.9(B) Solar PV Systems. Overcurrent Protection. Device Ratings.

690.9(B) has been revised in the 2020 NEC. It states:

Electronic devices listed to prevent backfeed current in PV system dc circuits shall be permitted to prevent overcurrent of conductors on the PV array side of the device.



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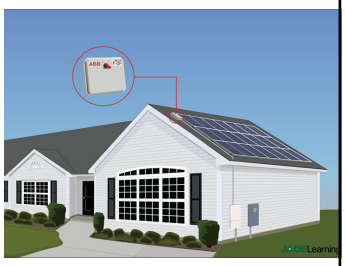
690.12(A) Solar PV Systems. Rapid Shutdown of PV Systems on Buildings. Controlled Conductors.

The rapid shutdown requirement for PV no longer applies to <u>all</u> conductors, but only to these two types:

1. *PV system dc circuits.*
2. *Inverter output circuits originating from inverters located within the array boundary.*



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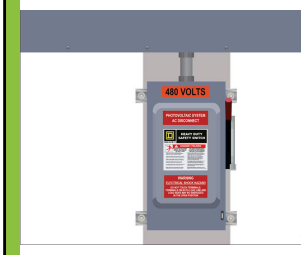
690.13(A), (E) Solar PV Systems. Photovoltaic System Disconnecting Means. Location. Type of Disconnect.



- In 2020 NEC, new requirements exist for PV disconnecting means located readily accessible to *unqualified* persons.
- Breakers marked “line” and “load” were prohibited from being used for backfeeding in the 2017 NEC. The 2020 NEC declares they *may not be suitable.*

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690.33 Solar PV Systems. Mating Connectors.

The 2020 NEC now addresses **intermatability** between PV mating connectors and they must be one of the following:

1. Of the same type and brand for proper fit…*or*
2. Listed and identified for intermatability.

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690.41(B) Solar PV Systems. System Grounding. Ground-Fault Protection.

- New for 2020 NEC, all PV system dc circuits exceeding 30 volts or 8 amps must be provided with dc ground-fault protection.
- In the 2017 NEC, only PV system dc circuits located within the PV Array required ground-fault protection.

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690.41(B) Solar PV Systems. System Grounding. Ground-Fault Protection.

Also new for 2020 NEC, Section 690.41(B)(3) requires ground-fault protection equipment serving PV system dc circuits to indicate (display) in a readily accessible location anytime a ground-fault condition is present.

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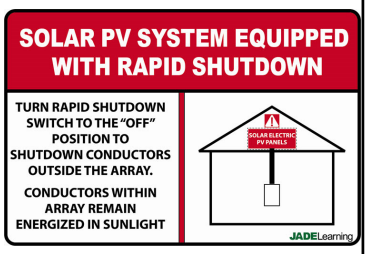
690.56(C) Solar PV Systems. Identification of Power Sources. Buildings with Rapid Shutdown.

- The 2020 NEC no longer allows rapid-shutdown systems to **only** control conductors outside of the PV array, so that label option was removed.
- Labels have experienced minor updates for the 2020 Code cycle.



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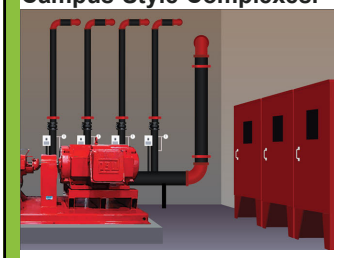
695.3(C)(3) Fire Pumps. Power Source(s) for Electric Motor-Driven Fire Pumps. Multibuilding Campus-Style Complexes.



The 2020 NEC requires selective coordination of OCPDs in multibuilding complexes to be:

1. Performed by a licensed engineer or equivalent.
2. Documented.
3. Made available to individuals who design, install, maintain or operate the system.

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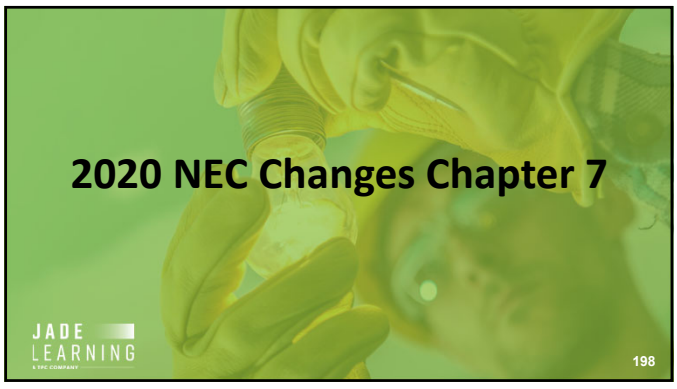

198

700.5(A) Emergency Systems. Transfer Equipment.

- Meter-mounted transfer switches are no longer permitted for emergency system use.
- All emergency system transfer switches must now be listed and marked for emergency use.

2020 NEC Changes www.jadelearning.com 199

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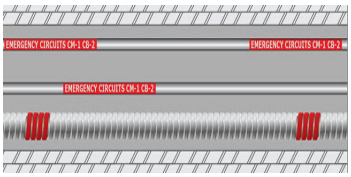
700.12(B), (H), Emergency Systems. General Requirements. Equipment Design and Location. DC Microgrid Systems.



- The 2020 NEC requires emergency system equipment not protected by a fire suppression system to be in a space with a 2-hour fire rating (2017 NEC is 1 hour).
- DC microgrid systems are now permitted for emergency system use.

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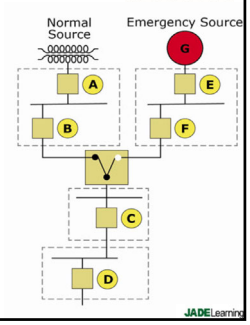
700.32 Emergency Systems. Selective Coordination.

A new informational note and diagram were added in the 2020 Code cycle:

1. OCPD D must selectively coordinate with OCPDs C, F, E, B, and A.
2. OCPD C must selectively coordinate with OCPDs F, E, B, and A.
3. OCPD F must selectively coordinate with OCPD E.
4. OCPD B is **not** required to selectively coordinate with OCPD A.



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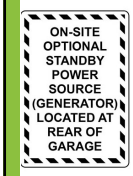
201

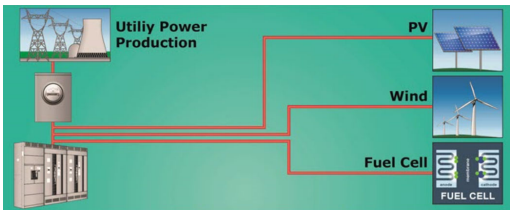
702.7(A) Optional Standby Systems. Signs. Standby.



- Section 702.7(A) in the 2020 NEC now separates sign requirements for commercial and industrial vs. one- and two-family dwellings.
- At one- and two-family dwelling units, a sign must be placed at the service disconnecting means indicating the location of each on-site optional standby power source disconnect.

202

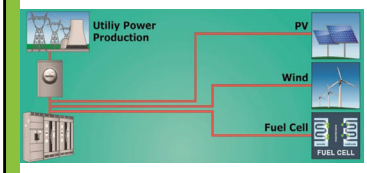
705.11 Interconnected Electric Power Production Sources. Supply-Side Source Connections. (1of2)



Section 705.11 is new and addresses requirements for connecting PV, wind, or other power producing systems to a home or business, ***before*** the supply conductors reach the main-breaker in the service equipment. (CONT')

203

705.11 Interconnected Electric Power Production Sources. Supply-Side Source Connections. (2of2)



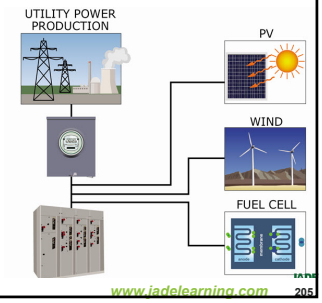
This new Section addresses:

1. Output ratings
2. Conductors
3. Overcurrent Protection
4. Connections
5. Ground-Fault Protection

204

705.12 Interconnected Electric Power Production Sources. Load-Side Source Connections.

- 705.12 in the 2020 NEC allows an interconnected (grid-tied) power source such as a solar PV system to connect and introduce power on the load side of the main service disconnect.
- If connected in this way, Sections 705.12(A) through (E) will apply in most cases.



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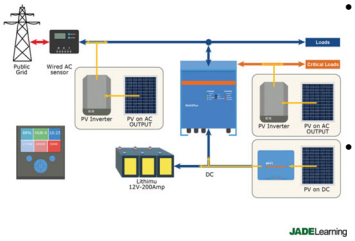
705.13 Interconnected Electric Power Production Sources. Power Control Systems.



- Section 705.13 is brand new and addresses interconnected power production sources like PV, and their control using power control systems (PCS).
- 705.13 addresses monitoring, ampacity settings, and overcurrent protection using PCS.

2020 NEC Changes www.jadelearning.com 206

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706.1, 706.2 Energy Storage Systems. Scope. Definitions.

- This section applies to ESS having a capacity greater than 1kWh.
- A new informational note states ESS can include batteries, capacitors, kinetic energy devices, inverters, or converters.
- ESS differ from UPS systems.

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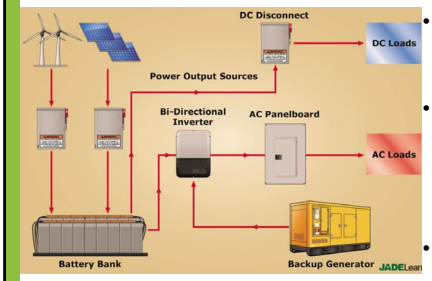
708.24(D) COPS. Bypass Isolation Automatic Transfer Switches.

- New for 2020 NEC, 708.24(D) addresses *Bypass Transfer Switches for COPS (Critical Operations Power Systems).* These systems supply power to essential governmental or similar operations if primary power is lost.
- The 2020 NEC now requires a bypass isolation switch if there is only one automatic transfer switch in the COPS.
- Bypass isolation switches allow repair to COPS systems without power loss to critical systems.

208

710.15 Stand-Alone Systems. General.

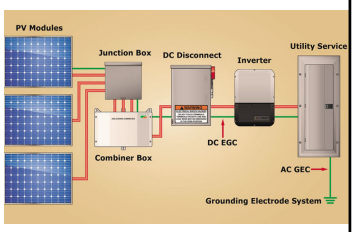


- Stand-alone systems may now power three-phase systems.
- Three-phase systems must be controlled or balanced compatible with the sum of the power supply capacities.
- A new information note assists with calculations.

209

712.2 DC Microgrids. Definitions. Grounded, Functionally.

- **Grounded, Functionally** is not grounded without interruption, but instead is grounded through an in-line resistor, inverter, or similar.
- **Grounded, Solidly** is connected to ground without inserting any resistor or impedance device.



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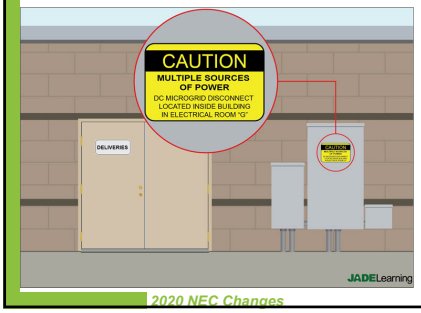
712.10 DC Microgrids. Directory.

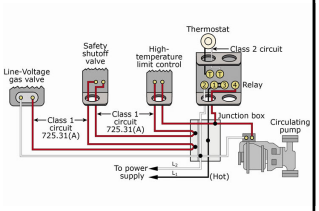


The 2020 NEC now requires that a permanent plaque or directory be installed outside the building at each service equipment (or approved readily visible location) when supplied by a dc microgrid system.

211

725.48(B)(1) Class 1, 2, & 3 Remote-Control, Signaling and Power-Limited Circuits. Class 1 Circuits with Power-Supply Circuits. In a Cable, Enclosure, or Raceway.

A new permission has been granted in the 2020 NEC, allowing Class 1 circuit conductors to occupy the same cable, enclosure, or raceway as power-supply circuits, even when they are **not** functionally associated.



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725.144, Table 725.144 Class 1, 2, & 3 Remote-Control, Signaling and Power-Limited Circuits. Transmission of Power and Data. (1of2)

Table 725.144 JADELearning

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Data Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

	Number of 4-Pair Cables in a Bundle																	
	1-7			8-19			20-37			38-61			62-91			92-192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.48	0.57	0.67	0.45	0.55	0.64	N/A	N/A	N/A
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.25	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.09	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.
Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 2.
Informational Note No. 1: Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for 4-pair balanced twisted pair cabling, see TIA-568-1B4-A, and 5, 6, 7, 6, 6, 5, and Annex G of ANSI/TIA-568-C.2, which provide guidance on adjustments for operating temperatures between 20°C and 60°C.
Informational Note No. 2: The pre-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in Table 725.144.

- Table 725.144 now has updated ampacities.
- A new informational note explains that data cable performance may decrease when temperatures are increased.

213

725.144, Table 725.144 Class 1, 2, & 3 Remote-Control, Signaling and Power-Limited Circuits. Transmission of Power and Data. (2of2)

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Table 725.144 JADELearning

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Data Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

	Number of 4-Pair Cables in a Bundle																	
	1-7			8-19			20-37			38-61			62-91			92-192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	N/A	N/A	N/A
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.25	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.
Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.
Informational Note No. 1: Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for open-supported twisted pair cabling, see TIA-TSB-184-A, and 5, 6, 7, 8, 9, and Annex G of ANSI/TIA-568-C.2, which provide guidance on adjustments for operating temperatures between 30°C and 60°C.
Informational Note No. 2: The pre-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in Table 725.144.

- Another new informational note reminds electricians that connectors can lower conductor amperage ratings.
- Common 8P8C connectors have a maximum rating of 1.0 amp at 60°C.

214

760.121(B) Fire Alarm Systems. Power Sources for PFLA Circuits. Branch Circuits.

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Power-Limited Fire Alarm (PLFA)

- New to the 2020 NEC, Section 760.121(B) permits branch-circuit disconnecting means to be secured in the "on" position.
- Breaker lockouts and similar devices may be placed on PFLA OCPDs to keep people from accidentally disconnecting power to PFLA systems.

215

770.24 Optical Fiber Cables. Mechanical Execution of Work.

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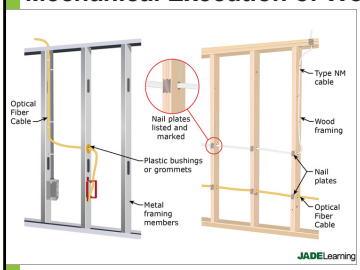


Optical Fiber Cables

- All of Section 300.4 must now be followed.
- Optical fiber cables must now be protected against physical damage.
- Nonmetallic accessories (cable ties) in plenum spaces must be listed as having low smoke and heat release properties.

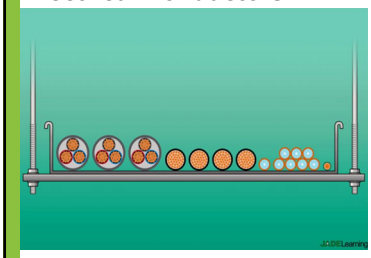
216

770.110(D) Optical Fiber Cables. Cable Trays.

- Section 770.110(D) was added in the 2020 NEC and permits optical fiber cables to be installed using metal or nonmetallic cable tray systems.
- Nonmetallic cable tray systems must be listed and be flame-retardant and provide voltage isolation.

217

770.133(A), (B) Optical Fiber Cables. Installation of Optical Fibers and Electrical Conductors.



- The NEC has determined that armor or metal-clad sheathing over optical fiber cable is a suitable divider from normal current-carrying conductors in the same cable tray or raceway.
- Section 770.133(B) is a new subsection, and reorganizes previous requirements.

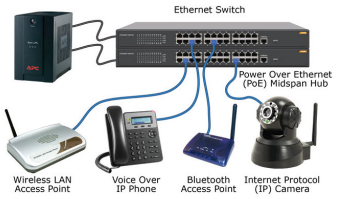
218

2020 NEC Changes Chapter 8

219

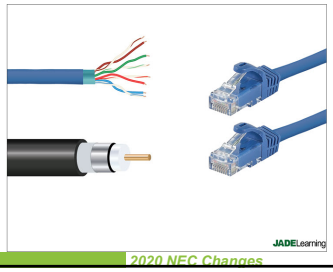
800.1, 800.2 General Requirements for Communications Systems.

- The 2020 NEC Code Making Panel (CMP) recognized that general requirements were often repeated in various sections of Article 800.
- The repeated information has been gathered to one place and is now presented at the beginning of Article 800 only.



220

800.27 General Requirements for Communications Systems. Temperature Limitation of Wire and Cables.



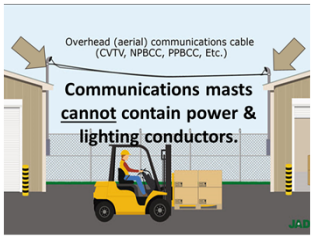
New for 2020 NEC, 800.27 says: *No wire or cable shall be used in such a manner that its operating temperature exceeds that of its rating.*

This new Code section names cables, where similar, previous Code sections named only conductors as protected.

221

800.44(C)&(D) General Requirements for Communications Systems. Overhead (Aerial) Wires and Cables. On Masts. Between Buildings.

New for 2020, NEC 800.44(C) says: *Overhead communications and CATV cables are permitted to attach to an above-the-roof raceway that does **NOT** enclose or support electric light or power circuit conductors.* **(CONT')**



222

800.44(C)&(D) General Requirements for Communications Systems. Overhead (Aerial) Wires and Cables. On Masts. Between Buildings.

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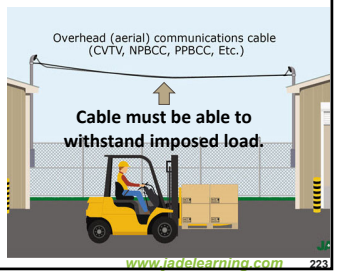
Also new for 2020 NEC, 800.44(D) says communications cables spanning between buildings or structures must be identified and have the strength to withstand loads to which they might be subjected or be supplied an appropriate messenger cable.



223

805.179(D) Communications Circuits. Communications Wires and Cables.

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CMR-LP (0.6A) (75C) 23 AWG 4 pair

- Article 805 is new and provides general communications circuit requirements that were moved from Article 800.
- Section 805.179(D) provides new and specific permission allowing electricians to use limited-power cable in place of Class 2 and Class 3 cables.

224

840.2 Premises-Powered Broadband Communications Systems. Definitions.

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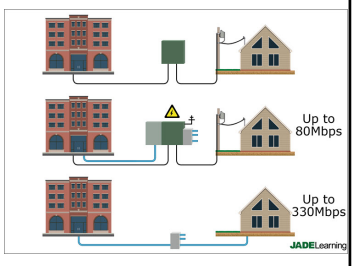
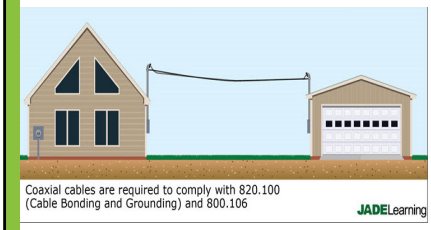
Two Newly Defined Terms:

1. **Broadband.** *Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.*
2. **Premises-Powered.** *Using power provided locally from the premises.*



225

840.94, 840.102 Premises-Powered Broadband Communications Systems. Premises Circuits Leaving the Building.



- Section 840.94 is new and covers the **protection** of communications systems.
- Section 840.102 is also new and covers the **grounding methods** of communications systems.

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840.160 Premises-Powered Broadband Communications Systems. Powering Circuits.

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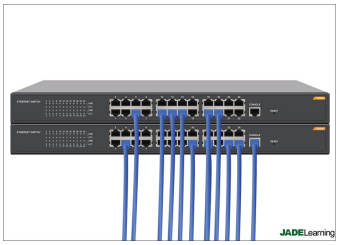
- New text in the 2020 NEC identifies new *listing* requirements for communications cables containing power conductors for equipment.
- 4-pair communications cables are now referenced in this Code section.



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