2020 NEC Changes Part 2
(4 hours credit)

Class Schedule

12:15 PM – 12:45 PM	Registration / Check In
12:45 PM – 1:50 PM	NEC Changes Ch. 4
1:50 PM – 2:00 PM	Break
2:00 PM – 2:50 PM	NEC Changes Ch. 5-6
2:50 PM – 3:00 PM	Break
3:00 PM – 3:50 PM	NEC Changes Ch. 6-7
3:50 PM – 4:00 PM	Break
4:00 PM – 4:30 PM	NEC Changes Ch. 7-8

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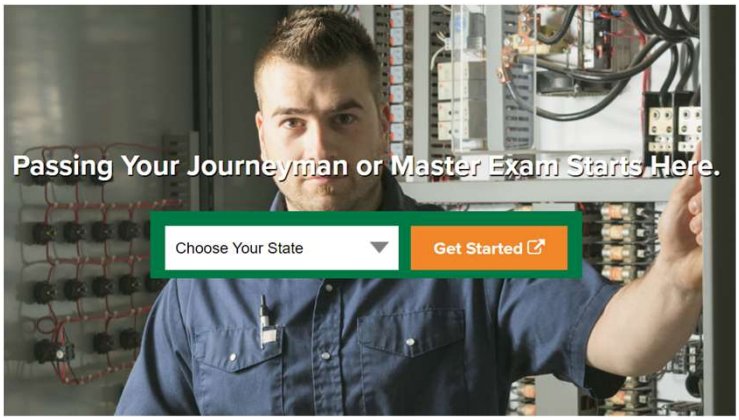

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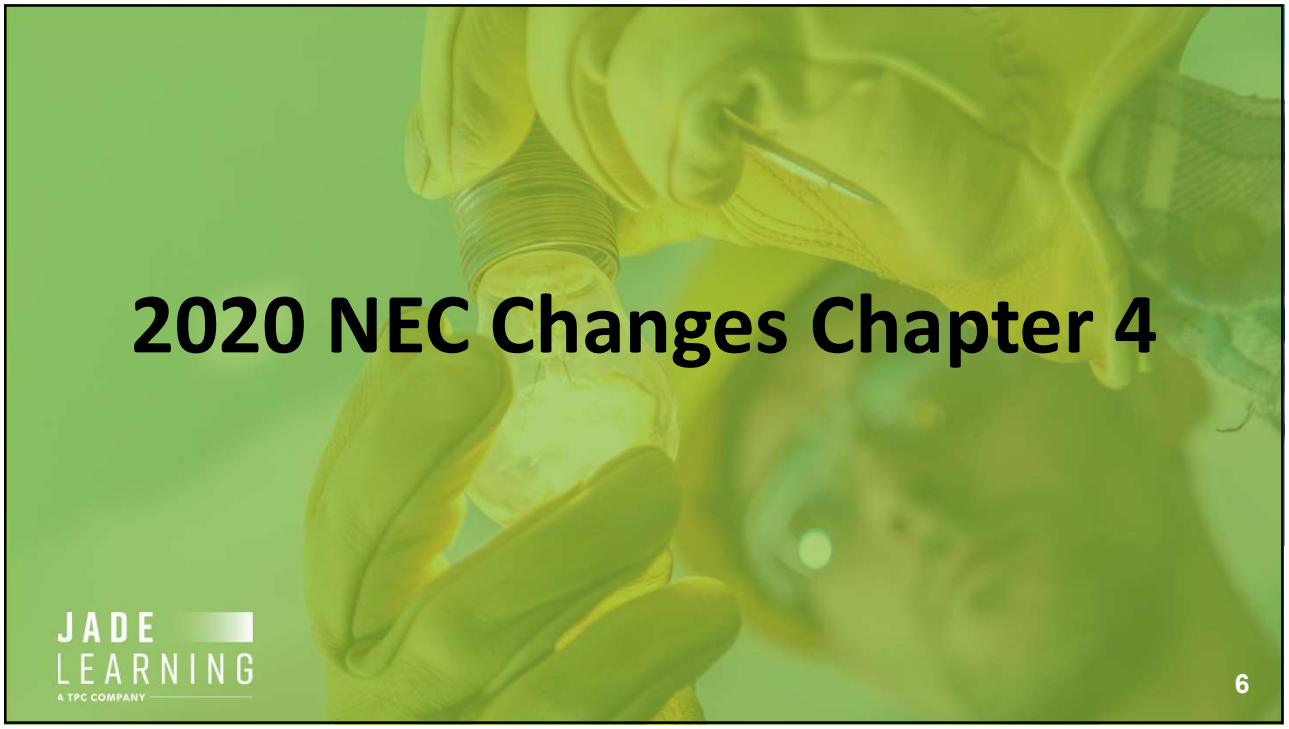
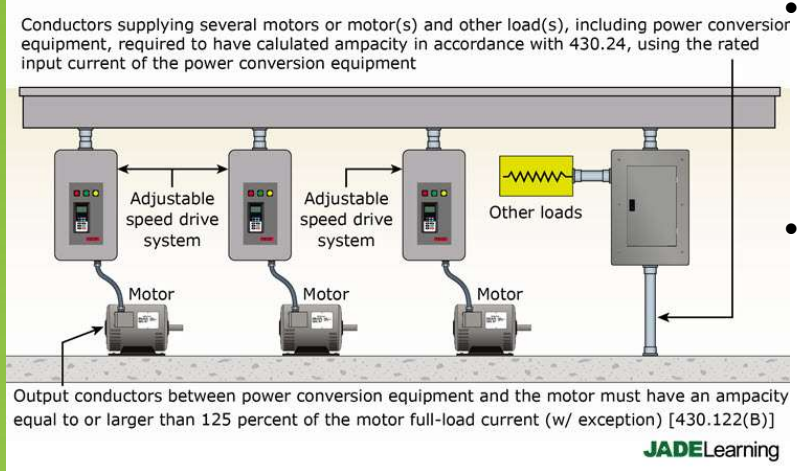


6

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

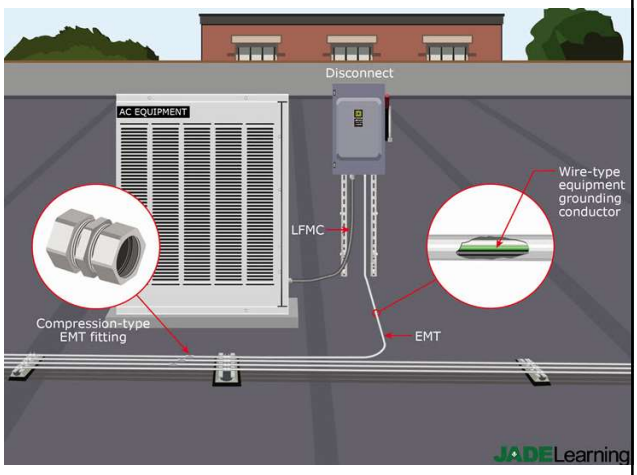


- Section 430.122(D) is new and sends electricians to Section 430.24.
- Motor circuit conductors must be chosen based on the sum of the motor and non-motor loads listed in Section 430.24.

7

440.9 Air Conditioning and Refrigeration Equipment. Grounding and Bonding.

- New wording in the 2020 Code cycle replaces “non-threaded” fittings with “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.



8

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

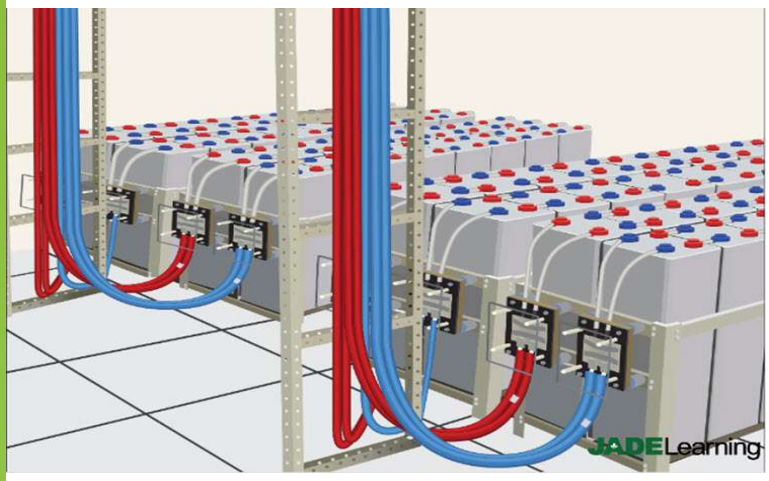
Section 445.18(D) is new in the 2020 NEC and states:

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

450.9 Transformers. Ventilation.

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

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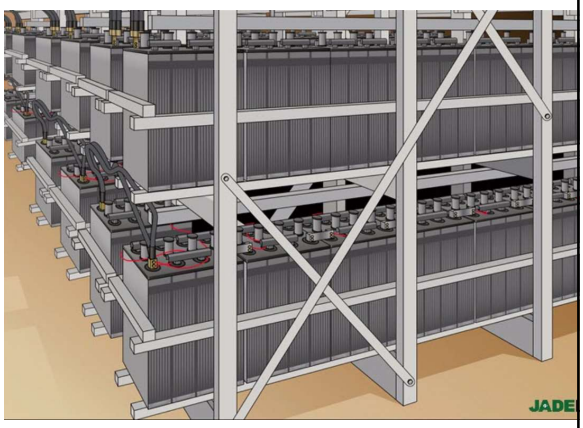
480.7(B),(C),(F),(G) Storage Batteries. DC Disconnect Methods.

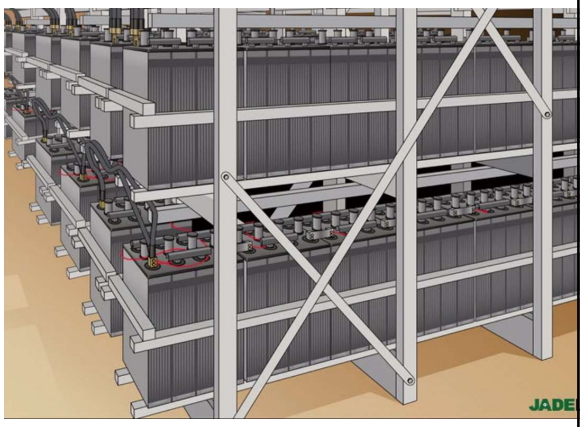
- 480.7(B): Storage battery systems in one- and two-family dwellings must have an emergency disconnect in a readily accessible location outside of the building.
- 480.7(C): The 2020 Code cycle now requires series battery circuits to have a disconnecting means when exceeding 240 volts.



12

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

- 480.7(F): The phrase “available fault current” replaced “maximum available short-circuit current” on notification labels.
- 480.7(G): Provides new identification requirements for facilities with storage battery disconnects.



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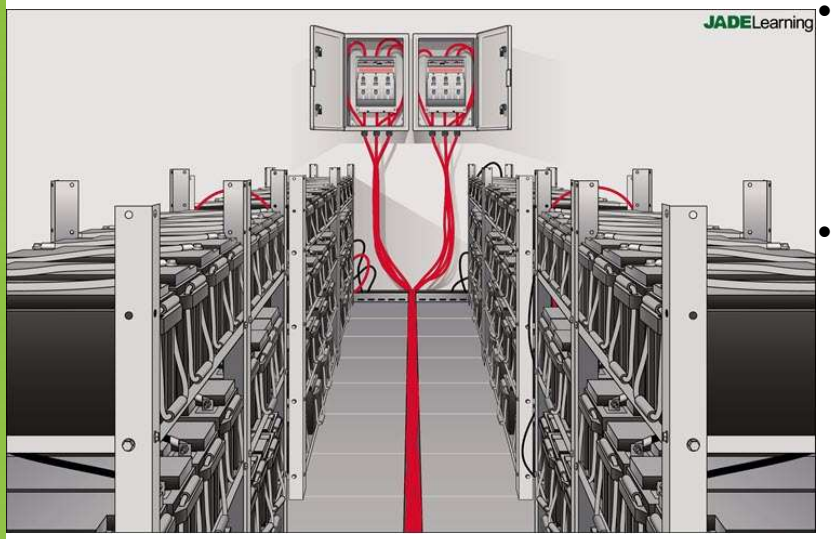
480.10(A) Storage Batteries. Battery Locations.

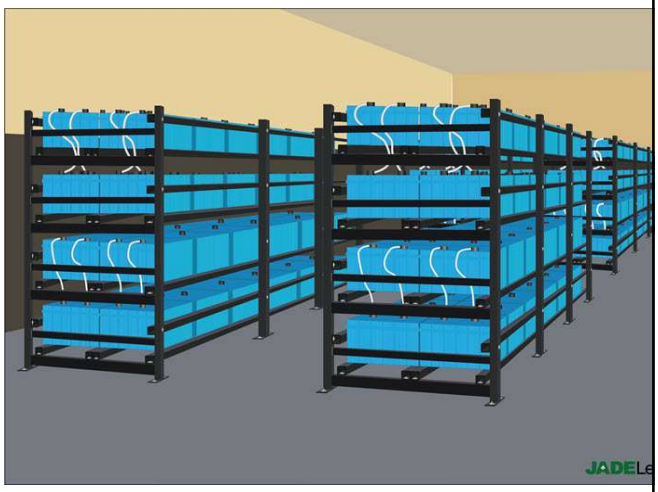


- Section 480.10(A) addresses the venting requirements of storage batteries.
- NFPA 1 (The *Fire Code)* requires the concentration of gasses to be 25% or less of the lower flammable limit of gas.

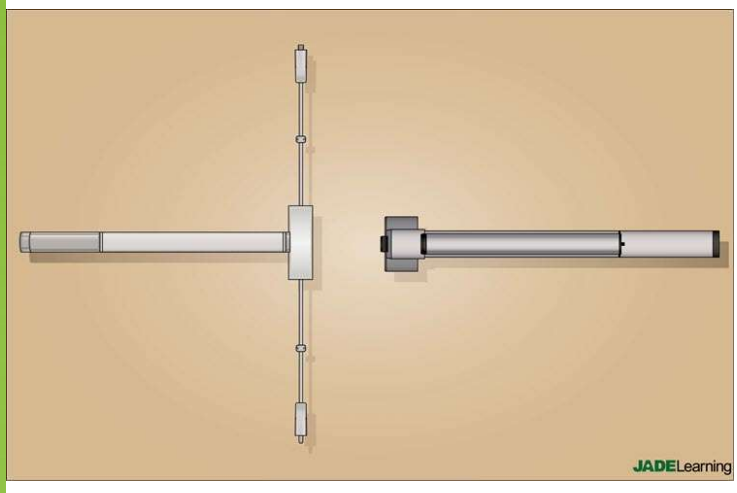
14

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 110.25.
- Battery systems over 1000 volts must now follow the more stringent working space requirements in Section 110.34.



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)

2020 NEC Changes Chapter 5

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

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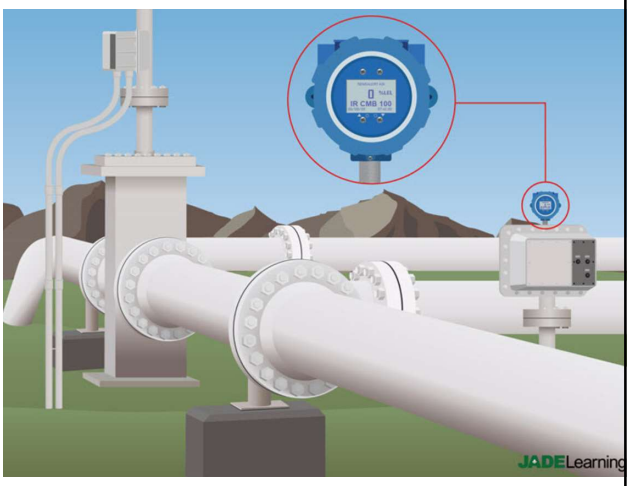
Four new techniques for protecting electrical and electronic equipment were introduced in the 2020 NEC:

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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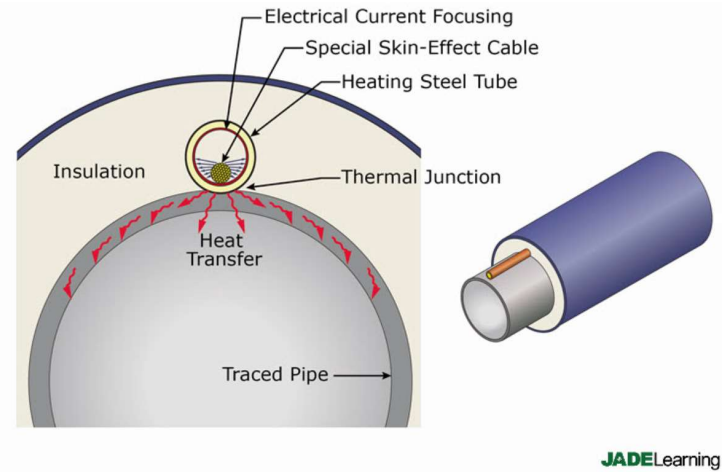
500.7(O) Hazardous Locations. Protection Techniques.



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

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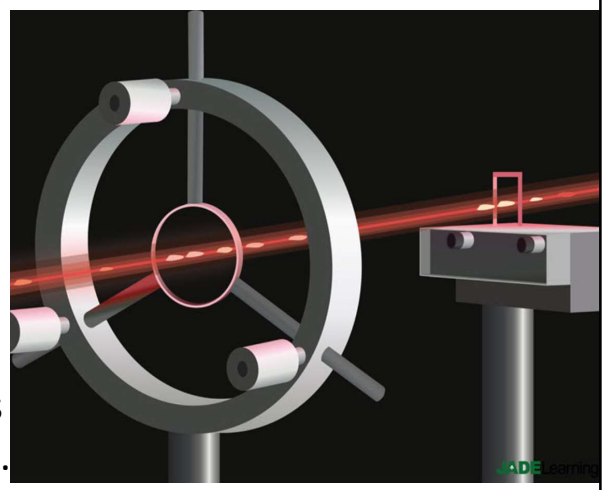
500.8(G) Hazardous (Classified) Locations. Equipment. Equipment Involving Optical Radiation.

- 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.



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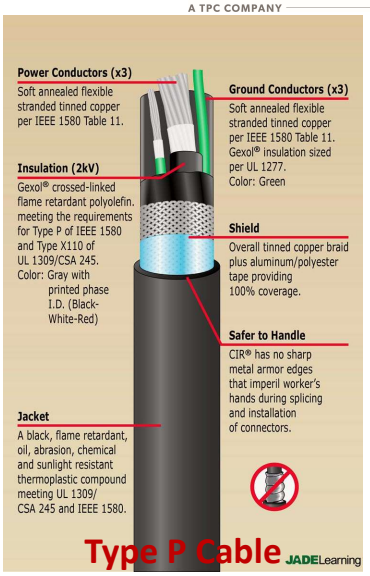
502.10(A)(2) Class II Locations. Wiring Method. Class II Division 1. Flexible Connections.

- 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).



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

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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

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

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- 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.

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	[p]	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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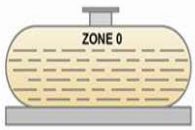
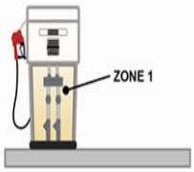
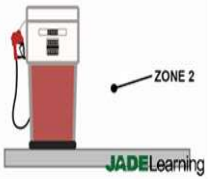
ZONE - NATURE AND PROBABILITY OF HAZARD MATERIAL		
ZONE 0	**ZONE 1**	**ZONE 2**
Ignitable concentrations of flammable gases or vapors which are present continuously or for long periods of time.	Ignitable concentrations of flammable gases or vapors which are likely to occur under normal operating conditions.	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.

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

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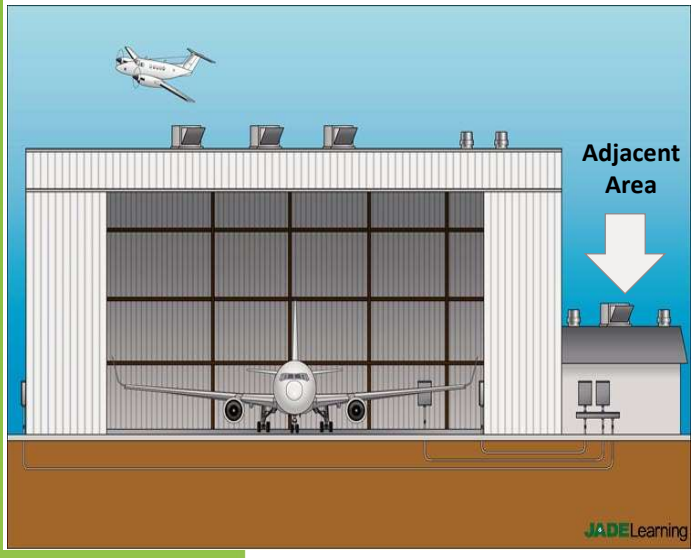
- Section 511.12 now references Section 210.8(B) for GFCI protection requirements.
- Section 210.8(B)(8) requires GFCI protection in garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls.

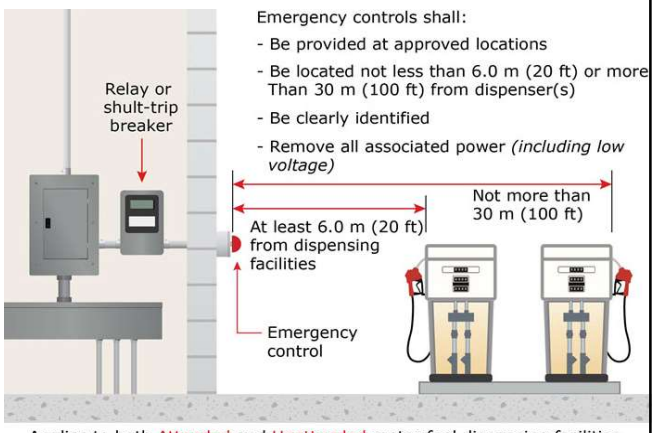
513.3(D) Aircraft Hangers. Classification of Locations.



- 2017: permitted areas adjacent to hangars to be declassified if 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.*

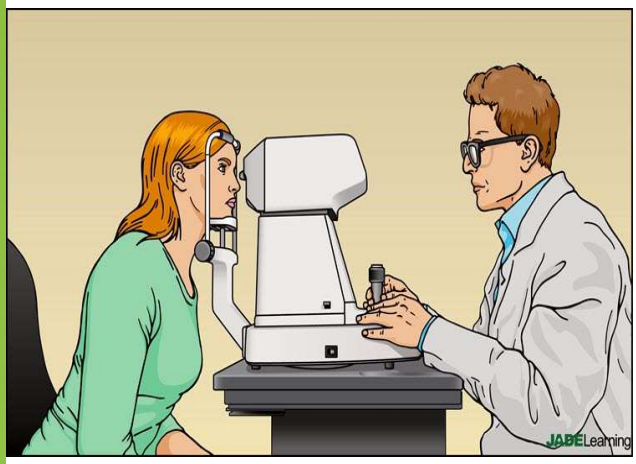
514.11(A) Motor Fuel Dispensing Facilities. Circuit Disconnects. Emergency Electrical Disconnects.

- All ungrounded and 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.



Applies to both Attended and Unattended motor fuel dispensing facilities

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



New patient care spaces were added in the 2020 Code cycle 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

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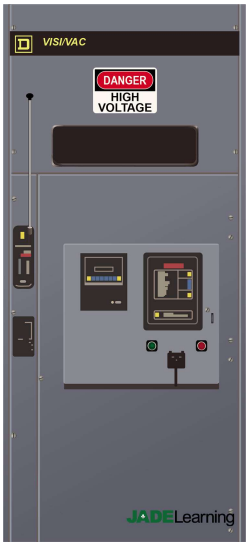
517.17(D) Health Care Facilities. Ground-Fault Protection of Equipment. Testing.

- 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).



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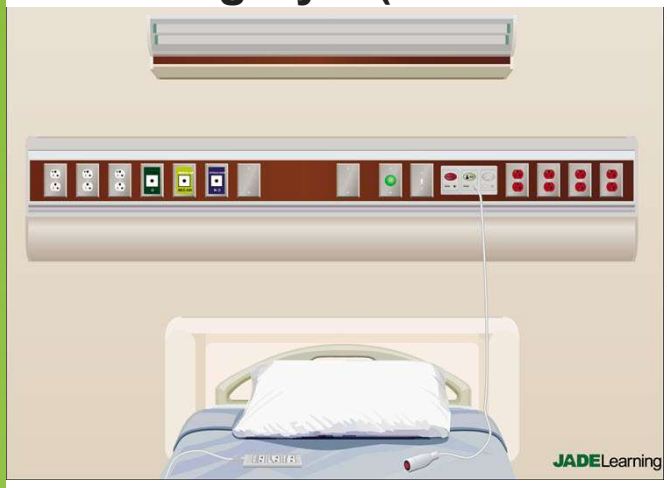
517.21 Health Care Facility. GFCI Protection for Personnel in Category 2 (General Care) and Category 1 (Critical Care) Spaces.



- 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 and 2 spaces are not exempt from normal GFCI requirements.

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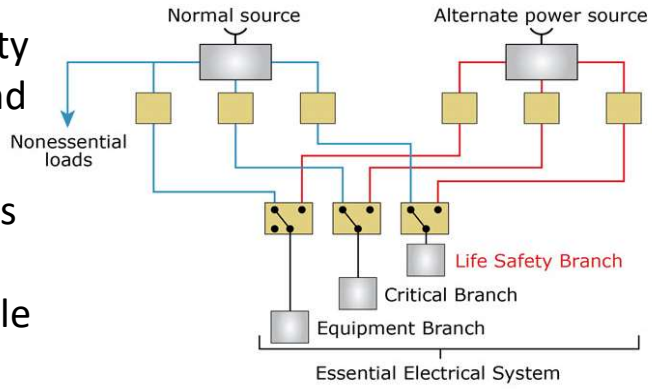
517.26 Health Care Facilities. Essential Electrical System. Application of Other Articles.

- 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.



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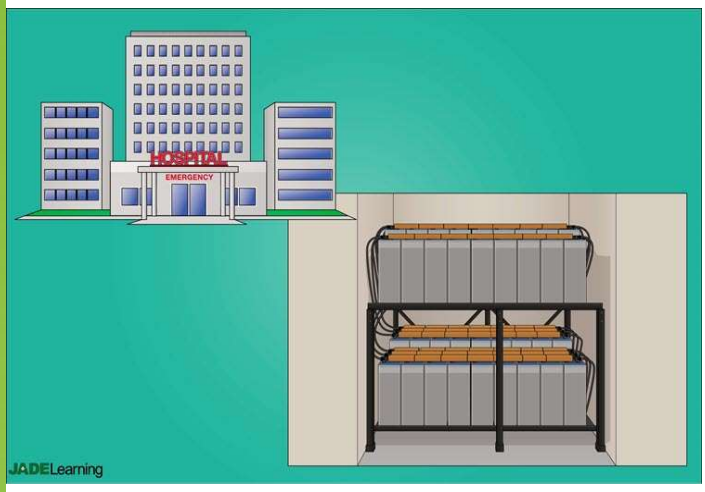
517.30(B)(3) Sources of Power. Types of Power Sources. Battery Systems.



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.

35

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.”
- Informational notes have changed the term “hospital” to “Type 1 Essential Electrical System.”

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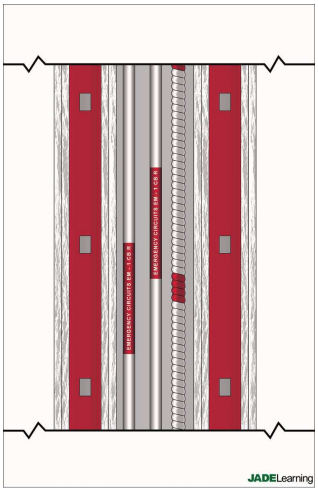
517.31(C)(3) Requirements for the Essential Electrical System. Mechanical Protection of the Essential Electrical System.

- 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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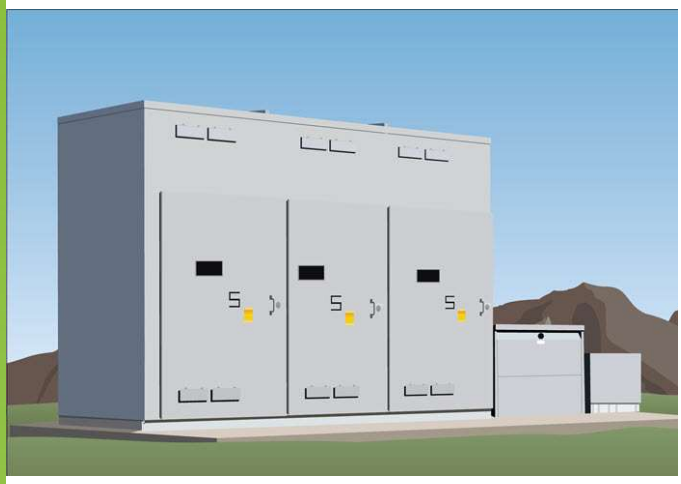
518.6 Assembly Occupancies. Illumination.

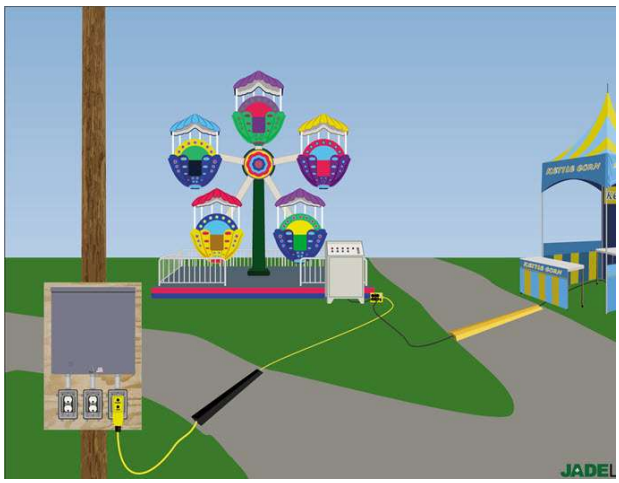


- Workspace for fixed service equipment installed outdoors at assembly occupancies must be provided with illumination.
- Control only by automatic means is not permitted.
- Additional lighting not required if illuminated by an adjacent light source.

39

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



40

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 provides requirements for disconnecting means and branch-circuit overcurrent protection.

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

At agricultural buildings, GFCI protection is <u>not</u> required for other than 125-volt, 15- and 20-amp receptacles installed:

1. In equipotential plane areas
2. Outdoors
3. In damp or wet locations
4. In dirt confinement areas for livestock.

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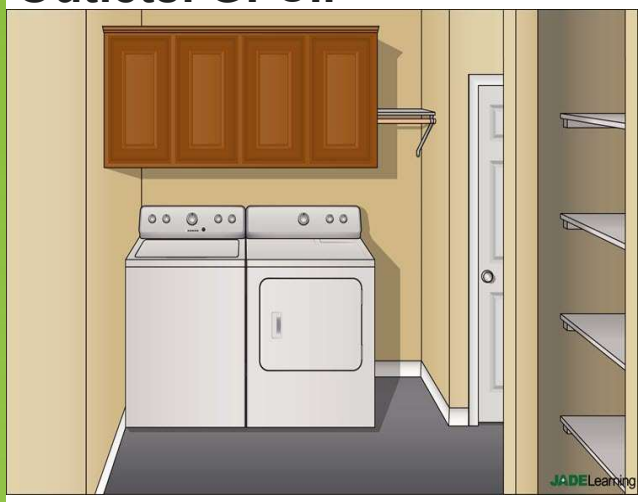
550.13(B) Mobile Homes, Manufactured Homes, Mobile Home Parks. Receptacle Outlets. GFCI.



In mobile and manufactured homes, GFCI protection is now required for:

1. Garages and 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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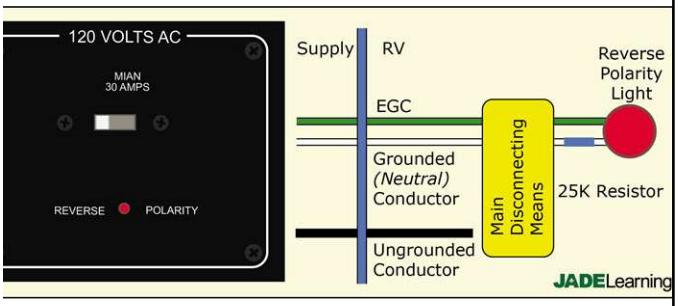
551.40(D) RVs and RV Parks. 120 V or 120/240 V, Nominal, Systems. Reverse Polarity Device.

- 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.

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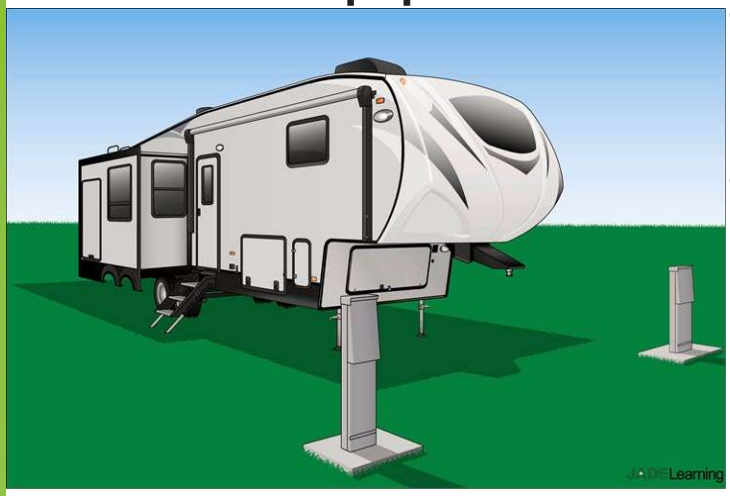
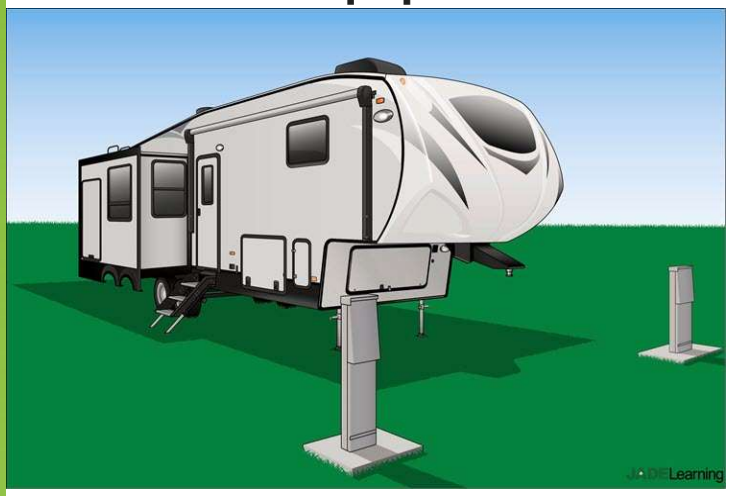
551.72(F) RVs and RV Parks. Distribution System. Connection to Recreational Vehicle Site Equipment.



- 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.

45

551.72(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.
- One 15- or 20-amp convenience receptacle may be used in addition to the supply cord.

46

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.

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.

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

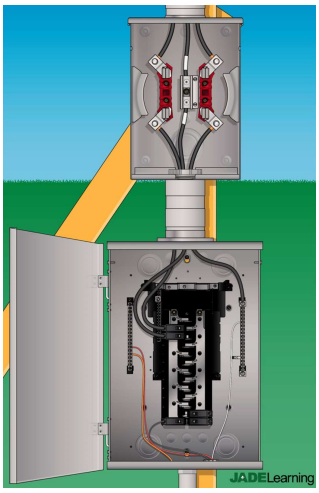
- GFCI requirements for boat hoists and residential boat docks was moved from Section 210.8(C) to Section 555.9.
- GFCI protection for personnel is required for outlets up to 240 volts that supply boat hoists at dwelling unit docking facilities.

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

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

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 arcing, overheating, loose parts, bound parts, or visible damage or deterioration.



51

2020 NEC Changes Chapter 6

52

52

600.2 Electric Signs and Outline Lighting. Definitions.

- Four new definitions for were provided in the 2020 Code cycle for retrofitting 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.

53

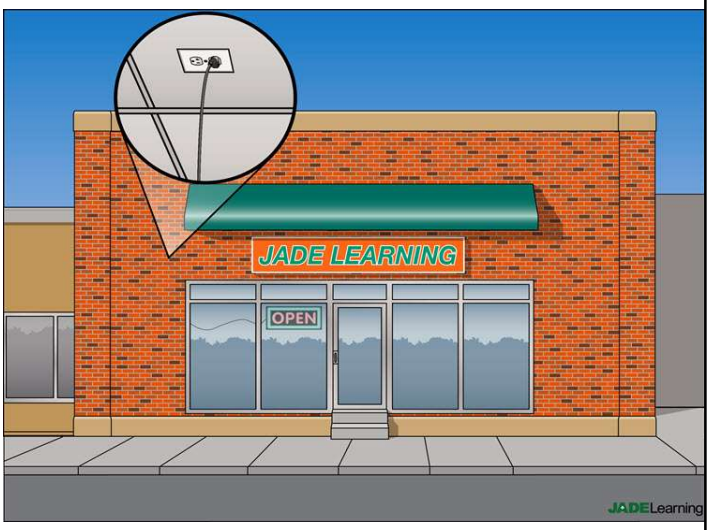
600.2 Electric Signs and Outline Lighting. Definitions.

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.

54

600.5(A) Electric Signs and Outline Lighting. Branch Circuits. 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.*



55

600.35 Electric Signs and Outline Lighting. Retrofit Kits.

Newly created Section 600.35 provides the requirements for installation, marking, wiring methods, and damaged components of retrofit kits.

56

605.1 Office Furnishings. Scope.

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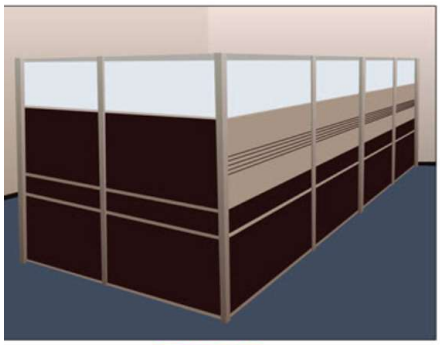
Article 605 does not cover *individual office furnishings not connected to a system such as chairs, freestanding desks, tables, storage units, and shelving units.*



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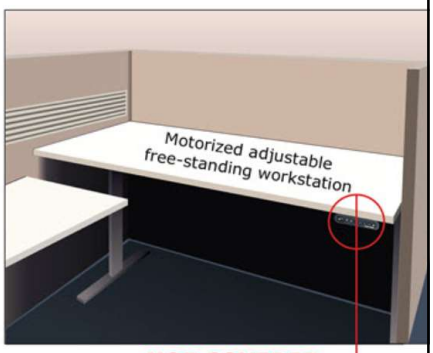

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57

625 and 625.1 Electric Vehicle Power Transfer System. Scope.

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- The scope of Article 625 was updated in the 2020 NEC.
- Electric vehicles are now recognized as being capable of sending stored energy from their on-board batteries to the electrical system of a home or business.

58

625 and 625.1 Electric Vehicle Power Transfer System. Scope.

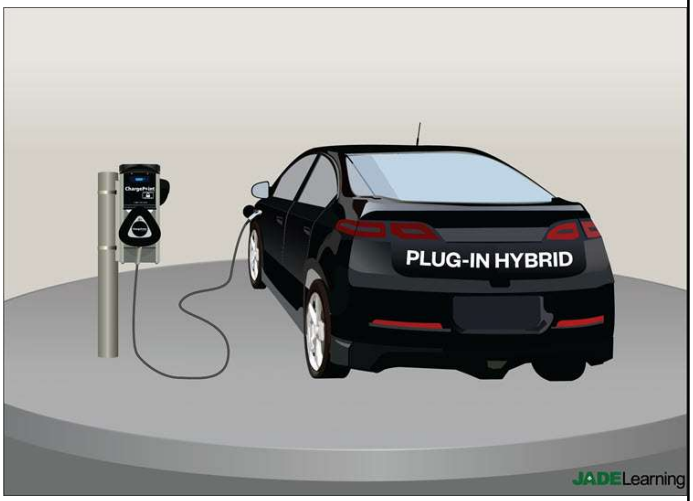
Electric Vehicle Power Export Equipment (EVPE) is:

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.

59

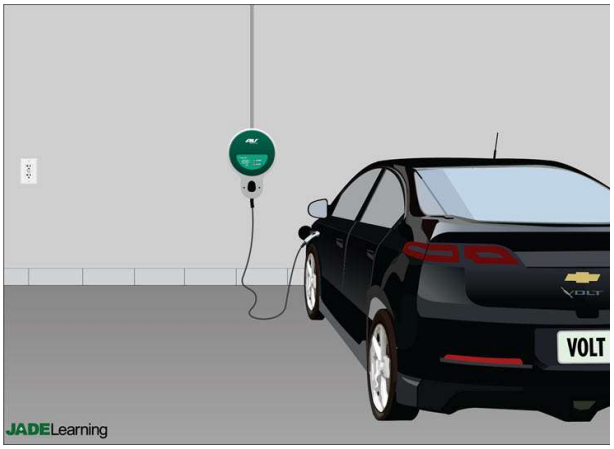
625.2 Electric Vehicle Power Transfer System. Definitions.

- 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.



60

625.44 Electric Vehicle Power Transfer System. Equipment Connection.

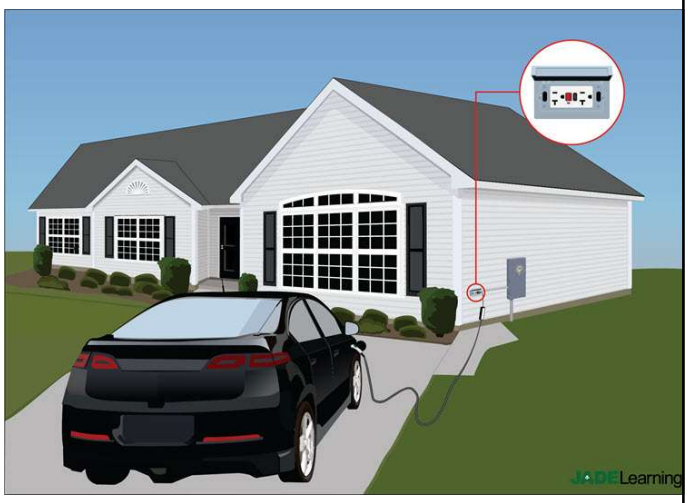


- Section 625.44 presents new connection types including certain 250-volt receptacle outlets.
- The term “stationary equipment” was replaced with “fastened-in-place.”
- “Equipment” was replaced with the more specific terms “EVSE” and “WPTE.”

61

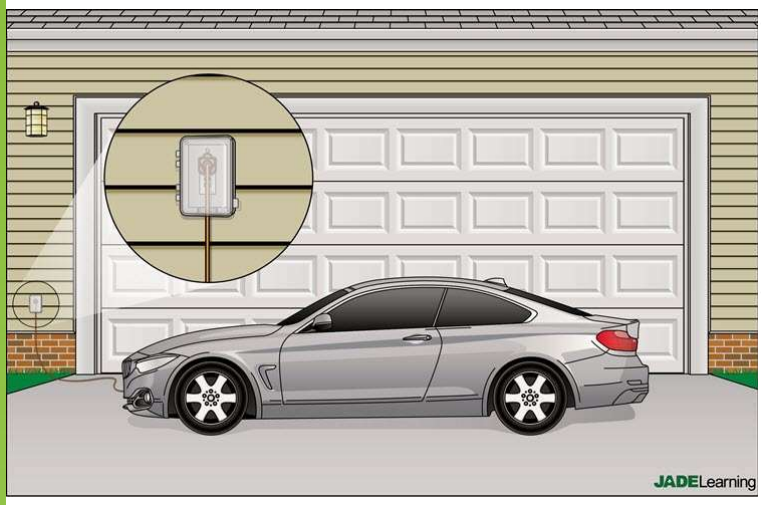
625.54 Electric Vehicle Power Transfer System. GFCI Protection for Personnel.

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



62

625.56 Electric Vehicle Power Transfer System. Receptacle Enclosures.



- 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.

63

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.

64

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

- The definition of “fountain” was expanded to clarify the meaning and intended application in the 2020 NEC.
- The term fountain in the 2017 NEC may provide confusion if the term covered water coolers.
- The 2020 NEC explains that water coolers, used for dispensing potable water, are not the types of water fountains being discussed in Article 680.

65

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

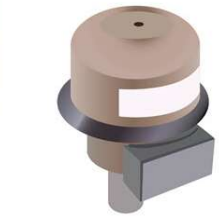
Section 680.4 now states:

The authority having jurisdiction shall be permitted to require periodic inspection and testing.

- This section allows for periodic electrical inspections indefinitely after pool, fountain, and similar installations.

66

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.

67

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.

68

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

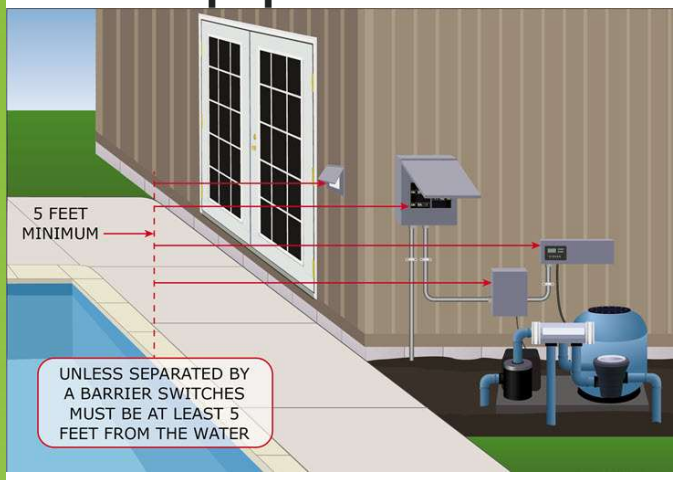
All 15- and 20-ampere, single-phase, 125-volt receptacles located within 20 feet of the inside walls of a pool shall be protected by a Class A ground-fault circuit interrupter (GFCI).

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 circuit must be located withi a pool equipment room.
- All other receptacles 150 volts or less to ground in a pool equipment room must be GFCI protected.

At least one GFCI-protected 125-volt, 15- or 20- ampere receptacle on a general-purpose circuit required to be located within a pool equipment room

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.

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.

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

- Electricians and manufacturers no longer need to conceal enough cable to service the luminaire on the dry surface above the spa.
- Spas may be drained so luminaires can be serviced on the spa bench.

73

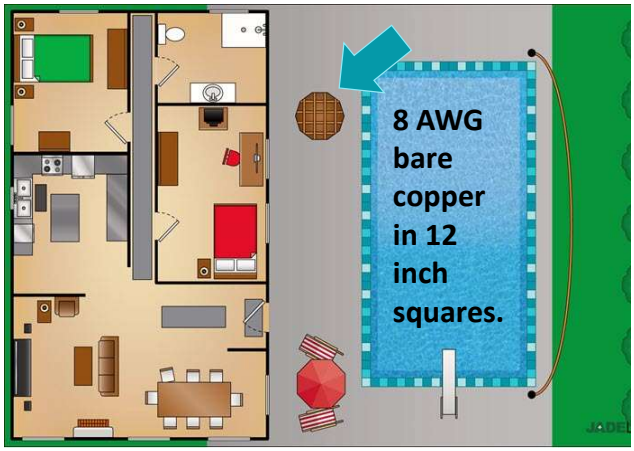
680.26(B)(2) and (B)(5) Swimming Pools, Fountains, and Similar Installations. Equipotential Bonding.

- Walking surfaces surrounding the perimeter of the pool for the first 3 feet horizontally must be bonded.
- All metal fittings, except isolated fittings measuring 4 inches or less, must now be bonded.

74

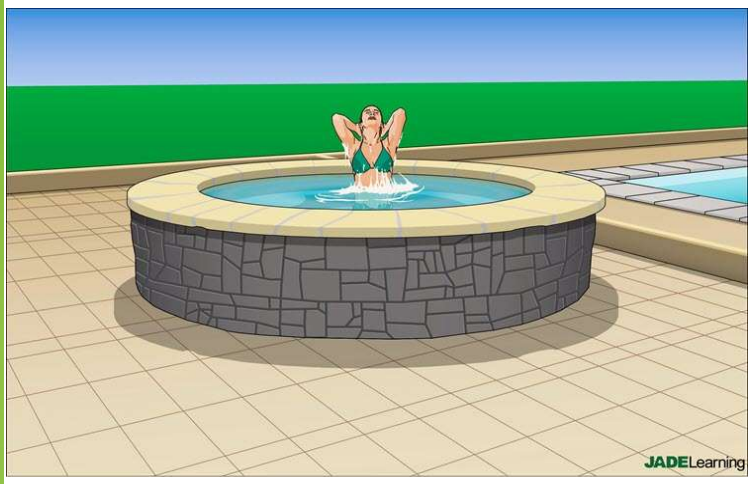
680.26(B)(2) and (B)(5) Swimming Pools, Fountains, and Similar Installations. Equipotential Bonding.

- A copper grid is now permitted to be installed 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.



75

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

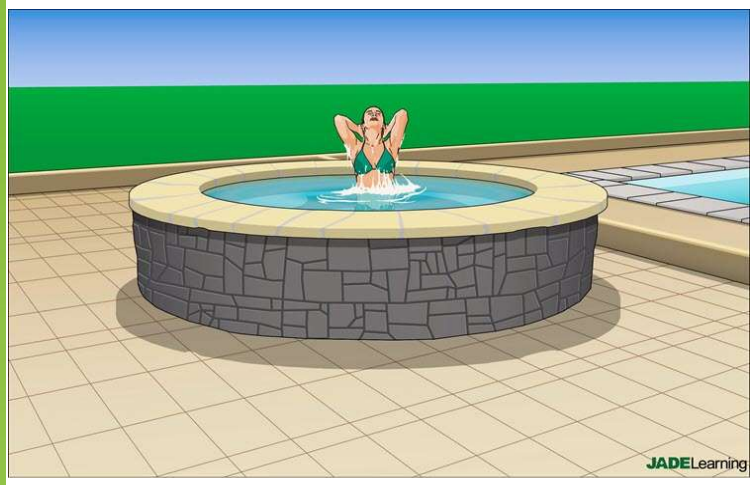


- Article 680 now covers immersion pools.
- An immersion pool is:

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

76

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



Section 680.35 provides many new immersion pool requirements including GFCI protection, heater, pump, and minimum distance requirements.

77

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, storable and portable pumps, heaters, audio equipment, and equipotential bonding.

78

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.

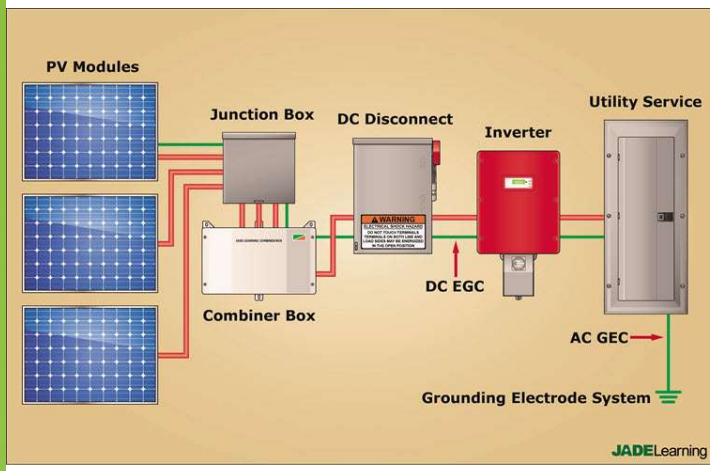
79

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

- Section 682.33(C)(2) provides 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.

80

690.2 Solar PV Systems. Definitions. Grounded, Functionally.

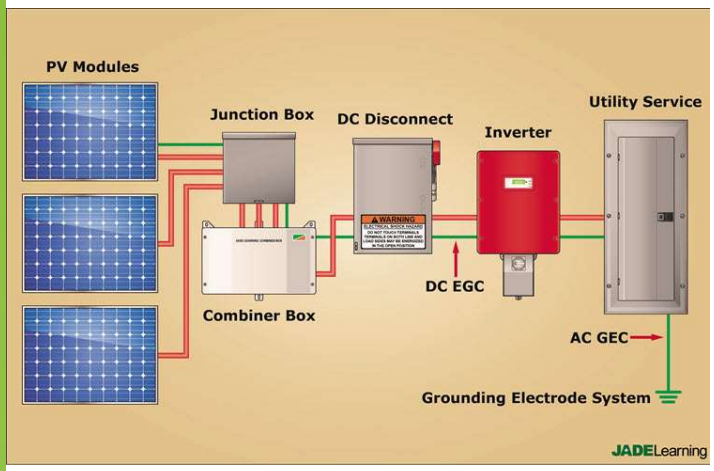


Section 690.2 provides a new definition for Grounded, Functionally:

A system that has an electrical ground reference for operational purposes that is not solidly grounded.

81

690.2 Solar PV Systems. Definitions. Grounded, Functionally.

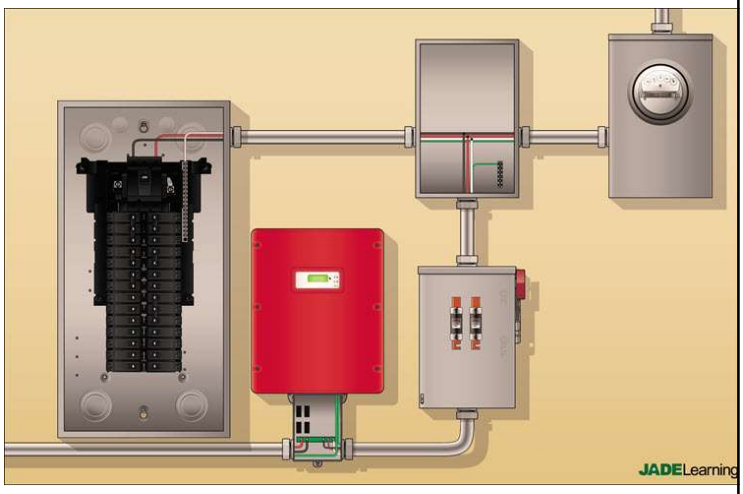


The informational note under the term **Grounded, Functionally** has been updated to help explain how the definition applies to Solar PV Systems.

82

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

Electronic devices that are 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.

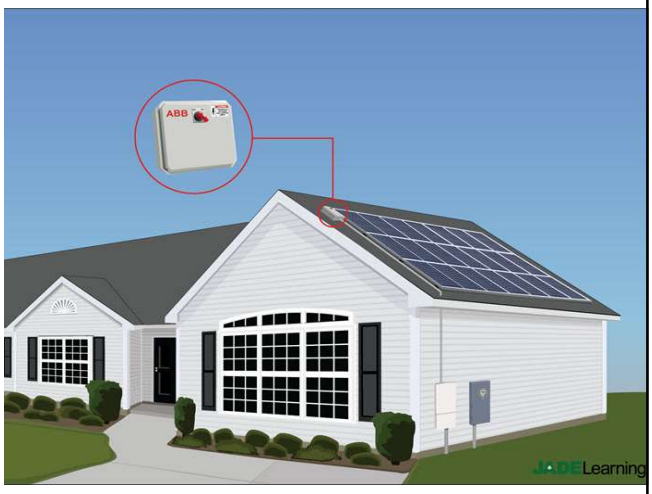


83

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

- The rapid shutdown requirement 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.*



84

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

- New requirements were added for disconnecting means that are readily accessible to unqualified persons.
- Breakers marked “line” and “load” were prohibited from being used for backfeeding. The 2020 NEC now declares these *may not be suitable.*

85

690.33 Solar PV Systems. Mating Connectors.

- The 2020 NEC now address intermatability between PV mating connectors and must be one of the following:

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

86

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

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

87

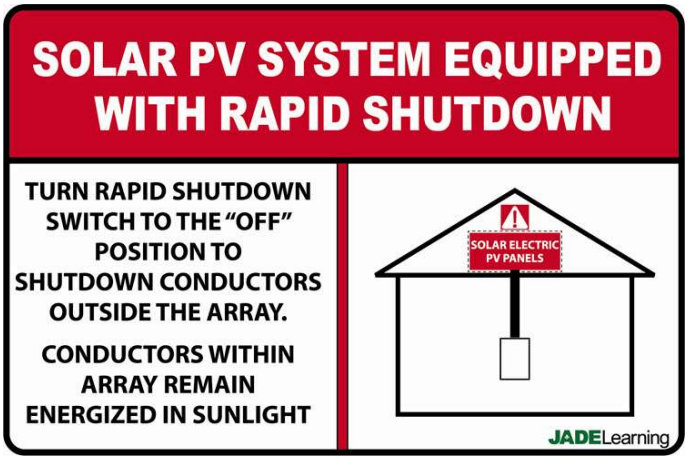
690.41(B) Solar PV Systems. System Grounding. Ground-Fault Protection.

Section 690.41(B)(3) now requires that ground-fault protection equipment serving PC system dc circuit conductors to indicate in a readily accessible location anytime there is a ground-fault condition.

88

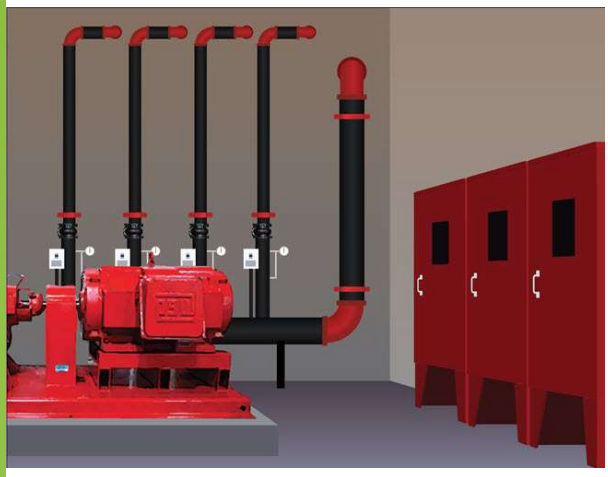
690.56(C) Solar PV Systems. Identification of Power Sources. Buildings with Rapid Shutdown.

- The 2020 NEC no longer permits an option to only control conductors outside of the array, so that label option was removed.
- Wording for labels have been updated slightly and must be reflective for emergencies.



89

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

90

2020 NEC Changes Chapter 7

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91

91

700.5(A) Emergency Systems. Transfer Equipment.

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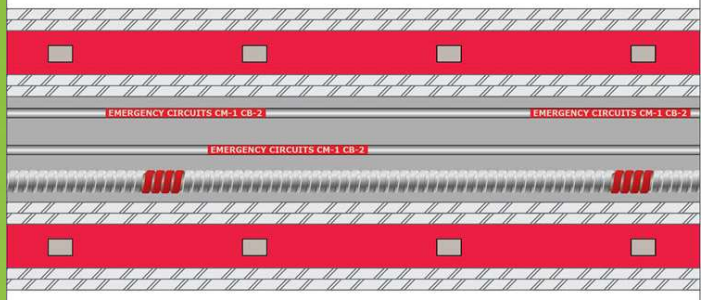
- Meter-mounted transfer switches are no longer permitted for emergency system use.
- All emergency system transfer switches must now be listed and marked for emergency use.

92

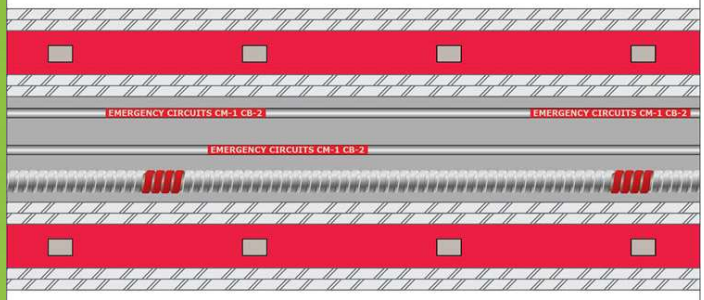
700.12(B), (H), Emergency Systems. General Requirements. Equipment Design and Location. DC Microgrid Systems.



Section 700.12(B) no longer lists “health care occupancies where people are incapable of self-preservation” as a location that is required to have emergency system equipment installed.

93

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



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

94

700.32 Emergency Systems. Selective Coordination.

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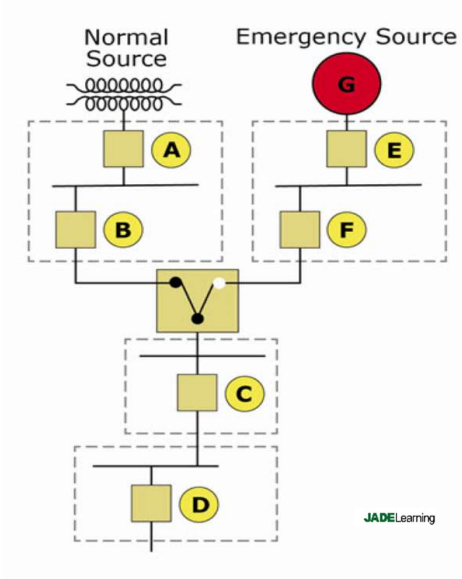
- A new informational note and diagram was added in the 2020 Code cycle.

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.



95

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

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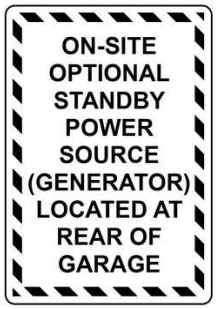
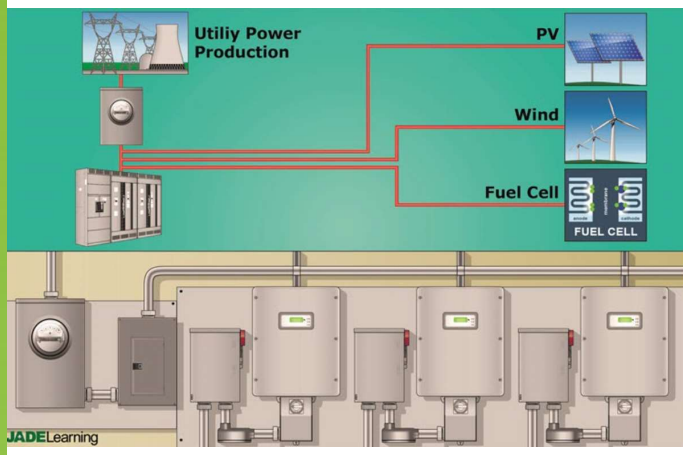


- Section 702.7(A) now separates sign requirements for commercial and industrial vs. one- and two-family dwellings.
- At one- and two-family dwelling units, a sign must be placed at the service disconnecting means indicating the location of each on-site optional standby power source disconnect.

96

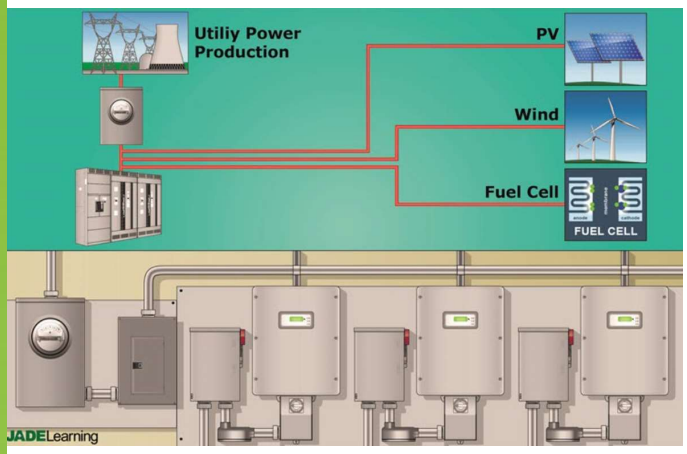
705.11 Interconnected Electric Power Production Sources. Supply-Side Source Connections.



Section 705.11 is new to the 2020 NEC, and addresses requirements for connecting PV systems, wind energy systems, or other power producing systems to a home or business before the conductors reach the main service breaker of the service equipment.

97

705.11 Interconnected Electric Power Production Sources. Supply-Side Source Connections.



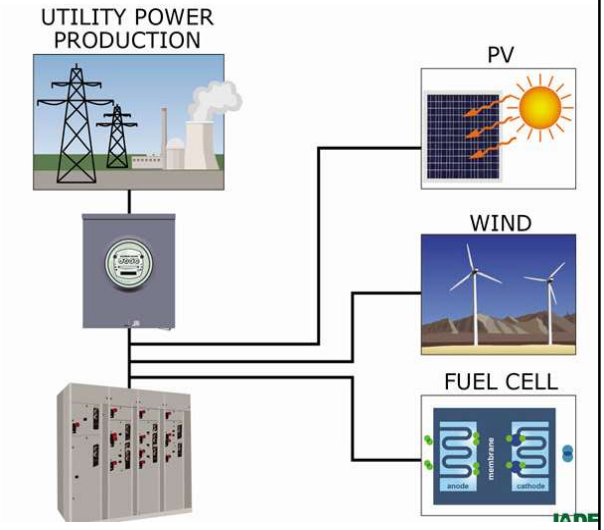
- This new section provides requirements on:

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

98

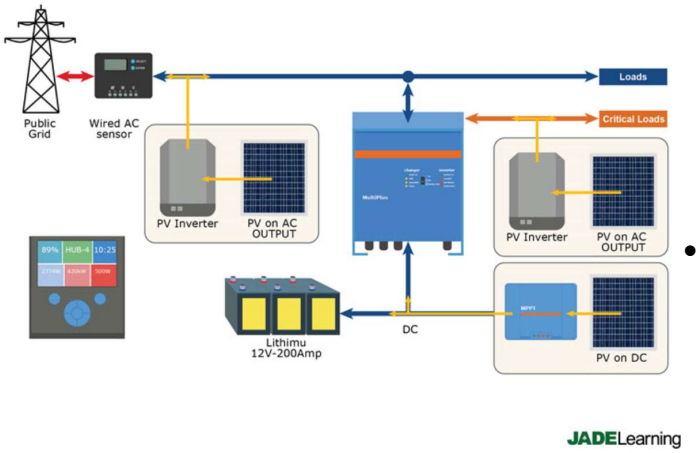
705.12 Interconnected Electric Power Production Sources. Load-Side Source Connections.

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



99

705.13 Interconnected Electric Power Production Sources. Power Control Systems.



- Section 705.13 is brand new and addresses interconnected power production sources using power control systems (PCS).
- This section includes requirements for monitoring, settings, and overcurrent protection for PCS.

100

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.

101

706.4, 706.7 Energy Storage Systems. System Requirements. Maintenance.

- New marking requirements are listed in Section 706.4 to verify the equipment is designed for the phase and frequency of the incoming power.
- Energy storage systems must be maintained in proper and safe operating conditions with a written record of repairs.

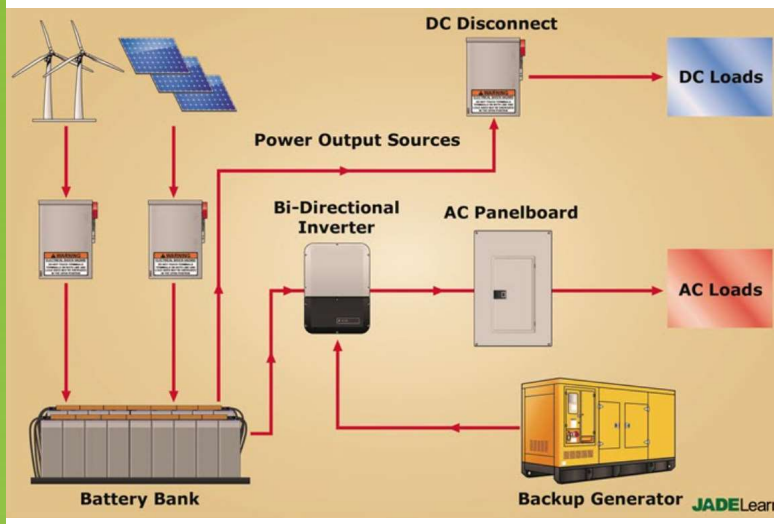
102

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

- Critical Operations Power Systems (COPS) supply power to essential parts of 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.

103

710.15 Stand-Alone Systems. General.

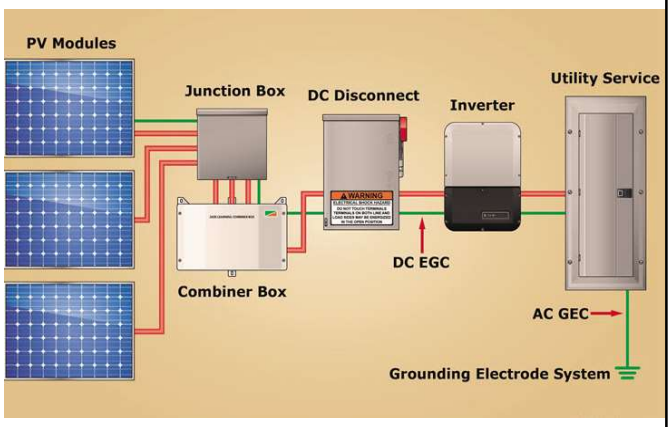


- Stand-alone systems may now power three-phase systems.
- Three-phase systems must be controlled or balanced with the sum of the power supply capacities.
- A new information note helps with calculations.

104

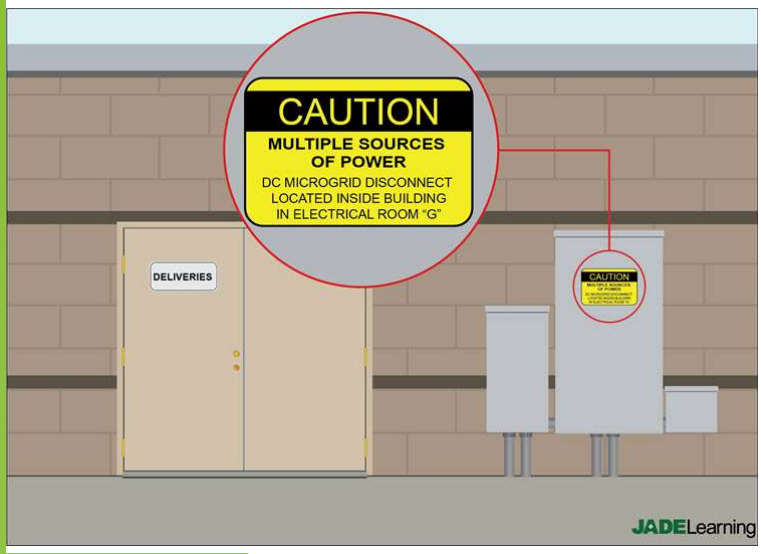
712.2 DC Microgrids. Definitions. Grounded, Functionally.

- **Grounded, Functionally** is not grounded solidly, but has an alternate means for grounding, like a resistor or inverter.
- **Grounded, Solidly** is connected to ground without inserting any resistor or impedance device.



105

712.10 DC Microgrids. Directory.

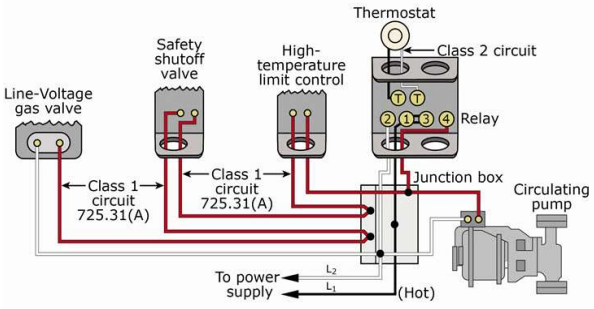


The 2020 NEC now requires that a permanent plaque or directory be installed outside the building at each service equipment (or approved readily visible location) when supplied by a dc microgrid system.

106

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.

- Electricians may still install Class 1 circuits in the same raceway with associated power-supply conductors.
- Electricians may now also install Class 1 circuits in raceways with other (unassociated) conductors types when separated by barriers.



107

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

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 4-pair balanced twisted pair cabling, see T1A-T5B-184-A, and 6, 4, 7, 6, 6, 3, and Annex G of ANSI/T1A-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.

108

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

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 4-pair balanced twisted pair cabling, see T1A-T5B-184-A, and 6, 4, 7, 6, 6, 3, and Annex G of ANS1/T1A-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.

- 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.

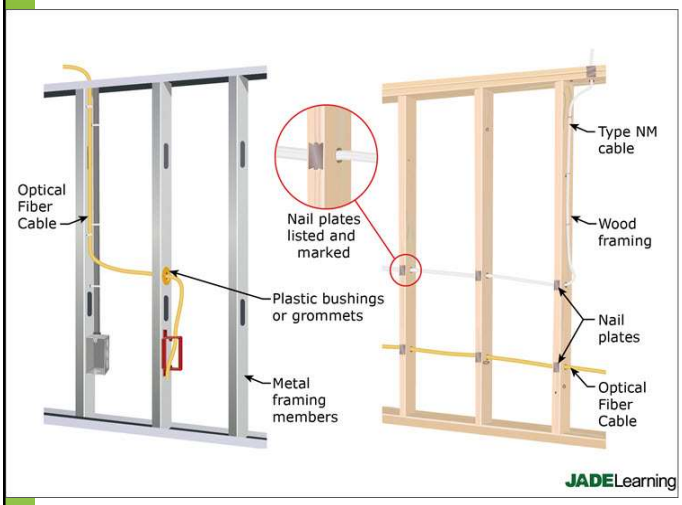
109

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

- 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.

110

770.24 Optical Fiber Cables. Mechanical Execution of Work.

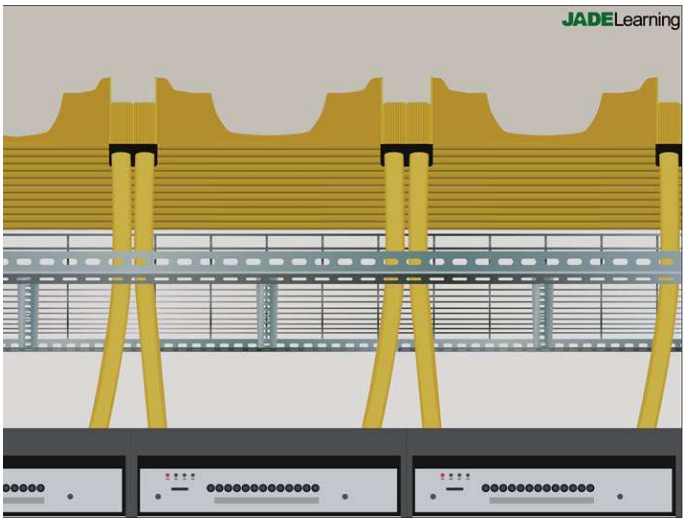


- All of Section 300.4 must now be followed.
- Optical fiber cables must now be protected against physical damage.
- Nonmetallic accessories (cable ties) in plenum spaces must be listed as having low smoke and heat release properties.

111

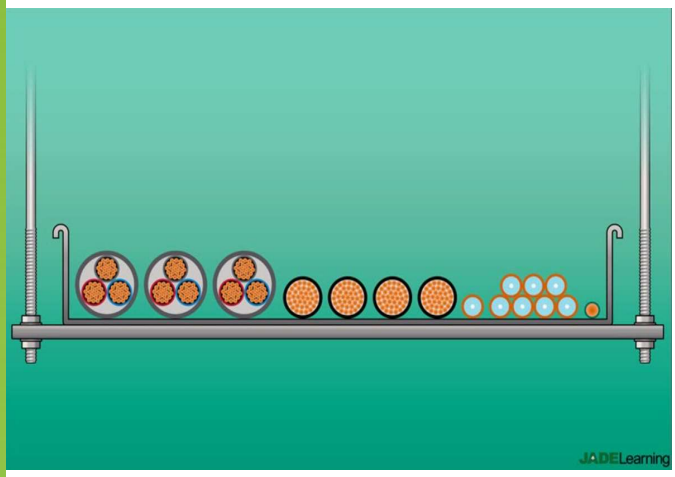
770.110(D) Optical Fiber Cables. Cable Trays.

- 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.



112

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.

113

2020 NEC Changes Chapter 8

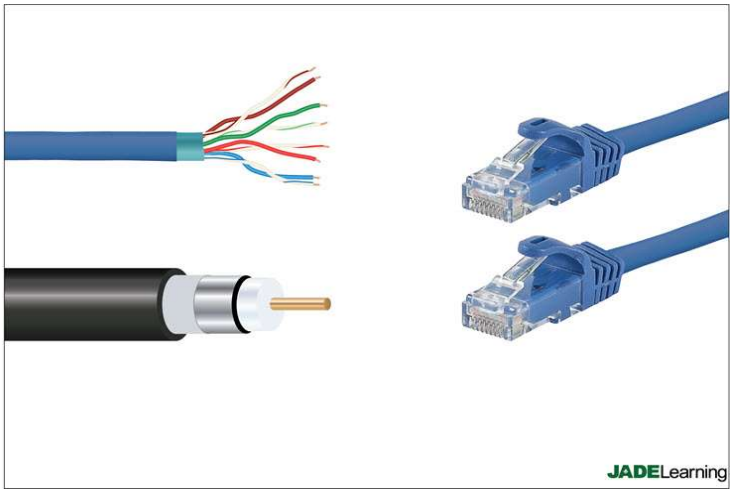
114

800.1, 800.2 General Requirements for Communications Systems.

- The 2020 NEC Code Making Panel (CMP) recognized that requirements were repeated at the beginning of several sections in Article 800.
- The repeated information was gathered together and provided at the beginning of Article 800 only.

115

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

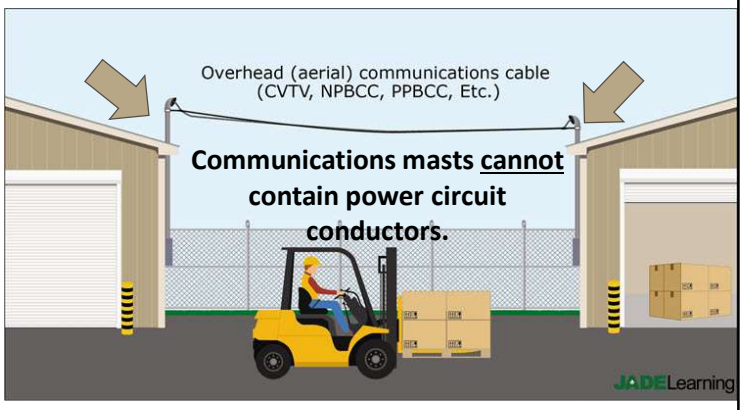


No wire or cable shall be used in such a manner that its operating temperature exceeds that of its rating.

116

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

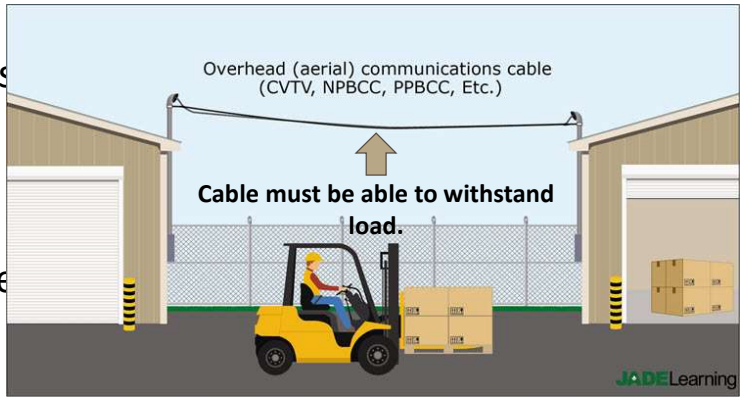
Overhead communications and CATV cables are permitted to be attached to an above-the-roof raceway that does not enclose or support electric light or power circuit conductors.



117

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

Communications cables extending between buildings or structures must be identified and have enough strength to withstand the loads to which they might be subjected or have a strong enough messenger cable.



118

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

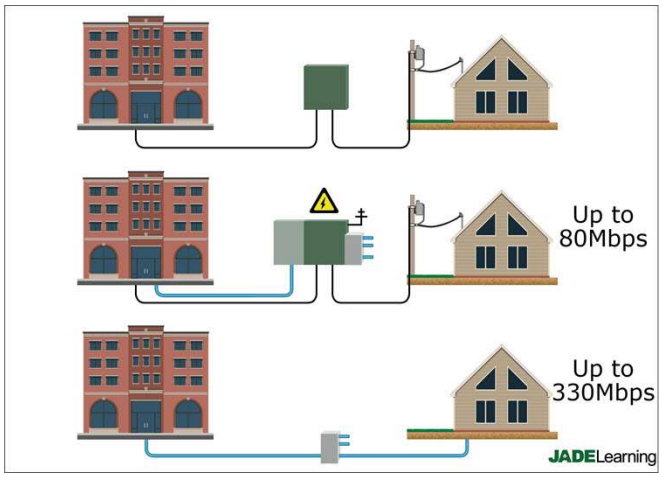
- Article 805 is new and provides general communication circuit requirements that were moved from Article 800.
- Section 805.179(D) provides new and specific permission allowing electricians to use limited-power cable in place of Class 2 and Class 3 cables.

119

840.2 Premises-Powered Broadband Communications Systems. Definitions.

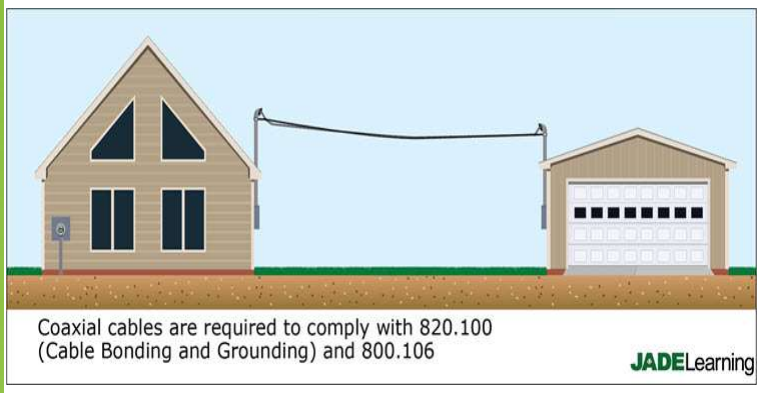
Two new definitions:

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.*



120

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



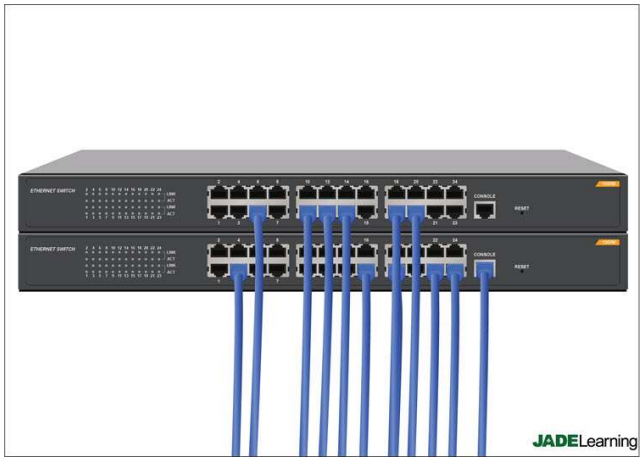
Section 840.94 is new and covers the protection of communications systems.

Section 840.102 is also new and covers the grounding methods of communications systems.

121

840.160 Premises-Powered Broadband Communications Systems. Powering Circuits.

- New text in the 2020 Code cycle identifies listing provisions for communications cables, powered communications equipment, and the power source.
- 4-pair communications cables are now referenced in this section.



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