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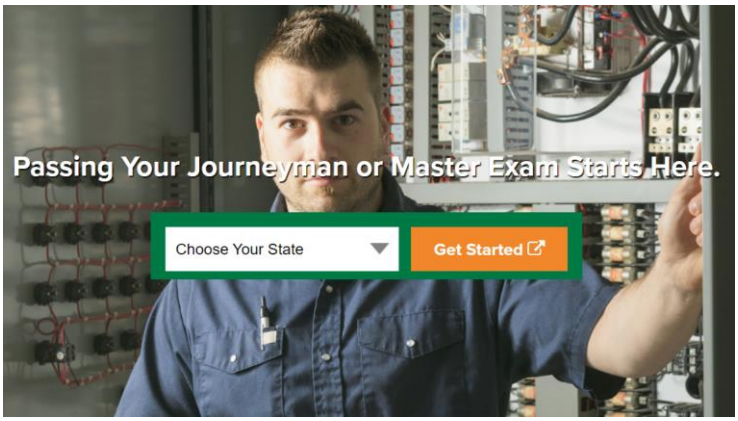

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2020 NEC Changes *www.jadelearning.com*

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Based on the NEC

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Welcome NC Electricians!

What Does North Carolina Require?

4 to 8 Hours of Continuing Education Required

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

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Important Reminders

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

Questions? Concerns?

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

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2020 NEC Changes Part 2

Important Changes From the 2020 NEC

12:40 PM– 12:55 PM	Registration / Check In / Intro
12:55 PM– 2:30 PM	NEC Chapter 4
2:30 PM – 2:40 PM	Break
2:40 PM – 3:30 PM	NEC Chapter 5
3:30 PM – 3:40 PM	Break
3:40 PM – 4:30 PM	NEC Chapter 6-7
4:30 PM —	Questions for instructor?
End of class	

2020 NEC Changes

NC AMENDMENTS

The new *2020 NC Electrical Code* does not apply to one-and two-family dwellings. The 2017 NC Electrical Code applies to one-and two-family dwellings.

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

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2020 NORTH CAROLINA STATE ELECTRICAL CODE

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

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

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

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WHERE TO APPLY NORTH CAROLINA ELECTRICAL CODE

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

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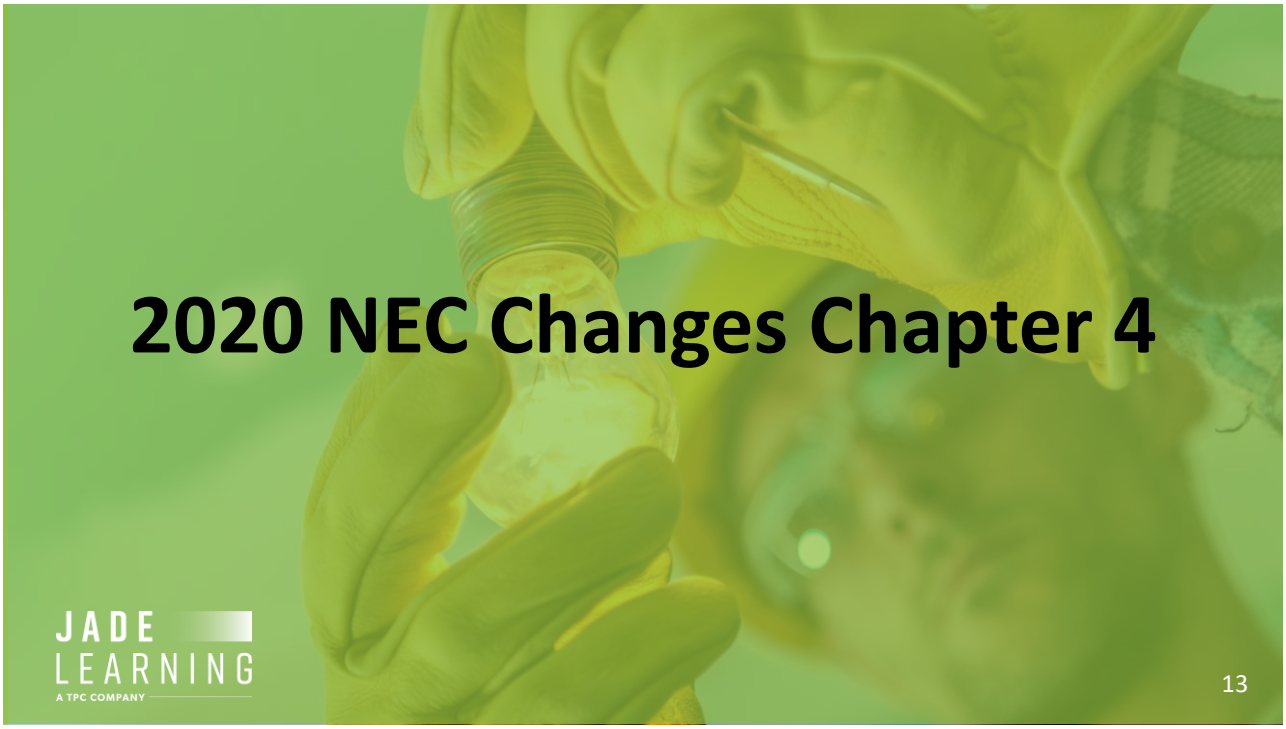

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What is CHAPTER-4 of the 2020 NEC?

Equipment for General Use

Chapter 4 covers *Equipment for General Use,* such as:

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

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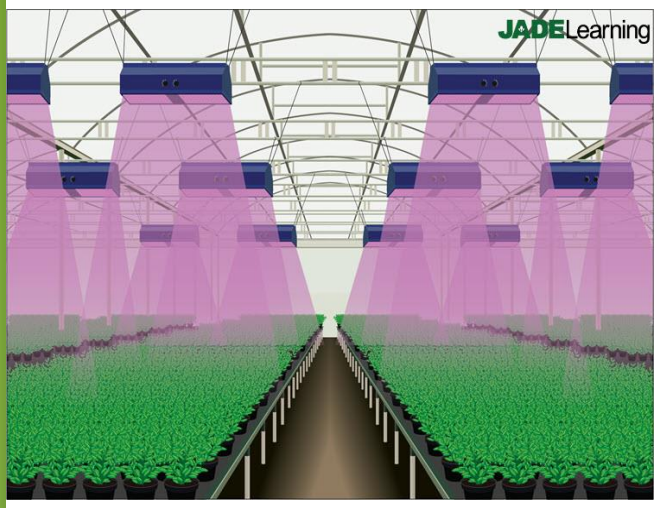
Let's Begin with

Luminaires

Important Changes in the 2020 NEC

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



NEW in the 2020 NEC-
Horticulture lighting equipment is now regulated by the NEC.

Hor·ti·cul·ture:
The art or practice of garden cultivation and management.
(e.g., greenhouses and nurseries.)

The new horticultural requirements address equipment listings (UL), installation, location, use of fittings & flexible cords, and GFCI protection.

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

(1 of 5)

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New in the 2020 NEC-

The phrase:

Closet Storage Space has been replaced with:

Clothes Closet Storage Space.

And North Carolina has amended the NEC definition!

- **NOTE: To view the locations in a clothes closet where lighting fixtures are permitted, refer to NEC Section 410.16.**

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

(2 of 5)

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Clothes Closet Storage Space Definition (2020 NEC)

410.2 Clothes Closet Storage Space. The volume bound by the sides and back closet walls and planes extending from the closet floor vertically to a height of 1.8 m (6 ft) or to the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 600 mm (24 in.) from the sides and back of the closet walls, respectively, and continuing vertically to the closet ceiling parallel to the walls at a horizontal distance of 300 mm (12 in.) or the width of the shelf, whichever is greater; for a closet that permits access to both sides of a hanging rod, this space includes the volume below the highest rod extending 300 mm (12 in.) on either side of the rod on a plane horizontal to the floor extending the entire length of the rod. See Figure 410.2.

410.2 and 410.16 Luminaires, Lampholders, and Lamps. Luminaires in Clothes Closets. *(3 of 5)*

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Cloth[illegible] Storage Space Definition (2020 NEC)

410.[illegible]ge Space. The volume bound by the sides and back closet wa[illegible] from the closet floor vertically to a height of 1.8 m (6 ft) or to th[illegible] rod and parallel to the walls at a horizontal distance of 600 m[illegible] and back of the closet walls, respectively, and continuing ve[illegible] parallel to the walls at a horizontal distance of 300 mm (12 in.), [illegible] whichever is greater; for a closet that permits access to [illegible] ing rod, this space includes the volume below the highest rod exten[illegible] m (12 in.) on either side of the rod on a plane horizontal to the floor extending the entire length of the rod. See Figure 410.2.

Amended by NC!

410.2 and 410.16 Luminaires, Lampholders, and Lamps. Luminaires in Clothes Closets. *(4 of 5)*

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NC AMENDMENT

NC AMENDMENT 410.2 declares an exception to the NEC definition for clothes closet storage space.

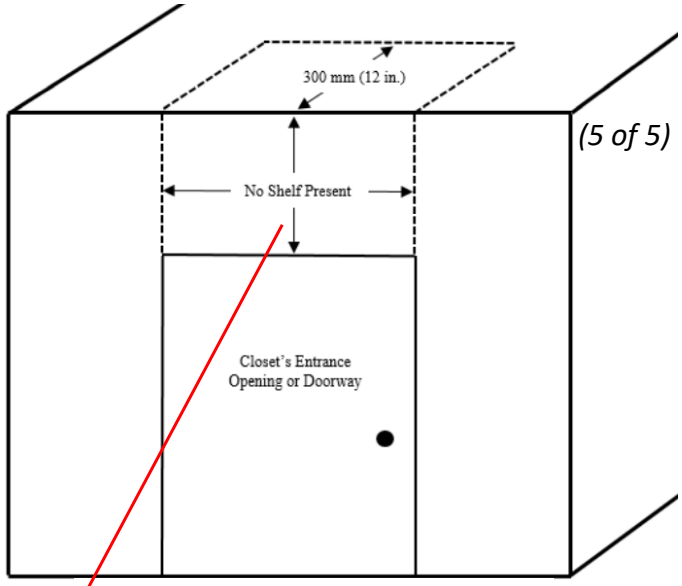
AMENDMENT 410.2. Definition: *Exception: Where a shelf is not present in the area of wall above the closet's entrance opening or doorway extending from the top of such opening or doorway vertically to the ceiling, including the area of ceiling extending perpendicular from the area of wall directly above the closet's entrance opening or doorway to a horizontal distance of 300 mm (12 in.), this shall not be defined as closet storage space. See Figure 410.2 Exception.*

NC AMENDMENT

NC AMENDMENT 410.2 declares an exception to the NEC definition for clothes closet storage space.

The amendment includes ***Figure 410.2 Exception*** to clarify the new amendment.

This is not considered clothes closet storage space when no shelf is present – per the Amendment.



(5 of 5)

Figure 410.2 Exception

410.7 Luminaires, Lampholders and Lamps. Reconditioned Equipment.

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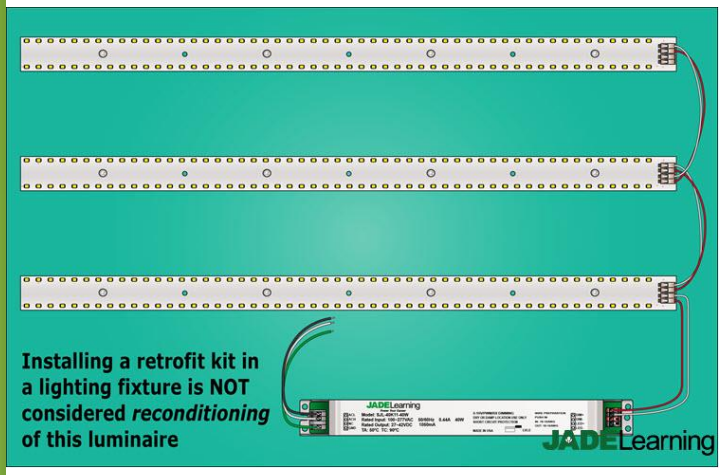

NEW in the 2020 NEC-

Section 410.7 is brand-new and states:

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

However, installing a retrofit kit to a luminaire in accordance with the kit instructions is **not** considered "reconditioning."

410.36(A) Luminaires Supported by Outlet Boxes.

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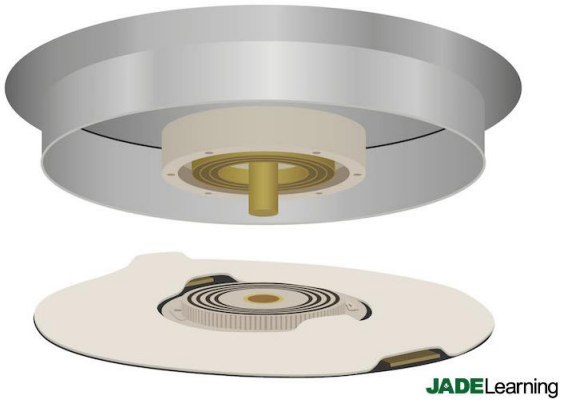
NEW in the 2020 NEC-

Section 410.36 has been revised in the 2020 NEC and states that a new quick-connect **locking support & mounting receptacle,** installed at an outlet box for the quick connection of a luminaire, is recognized as an approved lighting outlet and satisfies the lighting outlet requirements from NEC Section 210.70(A), (B), and (C).



410.44 Methods of Grounding. (Luminaires, Lampholders, and Lamps)

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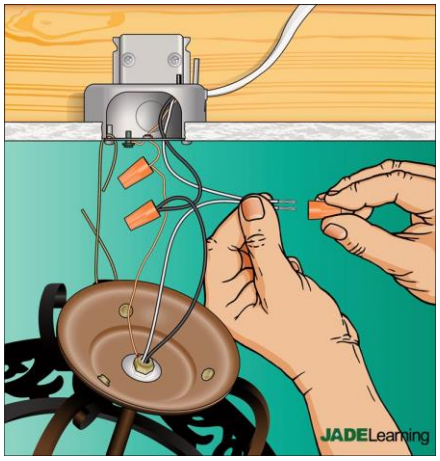
(1 of 2)

Section 410.44 in the NEC already required that luminaires and lampholders be mechanically connected to an equipment grounding conductor (EGC) sized according to 250.122 in compliance with 250.118.

But there existed exceptions to this preexisting requirement - and those exceptions have been revised for the new 2020 Code cycle.



410.44 Methods of Grounding.
(Luminaires, Lampholders, and Lamps)

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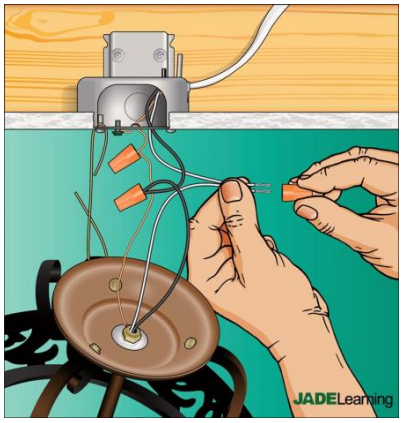
(2 of 2)

Exceptions to Section 410.44

Exc.(1) Deleted Entirely

Exc.(2) Replacement luminaires can connect to a required EGC in the same manner that a replacement receptacle is permitted to connect to a required EGC, as per NEC 250.130(C) and 410.42.

Exc.(3) If no EGC exists, luminaires that are GFCI protected, (and luminaires that contain no exposed conductive parts *[new for 2020]*) will not require an EGC.



410.69 Luminaires and Lamps. Identification of Control Conductor Insulation.

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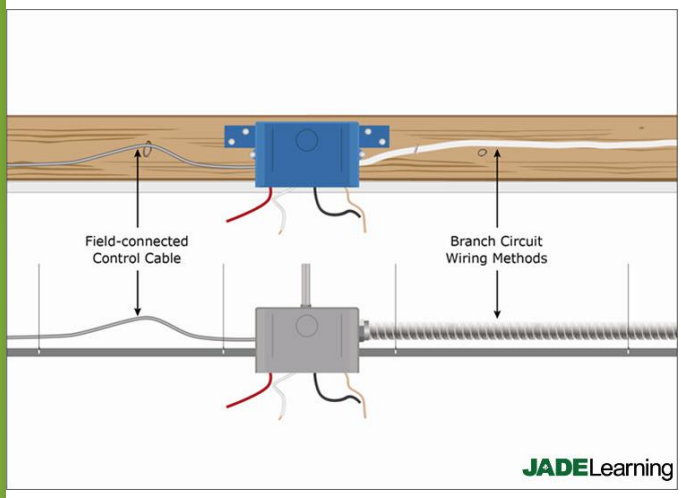

NEW in the 2020 NEC-

Field-installed control wiring inside the same enclosure as branch-circuit conductors must now have an insulation color other than colors reserved by the NEC for grounded or neutral conductors (white or gray) and equipment grounding conductors (green or green w/yellow stripes).

410.118 Luminaire Access to Other Boxes.

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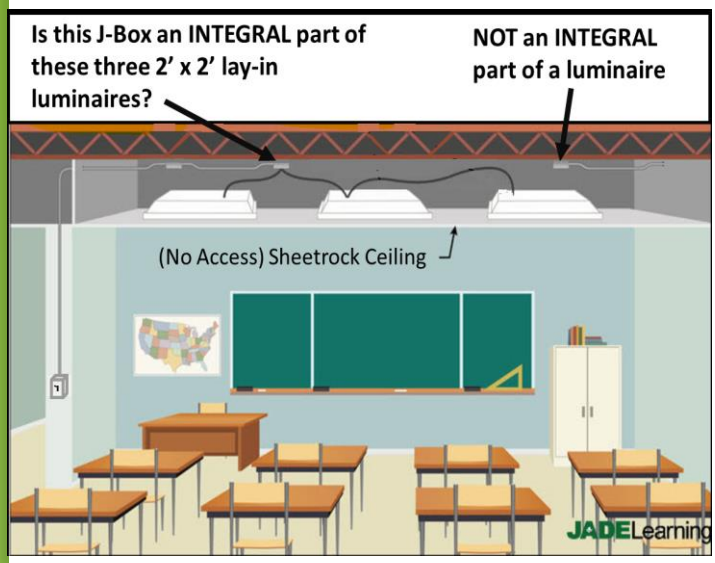

NEW in the 2020 NEC-
Recessed luminaires are now prohibited from serving as access points to outlet boxes, pull boxes, junction boxes or conduit bodies unless they are an **integral** part of the luminaire.

in·te·gral
/ˈin(t)əgrəl, inˈtegrəl/
adjective
1. Necessary to make a whole complete; essential or fundamental.

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Appliances & Motors

Important Changes in the 2020 NEC

422.5(A) GFCI Protection for Personnel.

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NEW in the 2020 NEC-

- In the 2017 NEC, Section 422.5(A) required GFCI protection for single- and 3-phase equipment & appliances rated 60-amps or less, 250-volts or less. In the 2020 NEC, the equipment rating has changed to *150-volts or less to ground.*
- Dishwashers have been moved to this Code section—from 210.8.
- Sump pumps have also been added to this Code section.

422.16(B) Specific Appliances.

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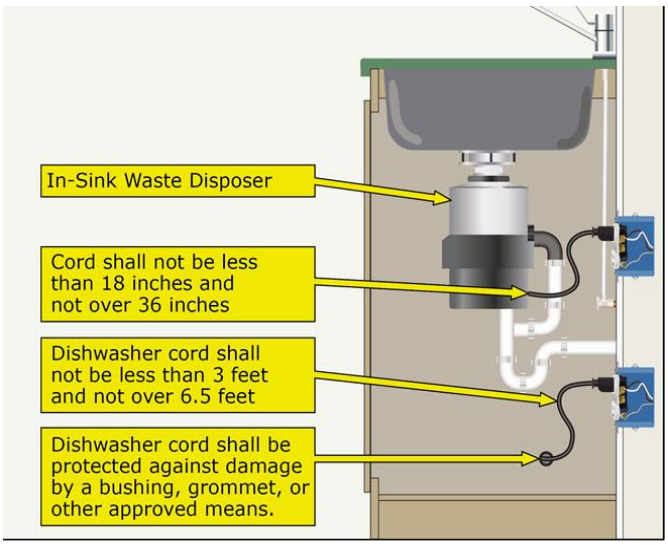

NEW in the 2020 NEC-

The 2017 NEC said flexible cords shall terminate with a grounding-type plug-end. But the 2020 NEC says flexible cords shall have an equipment grounding conductor **AND** terminate with a grounding-type plug-end.

Also *NEW-*

Dishwasher and trash compactor cords passing through a hole must now be protected by a bushing!

430.2 Definitions. Electronically Protected.

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NEW in the 2020 NEC-

The 2020 NEC now includes a definition for <u>electronically protected</u> as it applies 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, overload, and failure to start.

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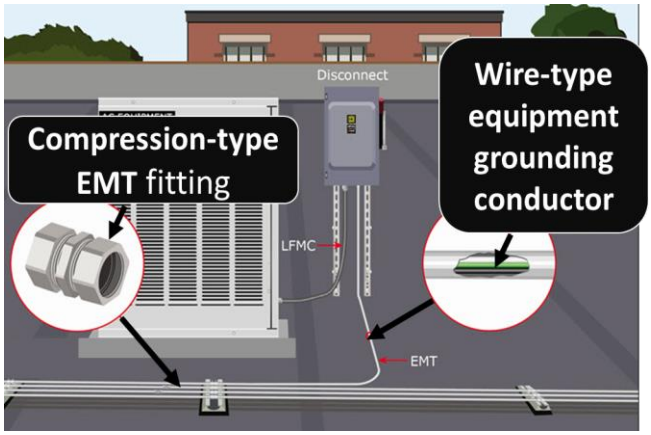
Heating AC and Refrigeration, Generators, Transformers, & Storage Batteries

Important Changes in the 2020 NEC

440.9 Air Conditioning and Refrigeration Equipment. Grounding & Bonding.

NEW in the 2020 NEC-

- The phrase "non-threaded fittings" has been replaced with "compression-type fittings" since compression fittings technically have threads.
- Also, a **wire-type** equipment grounding conductor must now be installed in metal raceway serving rooftop HACR equipment, when raceways have **compression-type fittings.**



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

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Section 445.18(D) is new in the 2020 NEC, and it 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.

450.9 Transformers. Ventilation.

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NEW in the 2020 NEC-

Section 450.9 States:

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

These new markings are to prevent storage on top of flat-topped transformers. Transformers get hot and often require ventilation near the top of the unit.

2020 NEC Changes

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

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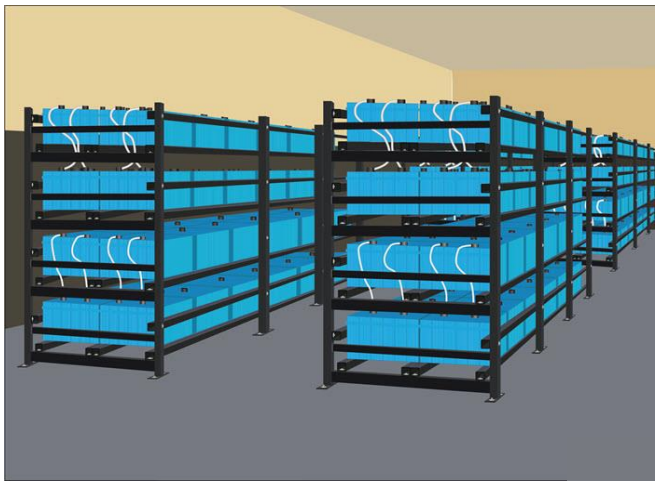
NEW in the 2020 NEC-

- Battery systems over 1000 volts must now follow the more stringent working space requirements from Section 110.34. (This is new for the 2020 NEC)
- Battery systems rated 1000 volts or less must still adhere to the working space requirements outlined in Section 110.26.



2020 NEC Changes *www.jadelearning.com* 36

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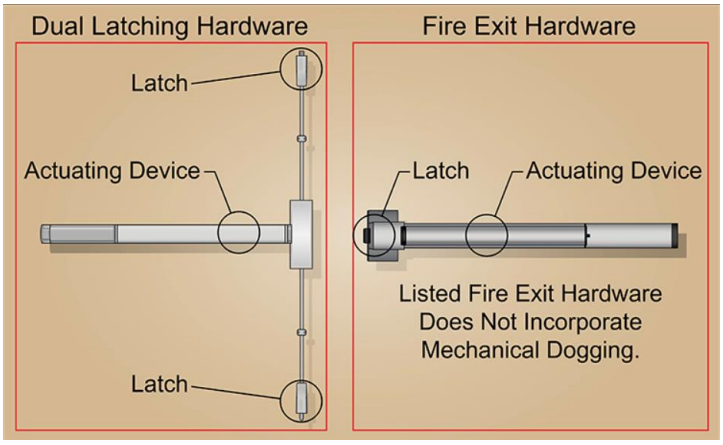
480.10(E) Storage Batteries. Battery Locations. Egress.



NEW in the 2020 NEC-

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

1. Listed panic hardware
2. Listed fire exit hardware (New for the 2020 NEC)

10 Minute Break

Electrician Talk:

Grounding vs. Grounded Conductors.

When the NEC says Grounding Conductor or Equipment Grounding Conductor, they mean the green or bare conductor.

When the NEC says Grounded Conductor, they mean the white or gray conductor.

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2020 NEC Changes Chapter 5

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Chapter 5 is all about *Special Occupancies*

Chapter 5 is where we find:

- Hazardous (Classified) Locations—Class I, II, and III
- Classes are then divided into two distinct divisions, Division-1 and Division-2
- Zones and their relationship to Classes

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HAZARDOUS LOCATIONS: CLASSES and DIVISIONS

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WHAT ARE CLASSES?

Class I: Areas containing flammable or explosive gases and vapors.
Class II: Areas containing combustible dust particles, such as a furniture manufacturing plant where sawdust is suspended in the air due to the cutting and sanding of large volumes of wood.
Class III: Areas containing larger fragments of easily ignitable fibers or flyings, such as a sawmill where ignitable wood chips and pieces of wood are present.

More than one "Class" can be assigned to a hazardous location; for example, a sawmill may be a combination of Class II and Class III environments since both combustible dust particles (Class II) and larger fragments (Class III) may be present.

HAZARDOUS LOCATIONS: CLASSES and DIVISIONS

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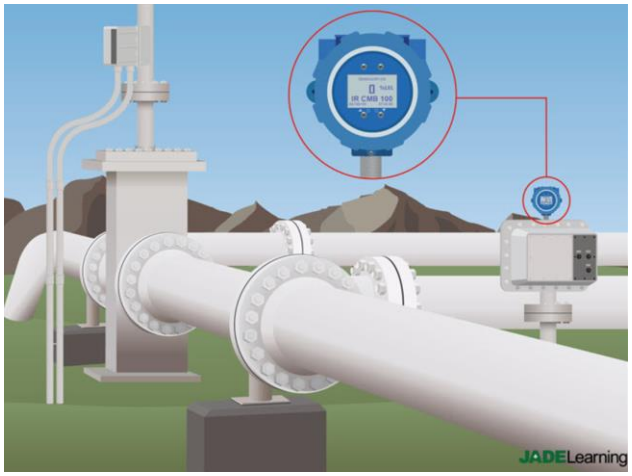
WHAT ARE DIVISIONS?

Division 1: The material is present during normal operation, such as the volatile fumes surrounding a gasoline pump.
Division 2: The material is present only during an accident, such as the rupture of a container containing flammable liquids.
By determining the class and division of a hazardous location, electricians can decide on the right materials and installation procedures for the area.
In hazardous locations it is necessary to implement protection techniques to prevent normally arcing electrical equipment (think switches and motors) from igniting combustible substances in the air.

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

NEW in the 2020 NEC-
Added to a list of already approved protection techniques for electrical equipment installed in hazardous locations, four new protection techniques have been introduced in the 2020 Code cycle:

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



500.7(O) Hazardous Locations. Protection Techniques.

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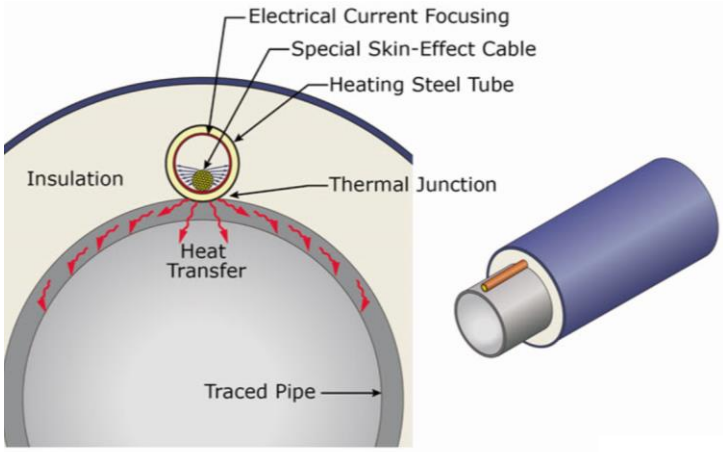

Here is an illustration of one of the newly approved protection techniques: *Skin Effect Trace Heating.* It is approved in these hazardous locations:

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

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

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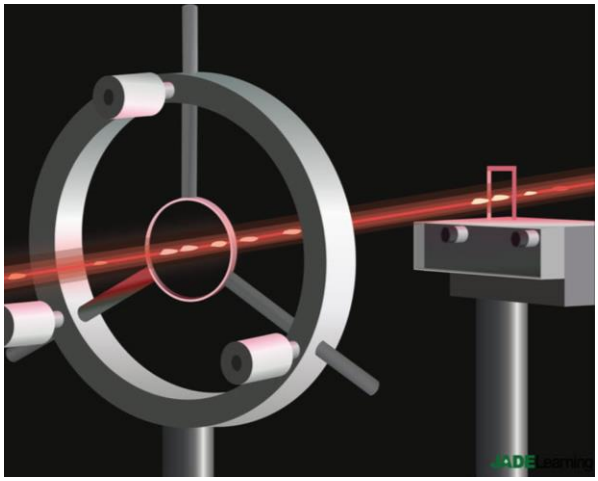
Section 500.8(G) is also new to the 2020 NEC - it provides guidelines for optical radiation equipment inside hazardous locations.



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

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Code Section 500.8(G) states:

- For equipment that includes optical radiation such as lasers or LED sources, when the wavelength range is from 380 nm to 10,000 nm, the risk of ignition from optical radiation shall be considered dangerous for all electrical parts and circuits exposed to the radiation.

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

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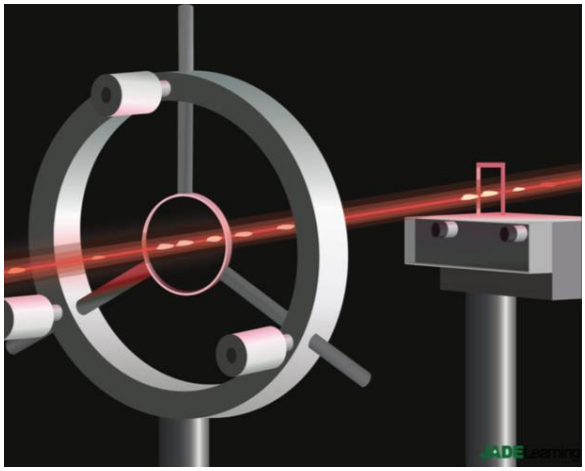
Since all sources of light (including LED lighting) produces optical radiation, are we required to evaluate and regulate all lighting near a hazardous location?
NO!

500.8(G) EXCEPTION. All luminaires (fixed, portable, transportable, etc.) including LEDs, are exempt from this requirement.



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

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Type TC-ER-HL Cable

Type P Cable

Flexible connections are necessary in Class I, Division 1 locations to limit the risk of combustion associated with vibrating motors. Vibration can cause metal conduits to loosen and emit sparks during vibration.

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

Type TC-ER-HL Cable

Type P Cable

Flexible cables newly approved to reduce vibration in the 2020 Code cycle:

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

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

NEW in the 2020 NEC-

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.

NEW in the 2020 NEC-

Section 503.10(A) now requires EGCs for Class III approved cables even when a drain (shield) wire is present. (Why?)

Because a drain wire cannot serve as an EGC; it is not connected at both ends (nor is it sized correctly).

503.10(A) now requires EGCs for these Class III cables:

1. PLTC and PLTC-ER
2. ITC and ITC-ER,
3. MV, TC, or TC-ER cables.

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

Zones

vs.

Classes & Divisions

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

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Section 505.9(C) in the 2020 NEC addresses the rules for marking electrical equipment installed in hazardous **ZONES.**

Zones are not (exactly) the same as *Classes* and *Divisions*.

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

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Understanding Zones:

- Zone 0 location has flammable gases or vapors continuously present.
- Zone 1 location is where flammable gases or vapors are likely to exist.
- Zone 2 location is where flammable gases or vapors are possible, but unlikely.

Assigning a “Zone” to a location is like assigning both a Class and Division to that location, rolled into one!

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 markings in the NEC.
- Zone 0, 1, and 2 locations contain flammable gas, vapors, or liquids.
- Therefore, if a location is a Zone 0, 1, or 2 —it is a Class I location by default!

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

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So, what's new with ZONES in the 2020 NEC?

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

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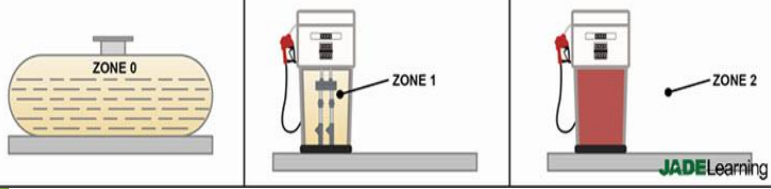
ZONE - NATURE AND PROBABILITY OF HAZARD MATERIAL		
ZONE 0 Ignitable concentrations of flammable gases or vapors which are present continuously or for long periods of time.	**ZONE 1** Ignitable concentrations of flammable gases or vapors which are likely to occur under normal operating conditions.	**ZONE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



What's new in 2020 NEC?

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 from some NEC text****, except for text that is extracted from other documents or to remain consistent (with other text) throughout this article.*

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Commercial Garages, Hangars, and Fuel Dispensing Facilities

Important Changes in the 2020 NEC

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

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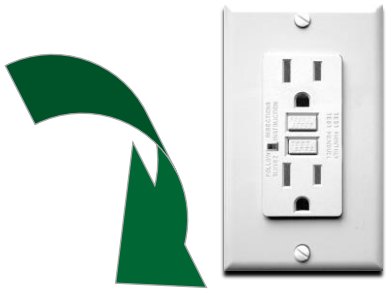
NEW in the 2020 NEC-

Section 511.12 (addressing commercial garages) now sends us to Section 210.8(B)(8) for GFCI protection requirements.



Section 210.8(B)(8) requires GFCI protection for *other than dwelling units,* in garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls.

513.3(D) Aircraft Hangars. Classification of Locations.

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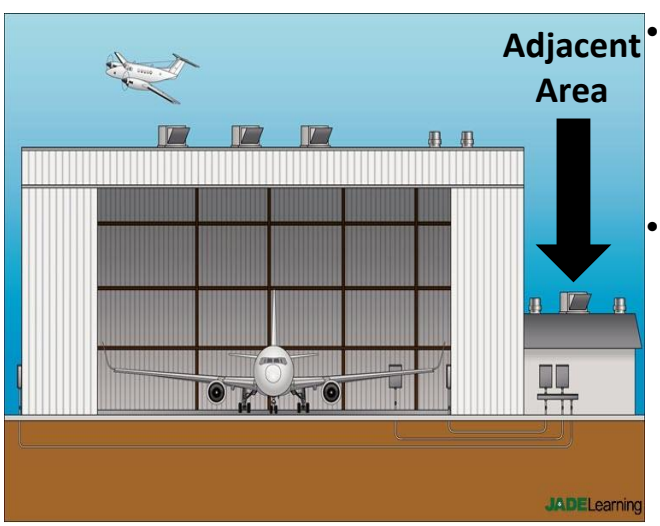

- **2017 NEC:** Said an area adjacent to hangars can be declassified if the area is cut off **AND** adequately ventilated.
- **2020 NEC:** Says an area can be declassified if cutoff **OR** adequately ventilated. And 2020 NEC clarifies "adequately ventilated" as *mechanically ventilated at a rate of four or more air changes per hour, or designed with positive air pressure.*

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

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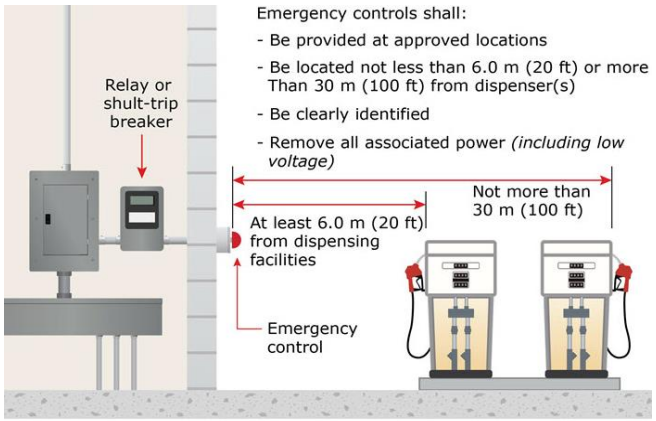
NEW in the 2020 NEC-

At *Motor Fuel Dispensing Facilities,* all ungrounded & grounded conductors must simultaneously disconnect when the emergency disconnect is activated.

- The conductors must disconnect from the source of supply.
- Equipment grounding conductors, however, must remain connected!



Applies to both Attended and Unattended motor fuel dispensing facilities

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Health Care Facilities, Assembly Occupancies, & Carnivals

Important Changes in the 2020 NEC

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

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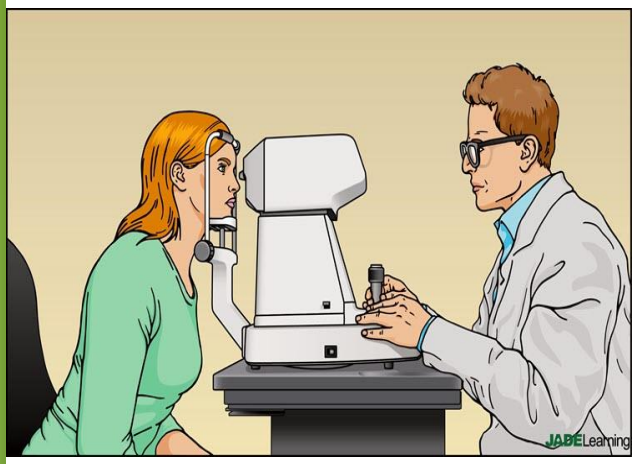

NEW in the 2020 NEC-

Four new patient care spaces were added to this Code section that are **not** required to adhere to strict NEC Article 517 Part II wiring methods:

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

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

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NEW in the 2020 NEC-

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 available to the authority having jurisdiction (AHJ).

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

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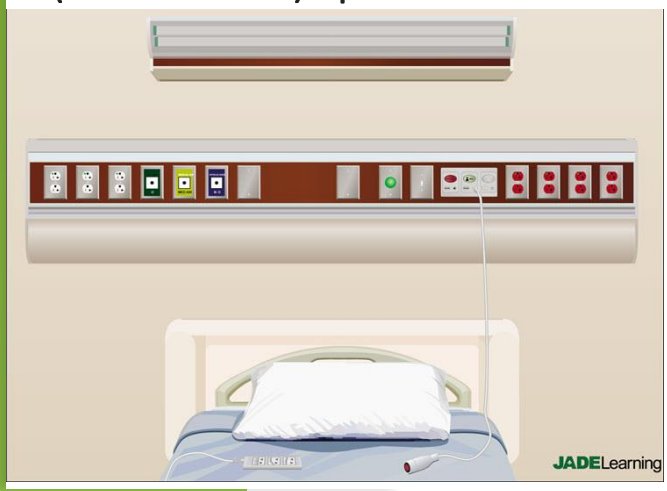

NEW in the 2020 NEC-

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 that contain receptacles in Category 1 & 2 Health Care facility spaces are **not** exempt from the normal GFCI requirements.

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

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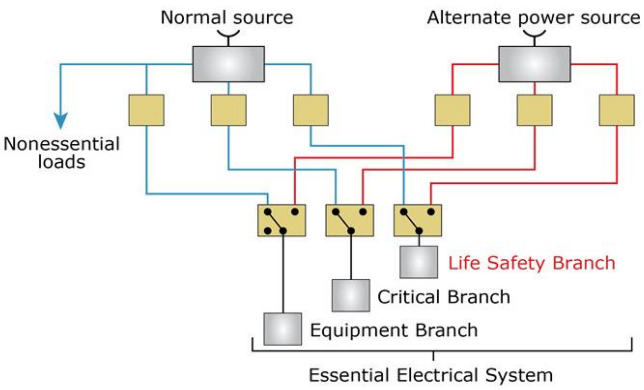
NEW in the 2020 NEC-

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.



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

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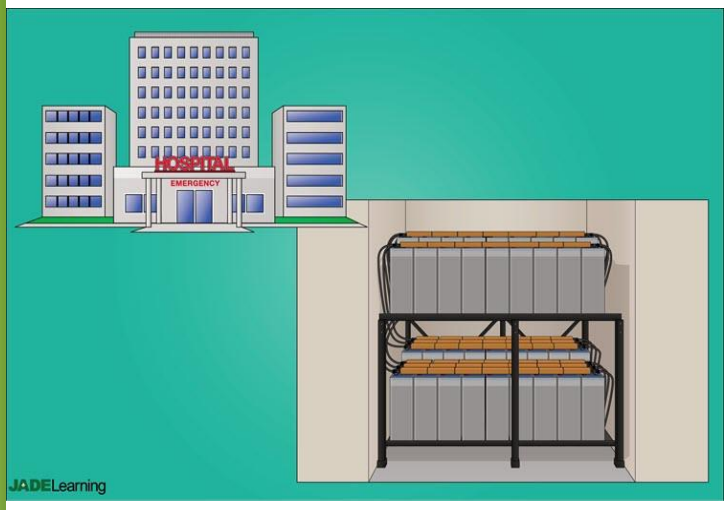

Section 517.30(B)(3) is new for the 2020 Code cycle and offers a new alternate power source for essential electrical systems (EES) serving a health care facility:

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

67

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

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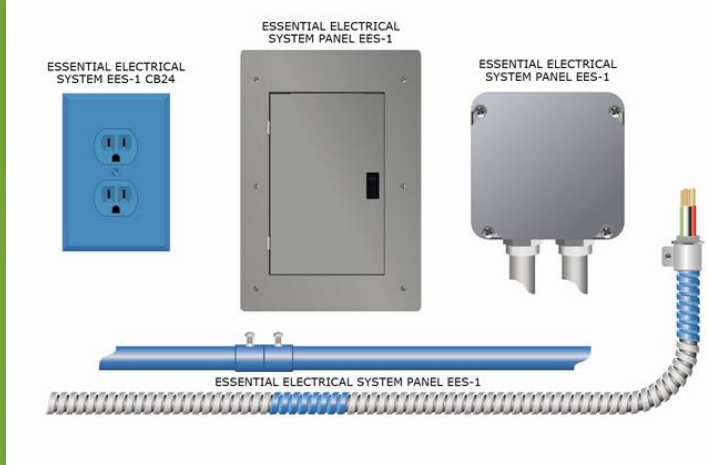

NEW in the 2020 NEC-

Section 517.31(C)(1)(b) now declares that conductors of EES life safety and critical branch circuits must be **separate and identified** from other wiring systems.

NOTE: Life safety and critical branch circuits in *Essential Electrical Systems (EES)* are too important to be confused with other circuits!

68

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

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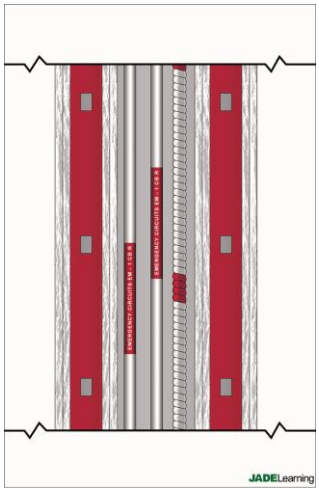
NEW in the 2020 NEC-

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).**



518.6 Assembly Occupancies. Illumination.

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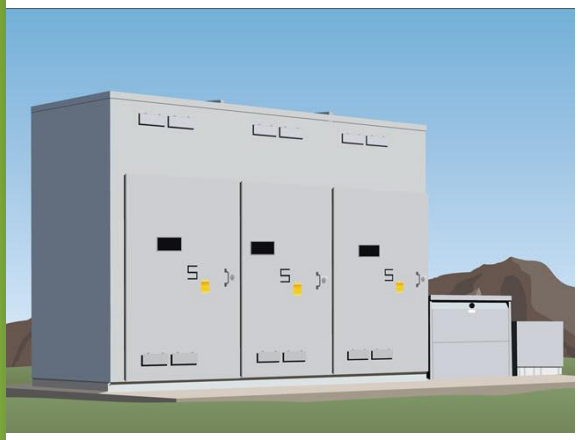

NEW in the 2020 NEC-

Workspace surrounding outdoor service equipment at *Assembly Occupancies* must be provided illumination:

- The control for the lighting cannot be **only** by automatic means.
- The illumination is not required if illumination is present from other adjacent light source(s).

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

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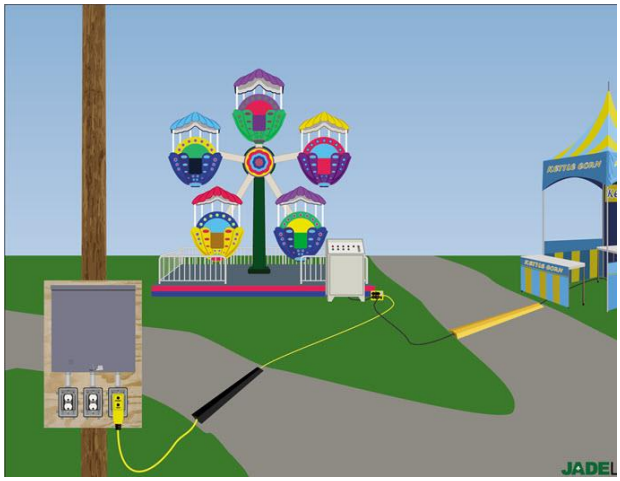
Flexible power cables used at traveling fairs and carnivals are approved to be buried at any depth to prevent a tripping hazard.

New in the 2020 NEC-

Instead of buried, the cables may be covered with a nonconductive matting <u>BUT THE MATTING MUST BE SECURED TO THE WALKWAY TO PREVENT REMOVAL.</u>

This is New!



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Manufactured Buildings, Barns, Mobile Homes & RVs

Important Changes in the 2020 NEC

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

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NEW in the 2020 NEC-

Part II Relocatable Structures is new and it is located in Article 545 of the 2020 NEC.

- **New Section 545.24 helps to distinguish between the requirements for mobile homes versus other portable buildings.**

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

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NEW in the 2020 NEC-

At agricultural buildings, GFCI protection is **not** required for receptacles rated more than 125-volts, 15- and 20-amps in the following areas:

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

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

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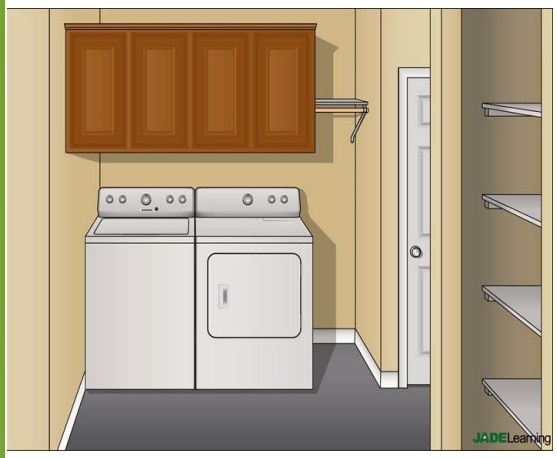

NEW in the 2020 NEC-

Mobile & manufactured homes now require GFCI protection according to Section 210.8(A) —just like stick-built homes!

Now these mobile & manufactured home locations require GFCI protection:

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

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

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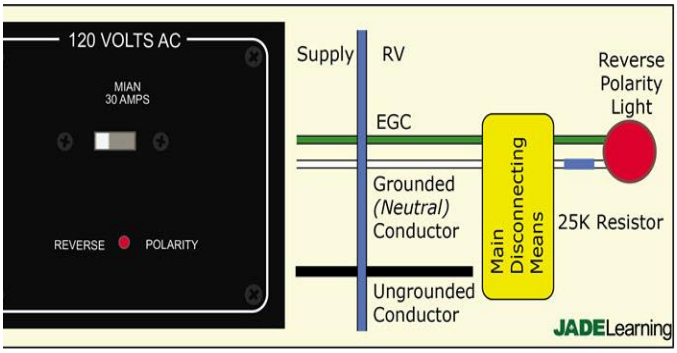
The 2020 NEC now requires new recreational vehicles (RV) to have a device to provide a continuous audible or visible signal when the RV is connected to power in reverse polarity. (Why?)



- **When polarity is reversed due to incorrectly wired RV pedestals or similar, any exposed metal in the RV in contact with the normally grounded side of the electrical system could become energized!**

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

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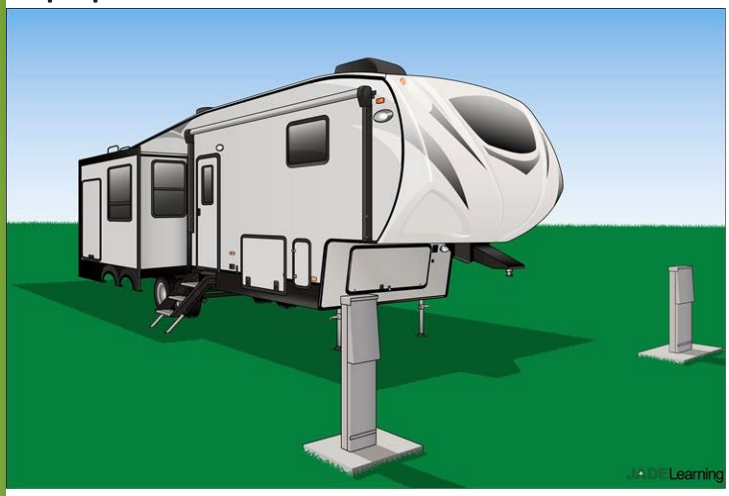

NEW in the 2020 NEC-

Section 551.72(F) is new and 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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Electrical Installations Near the Water

Important Changes in the 2020 NEC

555. Marinas, Boatyards, Floating Buildings and Commercial and Noncommercial Docking Facilities.

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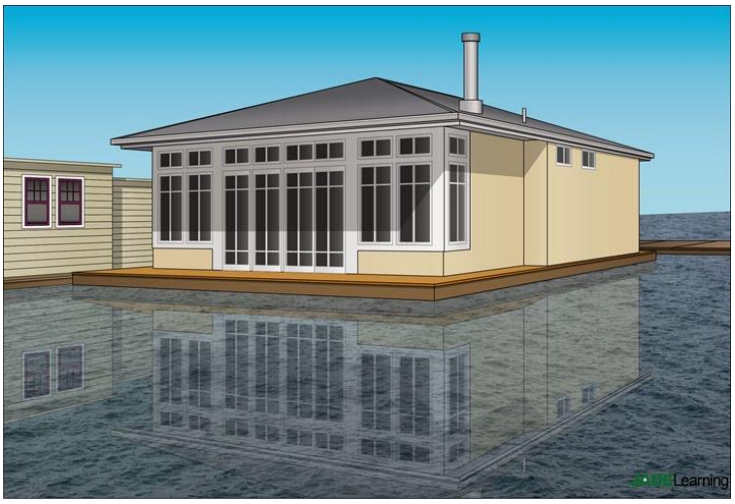
NEW in the 2020 NEC-

Article 553 covering *Floating Buildings* has been deleted.

The rules for floating buildings moved to Part III of Article 555

A floating building is not considered a watercraft but it shares many of the same safety requirements covered in Article *555. Marinas, Boatyards, etc.*



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

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NEW in the 2020 NEC-

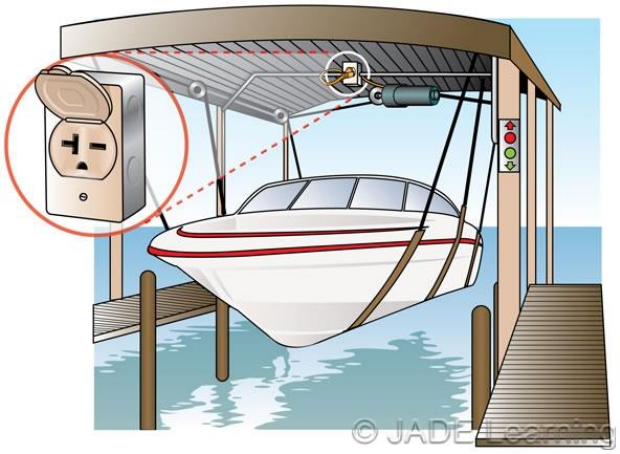
Section 555.2 is the new home for 14 terms and definitions used in Article 555 addressing marinas, boatyards, and other water-based structures.

In the 2017 NEC, only TWO definitions were included!

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

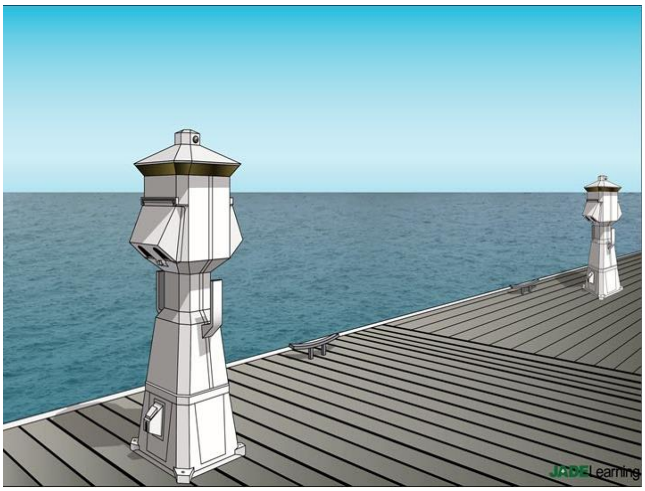
NEW in the 2020 NEC-

- The requirement to GFCI protect an outlet for a boat hoist at a residential boat dock was moved from Section 210.8(C) to Section 555.9.
- The rules haven't changed:
  GFCI protection is still required for outlets up to 240 volts supplying boat hoists at dwelling unit boat docks.



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

(1 of 6)



The 2020 NEC includes revised ground-fault protection requirements for boat docks!

In the 2020 NEC-

For other than floating buildings, ground-fault protection for personnel and equipment must be provided to docking facilities according to **555.35(A)(1)-(A)(3).**

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

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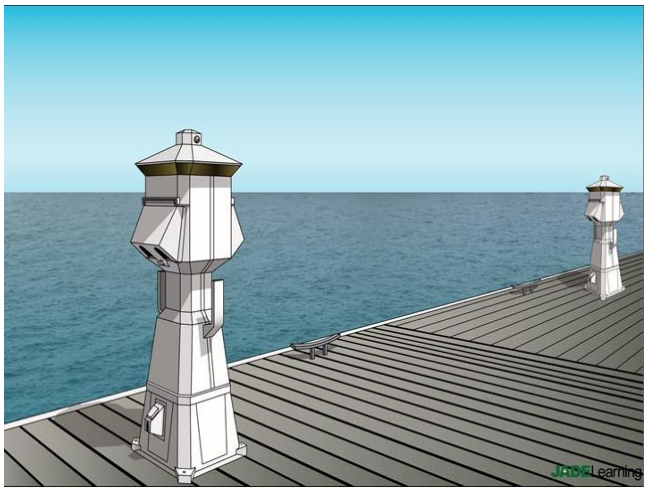
(2 of 6)



In the 2020 NEC-

(A)(1) Receptacles providing shore power for docking facilities must be protected by ground-fault protection equipment (GFPE) set to open at 30 mA or less.

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

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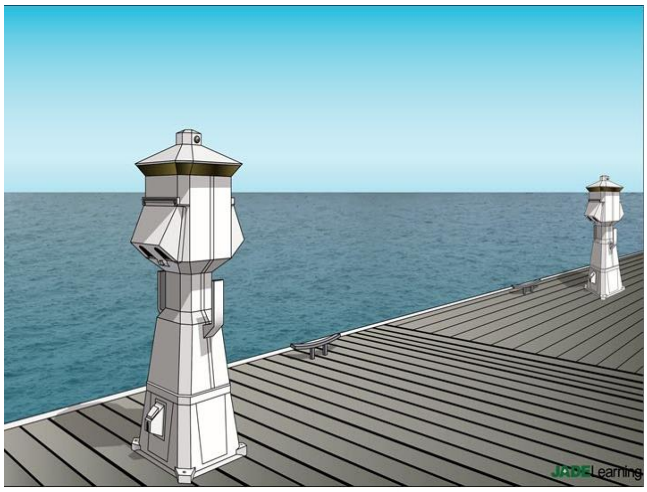
(3 of 6)



In the 2020 NEC-

(A)(2) All 125-volt, 15- and 20-amp receptacles at docking facilities for other than shore power must be provided ground-fault (GFCI) protection for personnel designed to trip at 4 to 6 mA.

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

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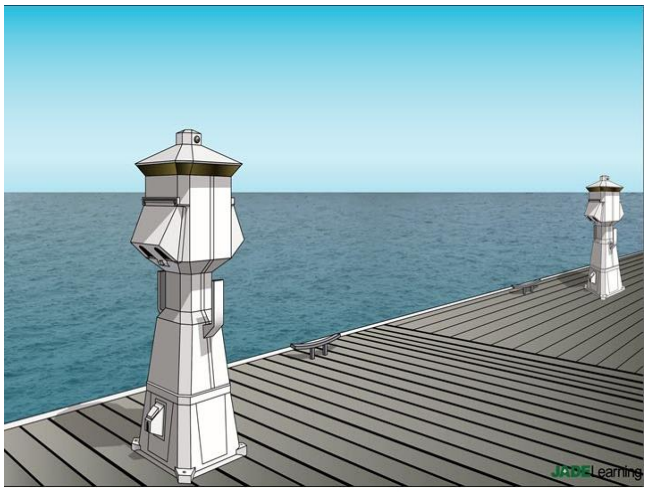
(4 of 6)



In the 2020 NEC-

(A)(3) Feeder and branch-circuit conductors that are installed on docking facilities shall be provided with GFPE set to open at currents not exceeding 100 milliamperes. Coordination with downstream GFPE shall be permitted at the feeder overcurrent device.

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

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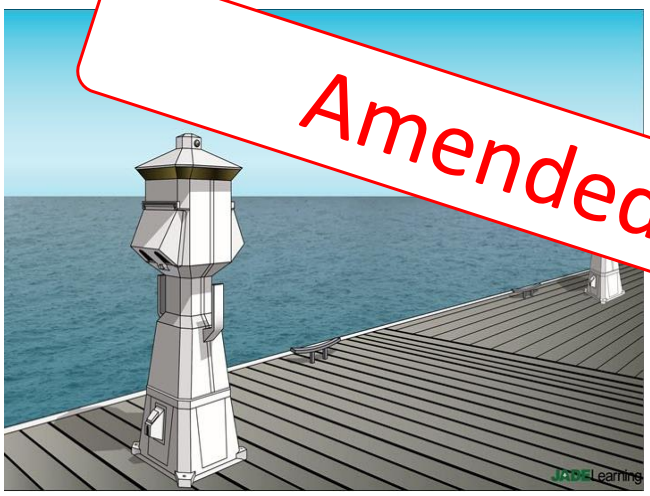
(5 of 6)



Amended by NC!

In the 2020 NEC-

(A)(3) Feeder and branch-circuit [illegible]ors that are installed on [illegible]hall be provided [illegible]urrents not exce[illegible] Coordination with [illegible] GFPE shall be permitted at the fee[illegible]r overcurrent device.

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

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(6 of 6)

NC AMENDMENT

NC AMENDMENT 555.35(A)(3) reduces the required trip setting for branch circuits at docking facilities.

3) Feeder and Branch Circuit Conductors with GFPE.

AMENDMENT 555.35(A)(3): ***Feeder and branch-circuit conductors that are installed on docking facilities shall be provided with GFPE set to open at currents not exceeding 100 milliamperes <u>for feeders and 30 milliamperes for branch circuits</u>. Coordination with downstream GFPE shall be permitted at the feeder overcurrent device.***

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Temporary Power

Important Changes in the 2020 NEC

590.8 Temporary Installations. Overcurrent Protective Devices.

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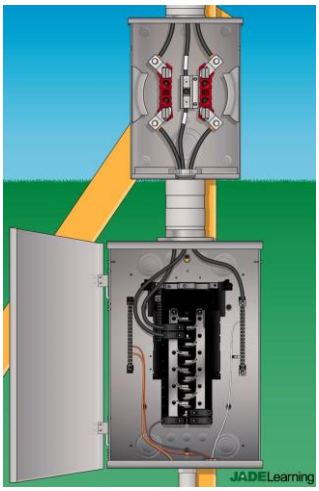
NEW in the 2020 NEC-

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



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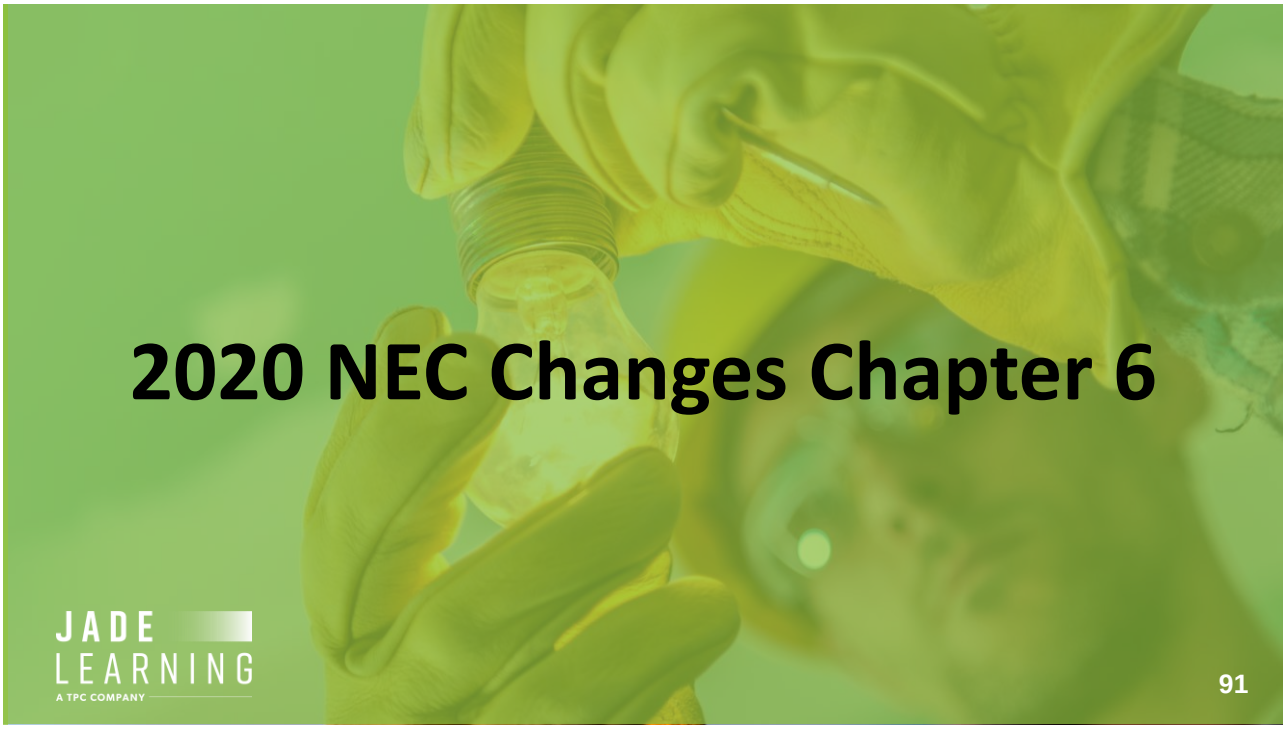
10 Minute Break

Electrician Talk:

Dimmer Switches Don't Fit?

Dimmer switches are often fitted with breakaway tabs on each side that serve as HEAT SINKS. Removing these tabs to make one switch fit beside another in a 2-gang box reduces the ampacity of the switch. If it can't dissipate heat through the metal tabs, it can overheat and prematurely fail.

JADE Learning



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What is Chapter 6 of the 2020 NEC?

Special Equipment

Chapter 6 covers *Special Equipment* requirements such as:

- Electric signs and outline lighting
- Manufactured wiring systems and office furnishings with electric
- Elevators
- Electric Vehicles (EV)
- Electric welders
- Modular Data Centers
- Swimming pools
- Wind energy
- Fire pumps

92

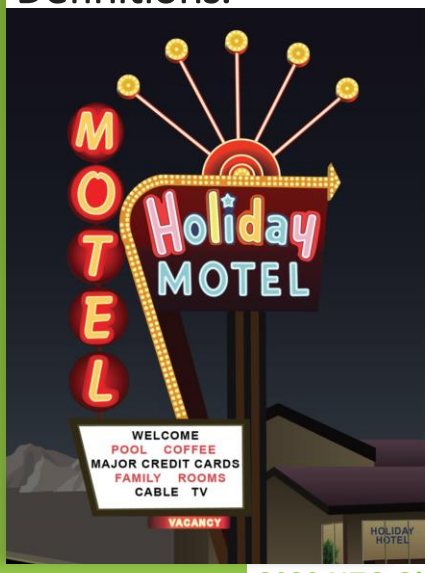
Let's Begin with

Signs

Important Changes in the 2020 NEC

600.2 Electric Signs and Outline Lighting. Definitions.

(1 of 2)



Four brand-new definitions were added to 2020 NEC applicable to 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 the primary parts (but not all parts) and a list of required parts for a sign subassembly in the field.

600.2 Electric Signs and Outline Lighting. Definitions.

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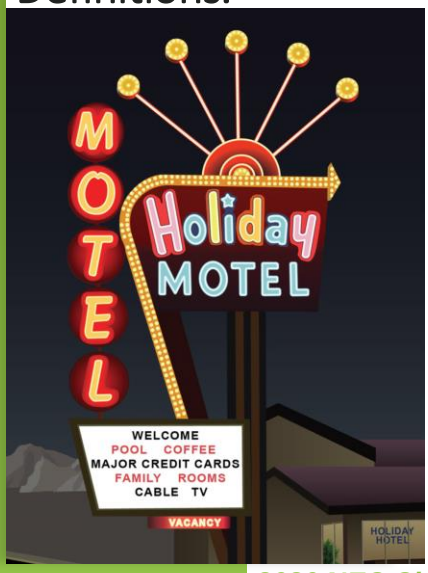
(2 of 2)



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.

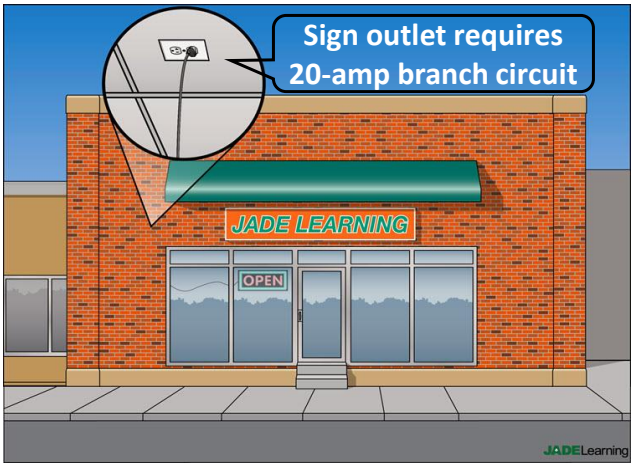
600.5(A) Electric Signs & Outline Lighting. Required Branch Circuit.

(1 of 3)

In the 2020 NEC-

Section 600.5 still requires a 20-amp branch circuit for sign outlets, but it removes the strange language used in previous editions of the NEC regarding pedestrians and their use of entrances at commercial buildings.

The NEC lost sight that pedestrian simply means: *People Walking.*



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

(2 of 3)

The 2017 NEC said:
At commercial buildings and tenant spaces, no less than one 20-amp branch circuit [serving no other loads] shall be located at pedestrian entrances for the connection of signs and outline lighting **but commercial service locations such as hallways, entrances, and corridors, shall not be considered accessible to pedestrians.**

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

(3 of 3)

The 2020 NEC says:
Each commercial building and each commercial occupancy accessible to pedestrians shall be provided with at least one outlet in an accessible location at each entrance to each tenant space for sign or outline-lighting system use. The outlet(s) shall be supplied by a branch circuit rated at least 20 amperes that supplies no other load. A sign or outline-lighting outlet shall not be required at entrances for deliveries, service corridors, or service hallways that are intended to be used only by service personnel or employees.

600.35 Electric Signs and Outline Lighting. Retrofit Kits.

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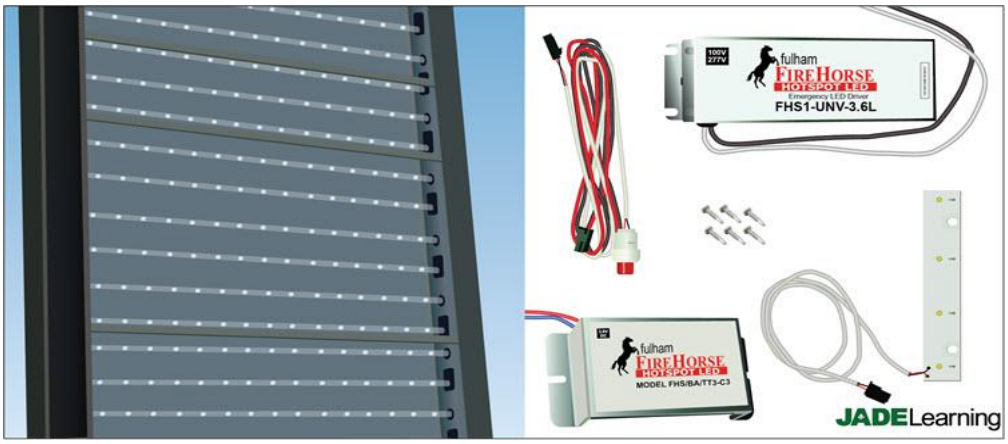
NEW in the 2020 NEC: Section 600.35(A)&(B) covers retrofit kit:

Installations — Marking — Wiring methods — Damaged components



625 Electric Vehicles

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Electric Vehicles

Important Changes in the 2020 NEC

625 and 625.1 Electric Vehicle Power Transfer System. Scope.

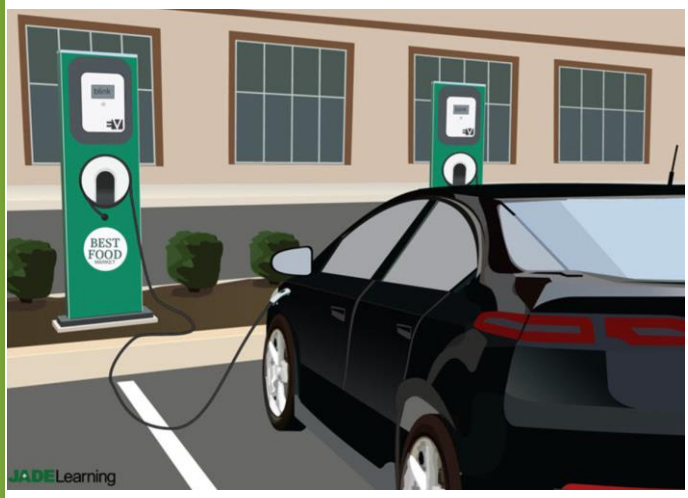
(1 of 2) JADE LEARNING A TPC COMPANY

The ***TITLE*** and ***SCOPE*** of Article 625 has changed in the 2020 NEC to make it clear:

- **The NEC now recognizes that electric vehicles can safely transfer on-board battery power to homes and businesses when they are in need of power.**

625 and 625.1 Electric Vehicle Power Transfer System. Scope.

(2 of 2) JADE LEARNING A TPC COMPANY



A new definition has been added to 625.2 — it supports the Article's new title and scope!

Electric Vehicle Power Export Equipment (EVPE):
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.

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

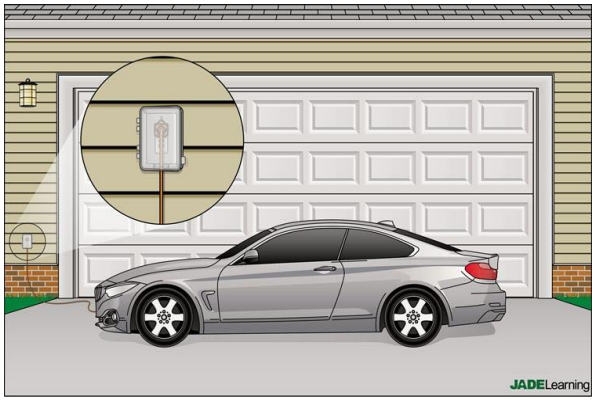
NEW in the 2020 NEC-

GFCI protection is now required for **ALL** outlets used for electric vehicle power transfer.

- **In the 2017 NEC, GFCI protection was only required for single-phase receptacles rated 150 volts to ground or less and 50 amps or less.**

625.56 Electric Vehicle Power Transfer System. Receptacle Enclosures.

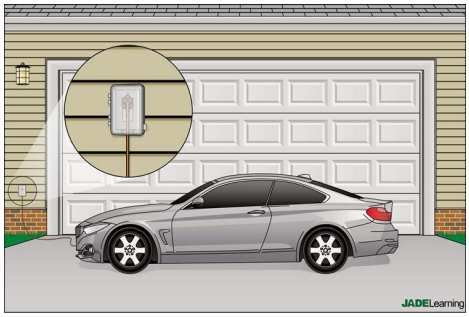
(1 of 3)



A Tentative Interim Amendment *[TIA]* from the 2017 NEC and one additional rule have combined to make a new Code requirement in the 2020 NEC: **NEW Section 625.56**

625.56 Electric Vehicle Power Transfer System. Receptacle Enclosures.

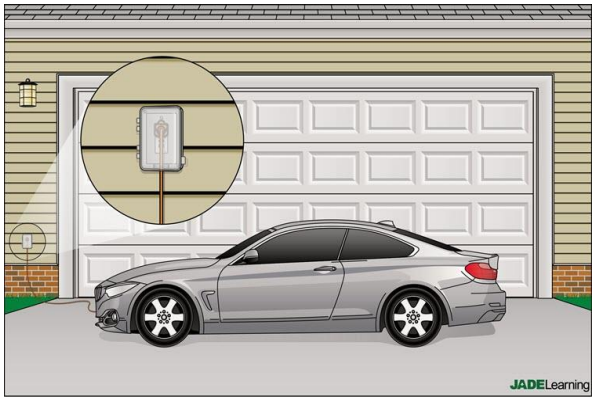
(2 of 3)



NEW Section 625.56 reads as follows: *All receptacles installed in a wet location for electric vehicle charging shall have an enclosure that is weatherproof with the attachment plug cap inserted or removed. An outlet box hood installed for this purpose shall be listed and shall be identified as extra duty. Other listed products, enclosures, or assemblies providing weatherproof protection that do not utilize an outlet box hood shall not be required to be marked extra duty.*

625.56 Electric Vehicle Power Transfer System. Receptacle Enclosures.

(3 of 3)



An important note about 625.56:

When 625.56 was introduced as a last-minute TIA in the 2017 NEC it stated that all electric vehicle charging receptacles in wet locations must be protected by a weatherproof enclosure.

However, it did not require the hood of the enclosure to be **listed** and identified as **extra duty. THIS IS BRAND NEW.**

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

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NEW in the 2020 NEC-

Section 625.60 is new; it is meant to ensure that all **AC receptacles installed in electric vehicles and intended for the connection of off-board utilization equipment** are safe!

This new Code section covers:

- **Types and ratings of receptacles**
- **Receptacle overcurrent protection**
- **Receptacle GFCI protection**

680 Swimming Pools, Fountains, and Similar Locations

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Swimming Pools, Fountains & Similar Installations

Important Changes in the 2020 NEC

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

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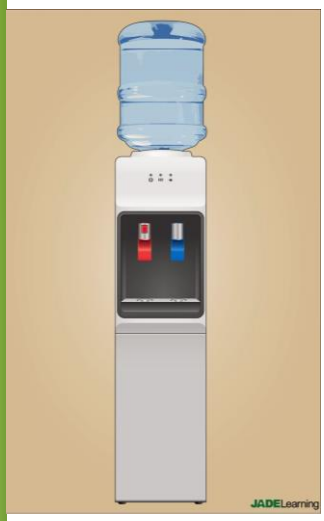

- The definition of “fountain” in the 2020 NEC has been revised to clarify its meaning and purpose in Article 680.
- The term “fountain” in the 2017 NEC omitted a drinking fountain from being included, but it could have caused confusion as to whether the NEC meant a *water cooler.*
- The 2020 NEC explains that water coolers, used for dispensing potable water, are not the types of water fountains addressed in Article 680.

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

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(1 of 3)

NEW in the 2020 NEC-

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

- This new Section allows for periodic electrical inspections of pools, fountains, and similar installations, **indefinitely**, even after the installation is complete and permit is closed.

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

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(2 of 3)

NEW 2020 NEC-

Sect states:
The auth shall be permitted to req inspection and testing.

Amended by NC!

- This new Section allows for periodic electrical inspections of pools, fountains, and similar installations, **indefinitely**, even after the installation is complete and permit is closed.

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

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NC AMENDMENT

(3 of 3)

NC AMENDMENT 680.4 has deleted permission allowing the authority having jurisdiction to require inspections after the permit is closed.

AMENDMENT 680.4: Inspections After Installation. *Deleted*

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

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New Swimming Pools

In the 2020 NEC, GFCI protection is required for all newly installed pool pump motors rated **150 volts or less to ground and 60 amps or less, single or 3-phase.**

The 2017 NEC required GFCI protection for only single-phase pool pump motors rated 120- to 240-volts.

680.21(D)(2) Swimming Pools, Fountains, and Similar Installations. Motors. Pool Pump Motor Replacement.

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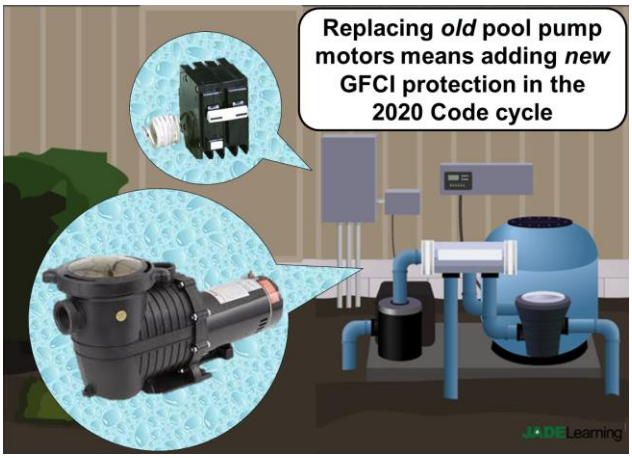
Existing Swimming Pools *(1 of 3)*

NEW in the 2020 NEC

Where a pool pump motor described in *680.21(C) is replaced for maintenance or repair, the replacement motor shall be provided with GFCI protection.

***680.21(C) motors are rated 150 volts or less to ground and 60 amps or less, single or 3-phase**



680.21(D)(2) Swimming Pools, Fountains, and Similar Installations. Motors. Pool Pump Motor Replacement.

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Existing Swimming Pools

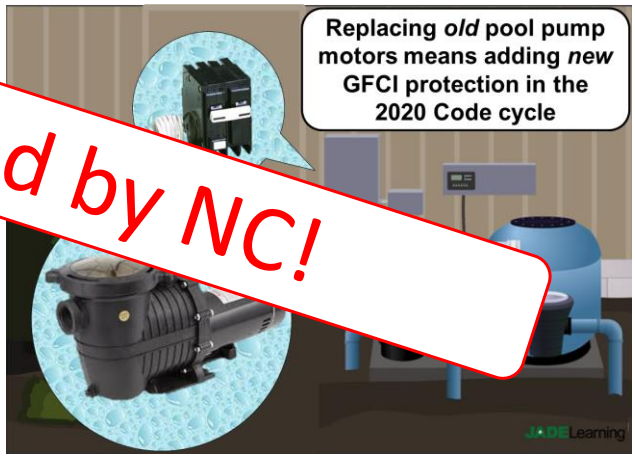
(2 of 3)

NEW

Where a p[illegible] in *680.21(C) is rep[illegible] maintenance or repair, the replacement motor shall be provided with GFCI protection.

***680.21(C) motors are rated 150 volts or less to ground and 60 amps or less, single or 3-phase**

Amended by NC!



680.21(D)(2) Swimming Pools, Fountains, and Similar Installations. Motors. Pool Pump Motor Replacement.

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NC AMENDMENT

(3 of 3)

NC AMENDMENT 680.21(D)(2) expands the GFCI protection requirement so it applies to both branch circuit conductors and the overcurrent device(s) that supply power to a pool pump.

AMENDMENT 680.21(D)(2). Existing Pool Pump Motor Branch Circuit and Overcurrent Protection: *All branch circuits and overcurrent devices that supply power to a pool pump motor by direct connection or outlet shall comply with the (GFCI) provisions of 680.21(C) when the branch circuits or overcurrent devices are altered, installed, modified, relocated, repaired, or replaced.*

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

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NEC Section 680.22(A)(4) in the 2020 NEC states:

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).***

- **CLASS-A protection was not specified in the 2017 NEC!**

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

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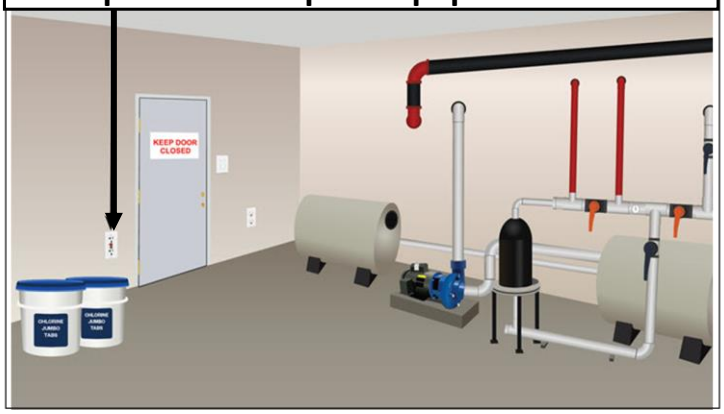
Brand- new Code section 680.22(A)(5) states: *At least one GFCI-protected 125-volt, 15- or 20- ampere receptacle on a general-purpose circuit shall be located within a pool equipment room, and all other receptacles supplied by branch circuits rated 150 volts or less to ground within a pool equipment room shall be GFCI protected.*

At least one GFCI protected receptacle is required in this pool equipment room!



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

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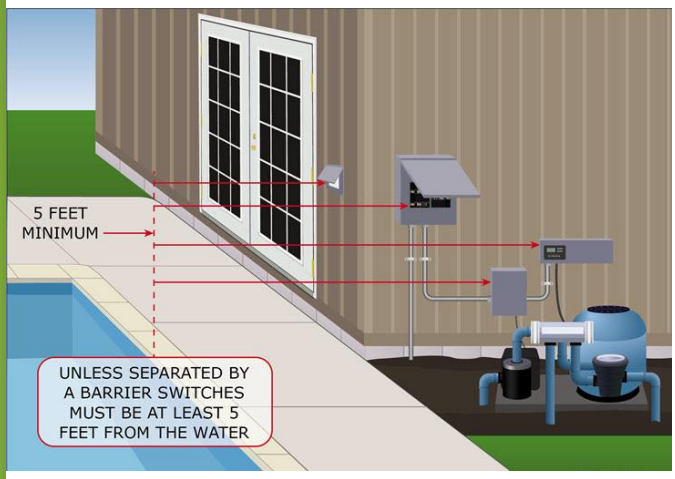

In the 2020 NEC-

Switching devices must be located at least 5 feet horizontally from the inside walls of a pool unless separated by a permanent barrier ***that provides at least a 5-foot reach distance***.

- Switches listed as being acceptable for use within 5ft. of a pool are permitted.

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

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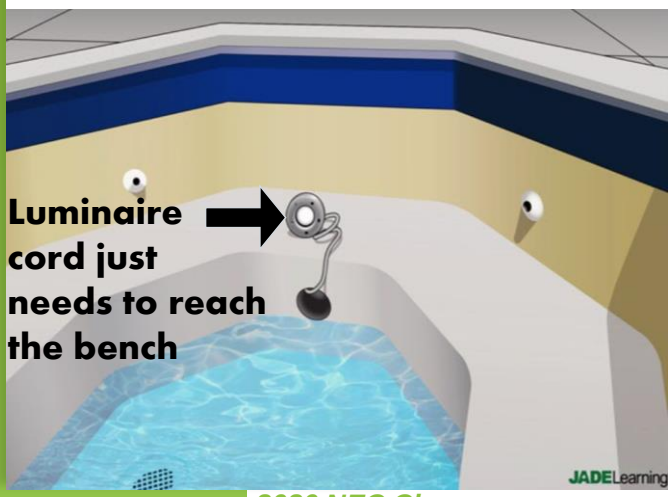

- In the 2020 NEC, electricians & manufacturers no longer have to conceal extra cable that allows the underwater luminaire to be pulled to the top to be serviced.
- Spas may now be drained & luminaires can be serviced down low on the spa bench.

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

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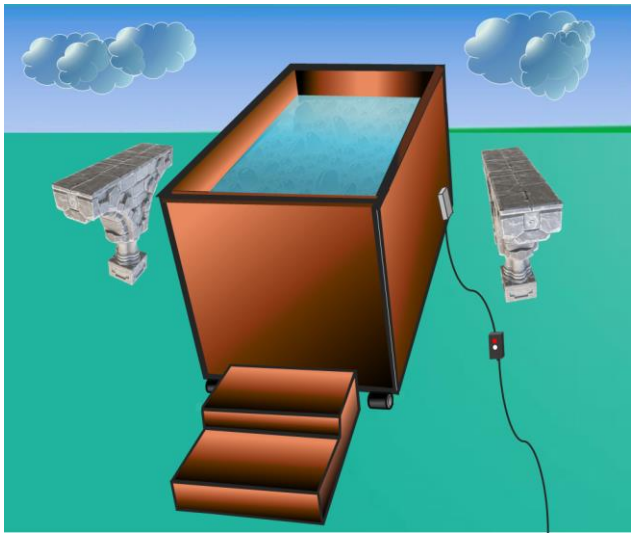

NEW in the 2020 NEC

Article 680 now covers storable & portable immersion pools and includes new installation 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.

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

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In the 2020 NEC

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.

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

In the 2020 NEC-

Section 680.59 is new to the 2020 NEC and requires all outlets that supply single-phase or 3-phase nonsubmersible pump motors to be provided GFCI protection when pumps are rated 250 volts or less and 60 amps or less.

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

Section 682.33(C) has been revised in the 2020 NEC to clarify bonding requirements for **natural** and **artificially made** bodies of water.

The previous 2017 NEC requirements still stand, and the Section now includes bonding requirements found in 682.33(C)(1), (C)(2), & (C)(3).

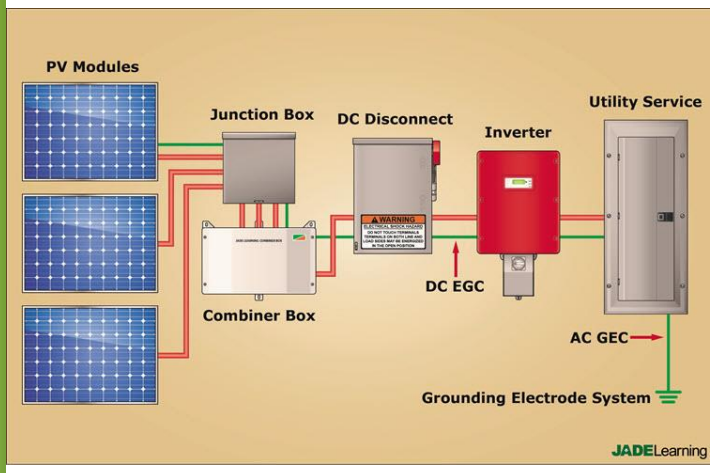
- **(C)(1)** contains the original 2017 requirements
- **(C)(2)** includes equipment bonding requirements
- **(C)(3)** includes walking surface bonding requirements

690 PV Systems.

PV Systems (Solar)

Important Changes in the 2020 NEC

690.2 Solar PV Systems. Definitions. Grounded, Functionally.



In the 2020 NEC-

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.

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

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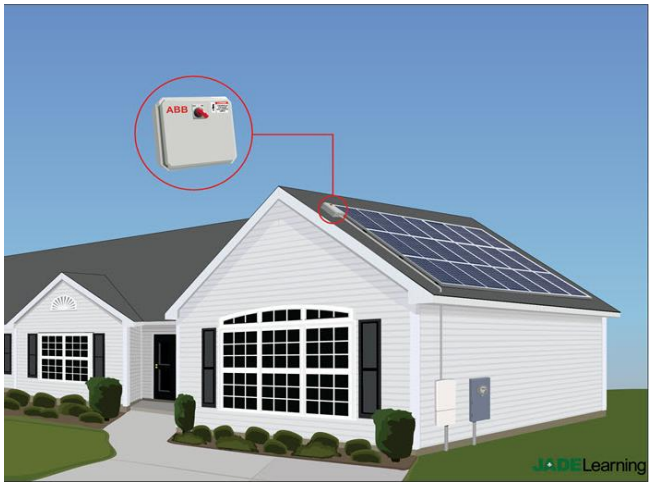
In the 2020 NEC-

The rapid shutdown requirement for PV system conductors no longer applies to all conductors. It now applies to these two types:

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



690.33 Solar PV Systems. Mating Connectors.

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In the 2020 NEC-

The 2020 NEC now addresses **intermatability** between PV 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.

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

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(1 of 2)

NEW in the 2020 NEC-

All PV system dc circuits exceeding 30 volts or 8 amps must be supplied with dc ground-fault protection.

In the 2017 NEC, only dc circuits located *WITHIN* the PV Array required dc ground-fault protection.

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

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(2 of 2)

NEW in the 2020 NEC-

Also new in the 2020 NEC, Section 690.41(B)(3) requires all equipment that provides ground-fault protection to PV system dc circuits to indicate (display) in a readily accessible location when a ground-fault condition is present on the protected wiring.

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

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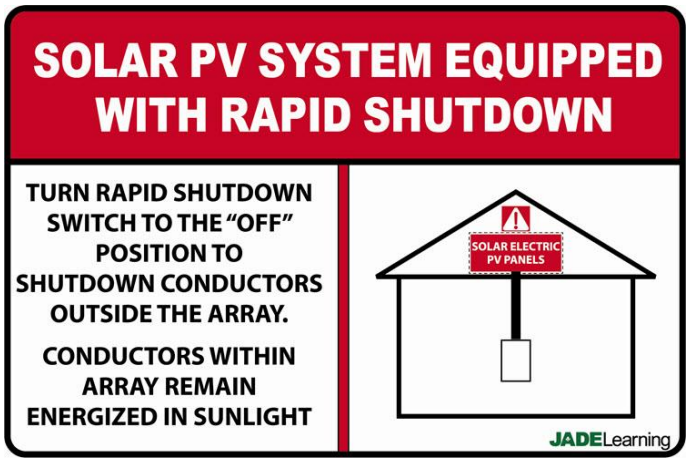
NEW in the 2020 NEC-

The 2020 NEC no longer allows rapid-shutdown systems to control **only conductors outside of the PV array**, therefore that label option has been removed from the NEC Section addressing *Rapid Shutdown Systems.*



695 Fire Pumps.

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Fire Pumps

Important Changes in the 2020 NEC

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

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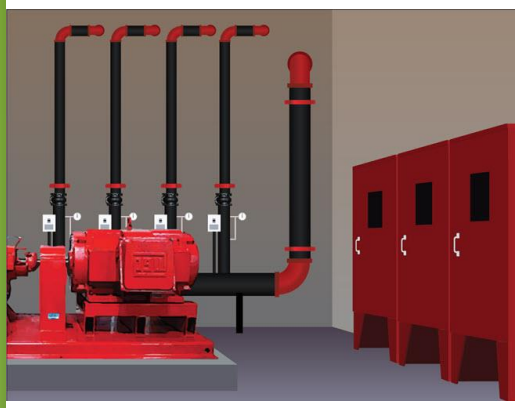
(1 of 3)



In the 2017 NEC-
Overcurrent protective devices for fire pumps had to be **selectively coordinated** with all supply-side overcurrent protective devices.

But what is—*SELECTIVELY COORDINATED?*

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

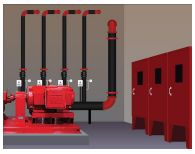
JADE LEARNING A TPC COMPANY

(2 of 3)

But what is—*SELECTIVELY COORDINATED?*

Selective coordination means the overcurrent device CLOSEST TO THE FAULT trips before an overcurrent device upstream. This keeps the power outage localized to the smallest area possible.

A ground fault on a 15-amp branch circuit should not trip a 200-amp main circuit breaker located upstream!



BUT WHAT'S NEW IN THE 2020 NEC?

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

JADE LEARNING
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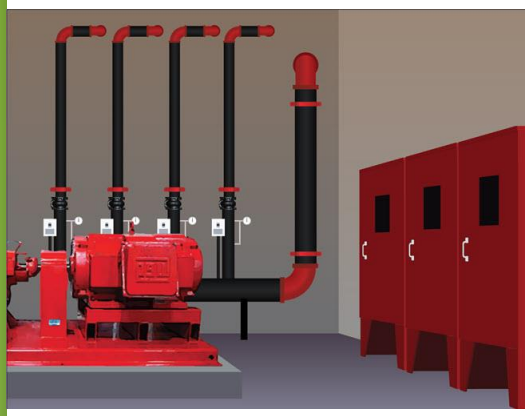
(3 of 3)



In the 2017 NEC-
Overcurrent protective devices for fire pumps had to be **selectively coordinated** with all supply-side overcurrent protective devices.

BUT WHAT'S NEW IN THE 2020 NEC?

The selective coordination must be performed by a licensed engineer or other qualified person and must be documented and made available to authorized persons.

135

2020 NEC Changes Chapter 7

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136

Chapter 7 is all about *Special Conditions*

Conditions outside of the scope of NEC Chapters 1-4

Chapter 7 addresses:

- **Emergency Systems**
- **Legally Required and Optional Standby Systems**
- **Interconnected Power Sources**
- **Energy Storage Systems**
- **Class 1, 2, & 3 Circuits** (Remote Control, Signaling, & Power Limited Circuits)
- **And More!**

137

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Emergency Systems, Optional Systems, & Stand-Alone Systems

Important Changes in the 2020 NEC

138

700.5(A) Emergency Systems. Transfer Equipment.

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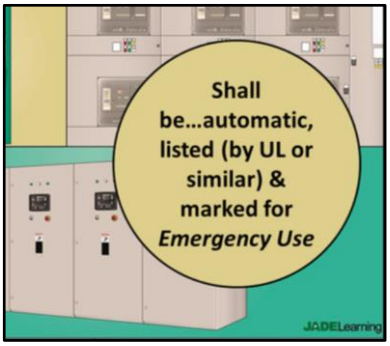
(1 of 4)

700.5(A) has been revised in the 2020 NEC concerning transfer switch equipment and emergency system use.

700.5(A) in the 2020 NEC says:
Transfer equipment shall be automatic, listed, and marked for emergency system use, and approved by the authority having jurisdiction. Transfer equipment shall be designed & installed to prevent inadvertent interconnection of normal and emergency sources of supply in any operation of the transfer equipment…. Meter-mounted transfer switches shall not be permitted for emergency system use.



700.5(A) Emergency Systems. Transfer Equipment.

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A TPC COMPANY

(2 of 4)

What's NEW in 700.5(A)?

- Meter-mounted transfer switches are no longer allowed for emergency system use.
- And all emergency system transfer switches must now be listed and marked for emergency use.

Those requirements are new, but-

What is an *Emergency System?* What is a *Meter-Mounted Transfer Switch?*

700.5(A) Emergency Systems. Transfer Equipment.

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A TPC COMPANY

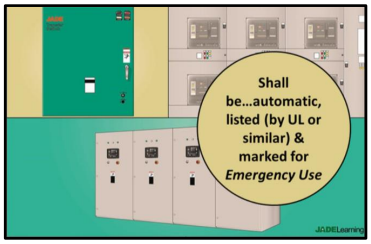
(3 of 4)

What is an *Emergency System?*

NEC 700.2 states:

Emergency System: A system that is legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction.

These systems are intended to automatically supply illumination, power, or both, to designated areas and equipment in the event of failure of the primary power supply or in the event of accident to elements of a system intended to supply, distribute, and control power and illumination essential to human life.



700.5(A) Emergency Systems. Transfer Equipment.

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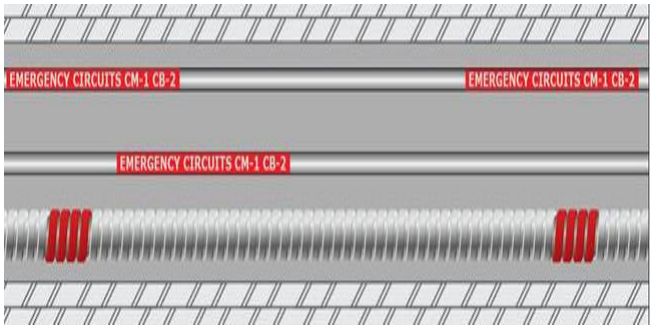
(4 of 4)

This is a meter-mounted transfer switch.

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



NEW in the 2020 NEC-

The 2020 NEC now requires emergency system equipment not protected by a fire suppression system to be in a space constructed with a 2-hour fire rating **[The 2017 NEC only required 1 hour]**

&

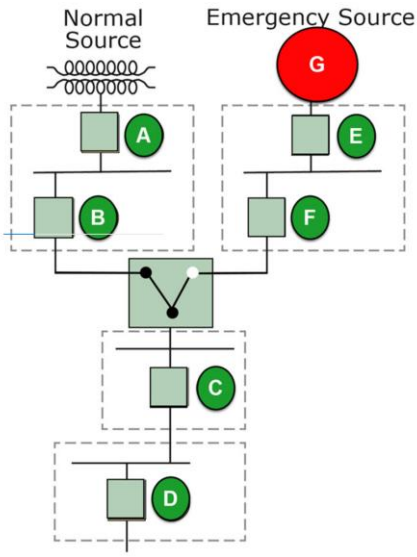
DC microgrid systems (such as PV) can now be used as emergency systems!

700.32 Emergency Systems. Selective Coordination.

In the 2020 NEC:

A new informational note and diagram have been added to Section 700.32 in the 2020 NEC. The new diagram provides a line drawing of the relationships between overcurrent devices in a selectively coordinated emergency system.

- **Remember-** ***Selective Coordination?***



700.32 Emergency Systems. Selective Coordination.

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What is *Selective Coordination?*

Selective coordination means the overcurrent device CLOSEST TO THE FAULT trips before an overcurrent device upstream. This keeps the power outage localized to the smallest area possible.

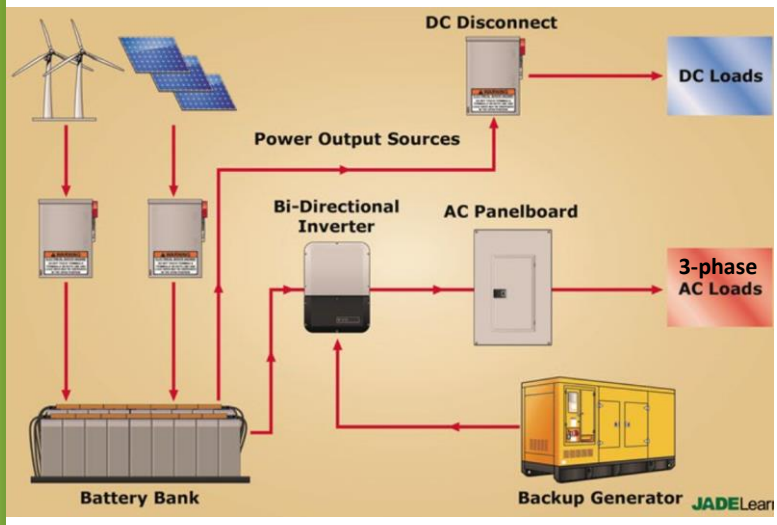
702.7(A) Optional Standby Systems. Signs. Standby.

Section 702.7(A) contains new sign requirements for Optional Standby Systems installed at commercial & industrial properties *versus dwelling units.*

- For commercial and industrial installations, a sign must be posted near the service entrance equipment.
- For one- and two-family dwellings, a sign must be placed at the emergency service disconnecting means required in *NEC 230.85. The sign must indicate the location of any on-site optional standby power source disconnects.

(230.85 is new in the 2020 NEC and has been deleted by NC amendments)

710.15 Stand-Alone Systems. General.



NEW in the 2020 NEC-

Stand-alone systems can now power three-phase loads!

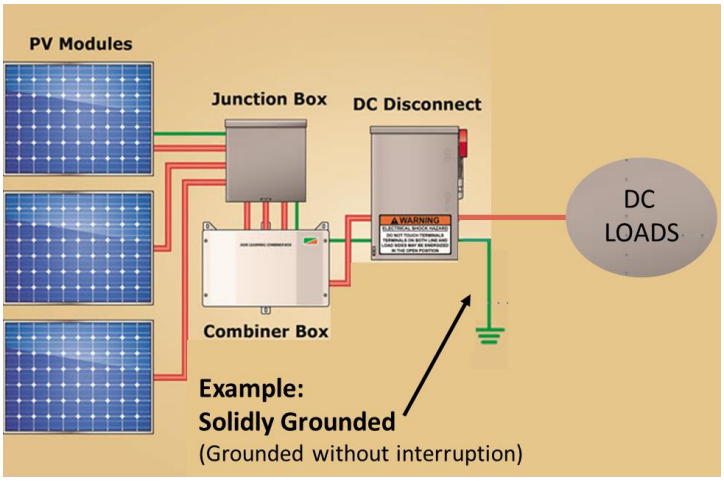
- **Stand-alone systems are "off-grid" and not connected to a utility provider or their distribution networks.**

712.2 DC Microgrids. Definitions. Grounded, Functionally.

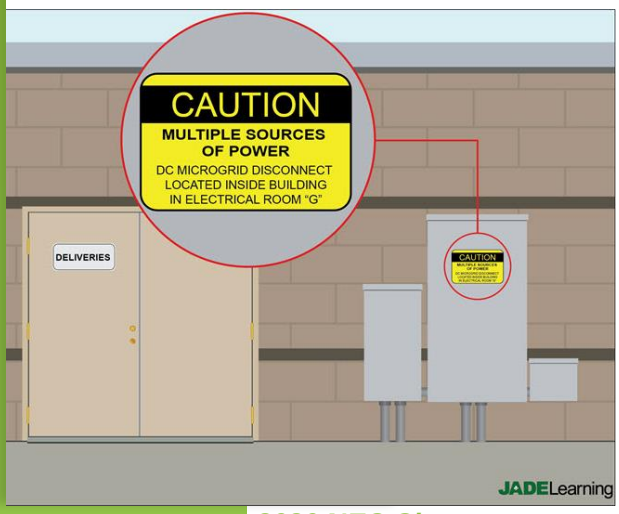
A newly revised definition for ***Grounded, Functionally***

Grounded, Functionally means grounded but with interruption. To be functionally grounded is to be effectively grounded through an in-line resistor, inverter, or similar in-line monitoring or protection device.

NOTE: Grounded, Solidly means grounded without the insertion of resistors or impedance devices.



712.10 DC Microgrids. Directory.



NEW in the 2020 NEC-

In addition to the dc power source directory required at each primary dc power source, the 2020 NEC now requires a permanent plaque or directory installed at each service equipment location, or at an approved readily visible location. The plaque or directory must indicate the location of each power source disconnect on or in the building or it must be grouped with other plaques or directories for other on-site power sources.

Remote Control and Signal Wiring, Fire Alarm Wiring, & Fiber Optic Cable

Important Changes in the 2020 NEC

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.

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In the 2020 NEC-

A new permission now allows Class 1 circuit conductors to occupy the same cable, enclosure, or raceway as power-supply circuits, **even when they are NOT functionally associated.**

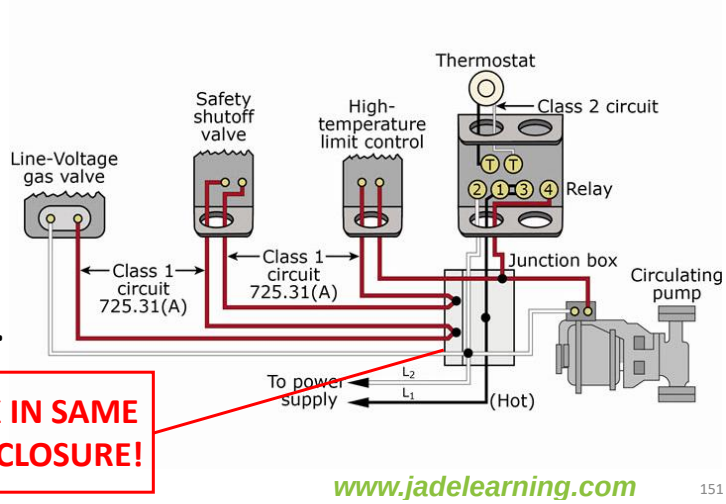

Table 725.144 Class 1, 2, & 3 Remote-Control, Signaling and Power-Limited Circuits. Transmission of Power and Data.

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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 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.

Table 725.144 for Class 1, 2, & 3 remote-control, signaling, and power-limited circuit conductors now contains updated ampacities.

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

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In the 2020 NEC:

The fire alarm branch-circuit disconnecting means can now be secured to the "on" position.

- Breaker lockouts and similar devices can be placed on PLFA OCPDs to keep personnel from accidentally disconnecting power to these critical circuits.

(PLFA) = Power-Limited Fire Alarm

770.24 Optical Fiber Cables. Mechanical Execution of Work.

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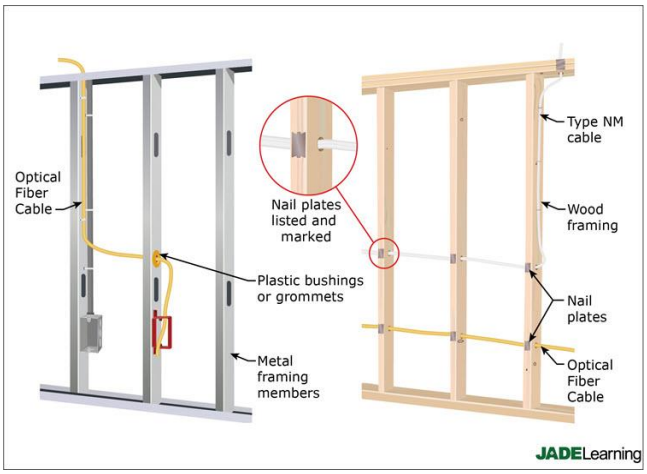

In the 2020 NEC-

New For 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 now be listed as having low smoke and heat release properties.

770.110(D) Optical Fiber Cables. Cable Trays.

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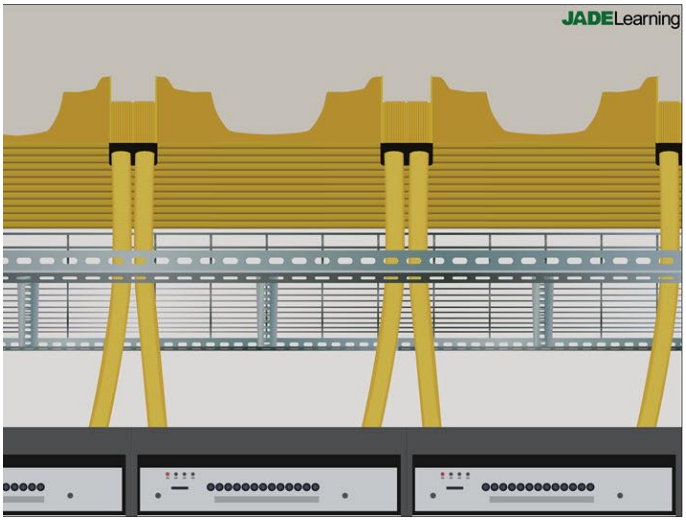

NEW in the 2020 NEC-

Section 770.110(D) has been added to the 2020 NEC - it permits optical fiber cables to be installed using metal or nonmetallic cable tray systems.

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

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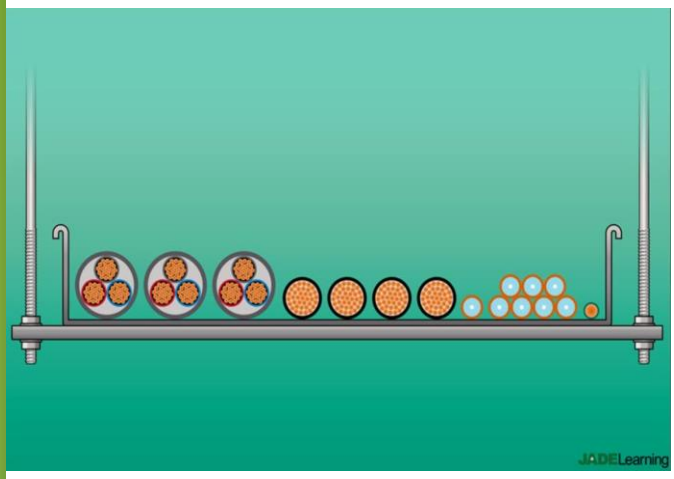

NEW in the 2020 NEC-

The 2020 NEC has determined that armor or metal-clad sheathing covering optical fiber cable is suitable as a divider against any power and lighting conductors in that same cable tray or raceway.

THANK YOU FOR ATTENDING!

Questions?

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For questions about your continuing education, please contact registrar@jadelearning.com

SURVEY LINK: https://www.surveymonkey.com/r/VXVFTWK

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