Instructions: **Fee $20**

1. Print these pages.
2. Circle the correct answers and transfer them to the answer sheet.
3. Page down to the last page for the verification forms and mailing instructions.
4. Use the included information as your reference materials.
5. 60 questions are listed in a straight order mini-section format throughout the complete quiz.

Course: 18826 2017 NEC Changes 4

This course is valid for these credentials:

Credential Description	Cred Code	Credit Hours
Registered/Beginner Electrician	BE	2.0
Commercial Electrical Inspector	CEI	2.0
Industrial Journeyman Electrician	IJE	2.0
Journeyman Electrician	JE	2.0
Master Electrician	ME	2.0
Residential Journeyman Electrician	RJE	2.0
Residential Master Electrician	RME	2.0
UDC-Electrical Inspector	UEI	2.0

2017 NEC Changes 4

610.42(B)(3) Branch-Circuit Short-Circuit and Ground-Fault Protection. (Cranes and Hoists)
2014 NEC Requirement. Where two or more motors are connected to the same branch circuit, each tap conductor to an individual motor is required to have individual overcurrent protection. Where taps to control circuits originate on the load side of a branch-circuit protective device, each tap and piece of equipment is required to have overcurrent protection. Brake coil taps were permitted for cranes or hoists without separate overcurrent protection.
2017 NEC Change. Brake coil taps for cranes or hoists without separate overcurrent protection have been deleted.

620.16 Short-Circuit Current Rating. (Elevators, Etc.)
2014 NEC Requirement. There were no provisions in Article 620 pertaining to the short-circuit current rating or the available short-circuit current for elevators, dumbwaiters, escalators, moving walks, platform lifts, or stairway chairlifts.
2017 NEC Change. New short-circuit current rating marking requirements and installation restrictions for elevator control panels were added at 620.16.

Article 625 Electric Vehicle Charging System
2014 NEC Requirement. The requirements for Electric Vehicle Charging Systems were located in Article 625.
2017 NEC Change. Article 625 for Electric Vehicle Charging Systems was reformatted with provisions for wireless power transfer equipment being incorporated into the article.

625.2 Definitions. (Electric Vehicle Charging System)
2014 NEC Requirement. There were no requirements in Article 625 for wireless charging of electric vehicles.
2017 NEC Change. Two new definitions, *Wireless Power Transfer (WPT)* and *Wireless Power Transfer Equipment (WPTE),* were added at 625.2 as well as a new Part IV of Article 625 entitled, "Wireless Power Transfer Equipment."

625.10 Electric Vehicle Coupler
2014 NEC Requirement. Electric vehicle couplers were required to comply with 625.10(A) through (F). This list included polarization requirements, non-interchangeability of electric vehicle couplers, construction and installation requirements. Provisions were provided to prevent unintentional disconnection and grounding pole requirements.

2017 NEC Change. The provisions for polarization and non-interchangeability of electric vehicle couplers were deleted for the 2017 *NEC* as this is a design issue addressed by the listing of the product.

Article 625, Part IV Wireless Power Transfer Equipment (Electric Vehicle Charging System)

2014 NEC Requirement. There were no requirements in Article 625 for wireless charging of electric vehicles.

2017 NEC Change. A new Part IV of Article 625 entitled, "Wireless Power Transfer Equipment" was added to Article 625, as well as two new definitions, *Wireless Power Transfer (WPT)* and *Wireless Power· Transfer Equipment (WPTE)* were added at 625.2.

1. Brake coil taps for cranes or hoists without separate overcurrent protection have been _____.
    a. revised
    b. relocated
    c. deleted
    d. added
2. New _____ for elevator control panels were added at 620.16.
    a. short-circuit current rating marking requirements
    b. installation restrictions
    c. both a & b
    d. none of the above
3. Article 625 for Electric Vehicle Charging Systems was reformatted with provisions for _____ power transfer equipment being incorporated into the article.
    a. wired
    b. wireless
    c. Wi-Fi
    d. date
4. Two new definitions, Wireless Power Transfer (WPT) and Wireless Power Transfer Equipment (WPTE), were _____ at 625.2 as well as a new Part IV of Article 625 entitled, "Wireless Power Transfer Equipment."
    a. moved
    b. relocated
    c. deleted
    d. added
5. The provisions for polarization and non-interchangeability of electric vehicle couplers were _____ for the 2017 *NEC* as this is a design issue addressed by the listing of the product.
    a. moved
    b. relocated
    c. deleted
    d. added
6. A new Part IV of Article 625 entitled, "Wireless Power Transfer Equipment" was added to Article 625, as well as two new definitions, _____ were added at 625.2.
    a. Wireless Power Transfer (WPT)
    b. Wired Power· Transfer Equipment (WPTE)
    c. Wireless Power· Transfer Equipment (WPTE)
    d. both a & c

645.3(B) Other Articles. (Information Technology Equipment)

2014 NEC Requirement. Wiring and cabling in a plenum above an information technology (IT) equipment room had to comply with a list of other articles and sections elsewhere in the *Code* other than the requirements of Article 645. This list of twelve other *Code* references was identified at 645.3(B) in a long single sentence.

2017 NEC Change. The information about other articles and sections applying to wiring and cabling in plenums above an IT equipment room has been reformatted into a list format with appropriate titles added at each *Code* reference. The title of 645.3(B) was changed from "Plenums" to "Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums)."

645.5(E) Supply Circuits and Interconnecting Cables. (Information Technology Equipment), Under Raised Floors

2014 NEC Requirement. The requirements for installing power cables, communications cables, connecting cables, interconnecting cables, cord-and-plug connections, and receptacles under a raised floor associated with the information technology equipment was (and is) addressed at 645.5(E). This information was delivered in long sentences and paragraphs. This information had a companion Table 645.5(E)(6) that contained several cable types permitted under a raised floor of an IT equipment room.
2017 NEC Change. First level subdivision 645.5(E) was revised and re-organized for usability and clarity. A list format was incorporated for usability as well. The previous Table 645.5(E)(6) was deleted as it is no longer needed.

645.18 Surge Protection for Critical Operations Data Systems. (Information Technology Equipment)

2014 NEC Requirement. Surge protection for critical operations data systems was not addressed in Article 645 in the 2014 *NEC*. Surge protection devices were, and are, required at all facility distribution voltage levels of a critical operations power system by the provisions of 708.2o(D).
2017 NEC Change. Surge protection is now required for critical operations data systems by the provisions of new 645.18.

Article 650 Pipe Organs

2014 NEC Requirement. Article 650 covers those electrical circuits and parts of electrically operated pipe organs that are employed for the control of the sounding apparatus and keyboards.
2017 NEC Change. Article 680 was revised by adding 650.2 for definitions pertaining to this article. A new 650.9 was added pertaining to protection against accidental contact with the sounding apparatus.

660.5 Disconnecting Means. (X-Ray Equipment)

2014 NEC Requirement. The disconnecting means for X-ray equipment was required to be operable from a location readily accessible from the X-ray control.
2017 *NEC* Change. The disconnecting means for X-ray equipment is now required to be located within sight from the X-ray control and readily accessible.

670.6 Surge Protection. (Industrial Machinery)

2014 NEC Requirement. There were no provisions in Article 670 for surge protection of industrial machinery with safety interlocking circuits.
2017 NEC Change. A new requirement was added at 670.6 requiring industrial machinery with safety interlock circuits to be provided with surge protection.

680.2 and Part VIII of Article 680 Definitions, Swimming Pools, Fountains, and Similar Installations

2014 NEC Requirement. There were no requirements or a definition for an *Electrically Powered Pool Lift* anywhere in Article 680.
2017 NEC Change. A new definition for *Electrically Powered Pool Lift* along with a new Part VIII entitled, "Electrically Powered Pool Lifts," were added to Article 680.

7. The information about other articles and sections applying to wiring and cabling in plenums above an IT equipment room has been _____ into a list format with appropriate titles added at each *Code* reference.
   a. moved
   b. relocated
   c. reformatted
   d. added

8. The title of 645.3(B) was changed from "Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums)" to "Plenums".
   a. true
   b. false

9. First level subdivision 645.5(E) was _____ and re-organized for usability and clarity. A list format was incorporated for usability as well. The previous Table 645.5(E)(6) was deleted as it is no longer needed.
   a. moved
   b. relocated
   c. revised
   d. added

10. Surge protection is now required for critical operations data systems by the provisions of new _____.
   a. 643.18
   b. 644.18

c. 645.18
d. 646.18

11. Article 680 was revised by adding 650.2 for definitions pertaining to this article. A new _____ was added pertaining to protection against accidental contact with the sounding apparatus.
a. 650.8
b. 650.9
c. 651.9
d. 652.9

12. The disconnecting means for X-ray equipment is now required to be located _____.
a. within sight from the X-ray control
b. readily accessible
c. within 20 ft of the equipment
d. both a & b

13. A new requirement was added at 670.6 requiring industrial machinery with safety interlock circuits to be provided with _____.
a. ground fault protection
b. surge protection
c. AFCI protection
d. all of the above

14. A new definition for Electrically Powered Pool Lift along with a new Part VIII entitled, "Electrically Powered Pool Lifts," were _____ to Article 680.
a. moved
b. relocated
c. revised
d. added

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

2014 NEC Requirement. The definition of *Storable Swimming, Wading, or Immersion Pools* added the term *or Storable/ Portable Spas and Hot Tubs* in the definition. This definition included storable swimming, wading, or immersion pools; or storable/ portable spas and hot tubs that are constructed on or above the ground and are capable of holding water to a maximum depth of 1.0 m (42 in.). This definition also included any pool with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension.

2017 NEC Change. Further clarification was instituted with the phrase "constructed on or above the ground" added before storable/portable "nonmetallic, polymeric or inflatable tubs, spas, or pools regardless of the dimension." This addition clarifies that a storable/portable pool, spa, or hot tub with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension is always installed "on or above the ground."

680.7 Grounding and Bonding Terminals. (Swimming Pools, Fountains, and Similar Installations)

2014 NEC Requirement. There were no specifics for grounding and bonding terminations in Article 680. Specific means for terminating equipment grounding conductors, bonding jumpers, etc., to metal enclosures would be described at 250.8. This description would include listed pressure connectors, pressure connectors listed as grounding and bonding equipment, etc.

2017 NEC Change. A new grounding and bonding termination requirement was added at 680.7. This new requirement calls for grounding and bonding terminals to be identified for use in wet and corrosive environments and listed for direct burial applications as well.

Table 680.10 Underground Wiring Location. (Swimming Pools, Fountains, and Similar Installations)

2014 NEC Requirement. Underground wiring was not permitted under the pool or within an area extending 1.5 m (5 ft) horizontally from the inside wall of the pool unless this wiring was necessary to supply pool equipment. Where space limitations prevented wiring from being routed a distance 1.5 m (5 ft) or more from the pool, such wiring was permitted to be installed within 1.5 m (5 ft) of the pool where installed in complete raceway systems of rigid metal conduit, intermediate metal conduit, or a nonmetallic raceway system. All metal conduit was required to be corrosion-resistant and suitable for the location. The minimum cover depths for wiring installed within 1.5 m (5 ft) of the pool were dictated by Table 680.10.

2017 NEC Change. Underground wiring is now permitted to be installed in close proximity to the pool, and no consideration needs to be given as to whether this wiring is "necessary to supply pool equipment." The wiring

methods employed are to be rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or Type MC cable, suitable for the conditions subject to that location. Underground wiring s hall not be permitted to be installed *under* the pool unless this wiring is necessary to supply pool equipment permitted by Article 680. The minimum burial depth cover requirements will now be facilitated by Table 300.5, and Table 680.10 for minimum cover depths around pools has been deleted.

680.12 and 680.14 680.12 Equipment Rooms and Pits. (Swimming Pools, Fountains, and Similar Installations) and 680.14 Corrosive Environment

2014 NEC Requirement. Electrical equipment cannot be installed in rooms or pits that do not have proper drainage for the prevention of water accumulation during normal operation or filter maintenance. Article 680 did not address the prevention of corrosion to electrical equipment in rooms or pits.

2017 NEC Change. In addition to proper drainage as required by previous 680.11, 680.12 now requires electrical equipment located in equipment rooms or pits to be suitable for the environment in accordance with 300.6, which calls for materials suitable for the environment in which they are to be installed. New requirements at 680.14 detail the corrosion resistance of wiring methods needed in swimming pool installations where chemicals are stored.

680.21 (A) (Swimming Pools, Fountains, and Similar Installations)

2014 NEC Requirement. The wiring method for a permanently installed swimming pool pump motor was limited to rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride (PVC) conduit, reinforced thermosetting resin conduit, or Type MC metal-clad cable specifically listed for the location. Electrical metallic tubing (EMT) was permitted to be used on or within buildings. Where flexible connections are necessary at or adjacent to the motor, liquidtight flexible metal or liquidtight flexible nonmetallic conduit with approved fittings was permitted. Pool pump motors located in one-family dwellings were permitted to be supplied by any of the general wiring methods recognized in *NEC* Chapter 3 where the wiring method was located inside the dwelling unit or an accessory building. All motors associated with permanently installed pools were required to be connected to an insulated copper equipment-grounding conductor not to be smaller than 12AWG

2017 NEC Change. The restricted wiring methods previously described in 680.21(A)(1) through (A)(5) will now only apply in areas where protection from physical damage is needed or where protection from environmental conditions associated with wet, damp, and corrosive conditions are present.

680.22(A)(2) Lighting, Receptacles, and Equipment. (Swimming Pools, Fountains, and Similar Installations)

2014 NEC Requirement. Receptacles that supply power for pool pump motors or other loads directly related to the circulation and sanitation system required the receptacle(s) to be located at least 3.0 m (10 ft) from the inside walls of the pool. Permission was granted at 68o.22(A)(2) to allow the circulation and sanitation receptacle(s) to be located not less than 1.83 m (6ft) from the inside walls of the pool if the receptacle(s) complied with all of the following conditions: consist of single receptacles; are of the grounding type; and are provided with GFCI protection.

2017 NEC Change. Receptacles that supply power for pool pump motors or other loads directly related to the circulation and sanitation system can now be located not less than 1.83 m (6ft) from the inside walls of the pool, provided the receptacle(s) are of the grounding type and equipped with GFCI protection.

15. Further clarification was instituted with the phrase "constructed on or above the ground" added before storable/portable "nonmetallic, polymeric or inflatable tubs, spas, or pools regardless of the dimension." This addition clarifies that a storable/portable pool, spa, or hot tub with _____ walls regardless of dimension is always installed "on or above the ground."

a. nonmetallic
b. molded polymeric
c. inflatable fabric
d. all of the above

16. A new grounding and bonding termination requirement was added at 680.7. This new requirement calls for _____ terminals to be identified for use in wet and corrosive environments and listed for direct burial applications as well.

a. grounding
b. bonding
c. earthing

d. both a & b

17. Underground wiring is now permitted to be installed _____ the pool, and no consideration needs to be given as to whether this wiring is "necessary to supply pool equipment." The wiring methods employed are to be rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or Type MC cable, suitable for the conditions subject to that location.

a. under
b. above
c. in close proximity to
d. all of the above

18. Underground wiring shall not be permitted to be installed *under* the pool unless this wiring is necessary to supply pool equipment permitted by Article 680. The minimum burial depth cover requirements will now be facilitated by Table _____.

a. 680.10
b. 300.4
c. 300.5
d. none of the above

19. In addition to proper drainage as required by previous 680.11, 680.12 now requires electrical equipment located in _____ to be suitable for the environment in accordance with 300.6, which calls for materials suitable for the environment in which they are to be installed.

a. equipment rooms
b. pits
c. mines
d. both a & b

20. New requirements at _____ detail the corrosion resistance of wiring methods needed in swimming pool installations where chemicals are stored.

a. 680.13
b. 680.14
c. 680.15
d. none of the above

21. Receptacles that supply power for pool pump motors or other loads directly related to the circulation and sanitation system can now be located not less than 1.83 m (6ft) from the inside walls of the pool, provided the receptacle(s) are of the _____ type and equipped with GFCI protection.

a. bonding
b. grounding
c. locking
d. all of the above

680.22(B)(7) Low-Voltage Gas-Fired Luminaires, Decorative Fireplaces, Fire Pits, and Similar Equipment

2014 NEC Requirement. Low-voltage luminaires around permanently installed pools were addressed in 680.22(B)(6). These provisions permitted specific low-voltage luminaires to be located less than 1.5 m (5 ft) from the inside walls of the pool under certain conditions. These luminaires must be of the type that does not require a grounding means and cannot exceed the voltage limitations defined in the definition of *Low Voltage Contact Limit* in 680.2. These luminaires must also be supplied by transformers or power supplies listed for swimming pool and spa use that comply with 680.23(A)(2).

2017 NEC Change. New provisions were added in 680.22(B)(7) to specifically address low-voltage gas-fired luminaires, decorative fireplaces, fire pits, and similar equipment. With the inclusion of electronic ignitors for these devices, *NEC* regulations were needed for this type of low-voltage, gas-fired equipment.

680.25 Feeders. (Swimming Pools, Fountains, and Similar Installations)

2014 NEC Requirement. The wiring methods for feeders on the supply side of panel boards supplying branch circuits for pool equipment were required to be installed in rigid metal conduit or intermediate metal conduit. Where not subject to physical damage, six specific wiring methods with conditions were permitted for this feeder installation including EMT and PVC. This feeder was required to include an insulated equipment grounding conductor.

2017 NEC Change. The previous 680.25(B) for grounding of swimming pool panelboard feeders was deleted in its entirety as grounding provisions for swimming pool panelboard feeders have been incorporated into the revised text at 680.25(A). The revised text at 680.25(A) requires restricted wiring methods only in areas where harsh conditions (such as physical damage, environmental conditions, corrosive conditions, etc.) are present. Chapter 3 wiring methods are now otherwise permitted.

680.27(B)(1), Ex. and 680.27(8)(2), Ex. Specialized Pool Equipment. (Swimming Pools, Fountains, and Similar Installations)

2014 NEC Requirement. The electric motors, controllers, and wiring for an electrically operated pool cover (regardless of the voltage rating) were required to be located not less than 1.5 m (5 ft) from the inside wall of the pool unless separated from the pool by a wall, cover, or other permanent barrier. Electric motors installed below grade level are required be of the totally enclosed type. The device that controls the operation of the pool cover motor is required to be located such that the operator has full view of the pool. The electric motor and controller were required to be connected to a branch circuit protected by a ground-fault circuit interrupter (GFCI).

2017 NEC Change. Two exceptions were added below the parent text of 680.27(B)(1) and 680.27(B)(2) recognizing pool cover motors that are part of a listed systern with ratings not exceeding the low-voltage contact limits, allowing such a low-voltage type motor to be installed within 1.5 m (5 ft) of the inside walls of the pool, and the omission of GFCI protection for said motor.

680.28 Gas-Fired Water Heater. (Swimming Pools, Fountains, and Similar Installations)

2014 NEC Requirement. No provisions existed for GFCI protection for swimming pool and spa water heaters (gas or electric). The requirements of 680.22(A)(2) called for GFCI protection for receptacles that provide power for water-pump motors or other loads directly related to the circulation and sanitation system.

2017 NEC Change. New provisions were added requiring branch circuits serving gas-fired swimming pool and spa water heaters operating at voltages above the low-voltage contact limit to be provided with GFCI protection for personnel.

680.74 Bonding. (Hydromassage Bathtubs)

2014 NEC Requirement. The requirements for equipotential bonding in the area of a hydro massage bathtub were incorporated into one long paragraph. These requirements indicated what needed to be bonded as well as the provisions for the bonding jumper(s) required to accomplish this equipotential bonding.

2017 NEC Change. The former requirements for equipotential bonding of a Hydromassage bathtub were retained and placed into a list format. Section 680.74 now has two first level subdivisions, (A) and (B), with two exceptions for 680.74(A). A list of metallic items located "within 1.5 m (5 ft) of the inside walls of the tub" were added to the items required to be bonded.

(A) General. The following parts shall be bonded together:

(1) All metal fittings within or attached to the tub structure that are in contact with the circulating water

(2) Metal parts of electrical equipment associated with the tub water circulating system, including pump and blower motors

(3) Metal-sheathed cables and raceways and metal piping that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub by a permanent barrier

(4) All exposed metal surfaces that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub area by a permanent barrier

(5) Electrical devices and controls that are not associated with the Hydromassage tubs and that are located within 1.5 m (5 ft) from such units

A new exception now exempts bonding of "small conductive surfaces."

682.15 Ground-Fault Circuit-Interrupter (GFCI) Protection. (Natural and Artificially Made Bodies of Water)

2014 NEC Requirement. GFCI protection was required for 15- and 20-ampere, single-phase, 125-volt through 250-volt receptacles installed outdoors and in or on floating buildings or structures within the electrical datum plane area. Protection was required only in areas used for storage, maintenance, or repair where portable electric hand tools, electrical diagnostic equipment, or portable lighting equipment were used.

2017 NEC Change. GFCI protection for personnel is now required for all 15- and 20-ampere, single-phase, 125-volt through 250-volt receptacles installed outdoors and in or on floating buildings or structures within the electrical datum plane area, not just those receptacles in areas used for storage, maintenance, or repair where portable electric hand tools, electrical diagnostic equipment, or portable lighting equipment are to be used.

22. New provisions were added in 680.22(B)(7) to specifically address low-voltage gas-fired luminaires, decorative _____. With the inclusion of electronic ignitors for these devices, *NEC* regulations were needed for this type of low-voltage, gas-fired equipment.
    a. fireplaces
    b. fire pits
    c. similar equipment
    d. all of the above
23. The revised text at 680.25(A) requires restricted wiring methods only in areas where harsh conditions such as _____ are present.
    a. physical damage
    b. environmental conditions
    c. corrosive conditions
    d. all of the above
24. Two exceptions were added below the parent text of 680.27(B)(1) and 680.27(B)(2) recognizing pool cover motors that are part of a listed system with ratings not exceeding the low-voltage contact limits, allowing such a low-voltage type motor to be installed within _____ of the inside walls of the pool.
    a. 1.5 m
    b. 5 ft
    c. both a & b
    d. none of the above
25. Two exceptions were added below the parent text of 680.27(B)(1) and 680.27(B)(2) recognizing pool cover motors that are part of a listed system with ratings not exceeding the low-voltage contact limits, allowing such a low-voltage type motor to be installed with the omission of _____ protection for said motor.
    a. AFCI
    b. GFCI
    c. combination GFCI/AFCI
    d. all of the above
26. New provisions were added requiring branch circuits serving gas-fired swimming pool and spa water heaters operating at voltages above the low-voltage contact limit to be provided with _____ protection for personnel.
    a. AFCI
    b. GFCI
    c. combination GFCI/AFCI
    d. all of the above
27. A list of metallic items located "within _____ of the inside walls of the tub" were added to the items required to be bonded
    a. 1.6 m
    b. 6 ft
    c. both a & b
    d. none of the above
28. 680.74 Bonding. (Hydromassage Bathtubs) The following parts shall be bonded together:
    a. All metal fittings within or attached to the tub structure that are in contact with the circulating water
    b. Metal parts of electrical equipment associated with the tub water circulating system, including pump and blower motors
    c. Metal-sheathed cables and raceways and metal piping that are within 1.6 m (6 ft) of the inside walls of the tub and not separated from the tub by a permanent barrier
    d. both a & b
29. 680.74 Bonding. (Hydromassage Bathtubs) The following parts shall be bonded together:
    a. (4) All exposed metal surfaces that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub area by a permanent barrier
    b. Electrical devices and controls that are not associated with the Hydromassage tubs and that are located within 1.5 m (5 ft) from such units
    c. small conductive surfaces
    d. both a & b

30. GFCI protection for personnel is now required for all 15- and 20-ampere, single-phase, 125-volt through 250-volt receptacles installed outdoors and _____ within the electrical datum plane area.

a. in floating buildings or structures
b. on floating buildings
c. on floating structures
d. all of the above

31. GFCI protection for personnel is now required for those receptacles in areas used for storage, maintenance, or repair where _____ are to be used.

a. portable electric hand tools
b. electrical diagnostic equipment
c. portable lighting equipment
d. all of the above

200.6 Definitions. [Solar Photovoltaic (PV) Systems]

2014 NEC Requirement. There was no definition for *functional grounded PV system* in the 2014 *NEC*. The term was not used anywhere in Article 690. The term *reference (center tap) conductor* was used a couple of times in Article 690, but there was no definition. Most referenced or functional grounded PV systems were treated as if they were solidly grounded systems.

2017 NEC Change. A new definition for *Functional Grounded PV System* was added at 690.2. This term is now used in six different locations throughout Article 690.

690.7 Maximum Voltage [Solar Photovoltaic (PV) Systems]

2014 NEC Requirement. Requirements for maximum voltages for PV systems were found at 690.7. The section had five first level subdivisions. Table 690.7 was part of this section as well.

2017 NEC Change. Section 690.7 went through an extensive revision this cycle to simplify these maximum voltage requirements. Three first level subdivisions remain, and Table 690.7 was changed to Table 690.7(A), as this is where the reference to this table exists.

690.8(A)(1) Circuit Sizing and Current. [Solar Photovoltaic (PV) Systems]

2014 NEC Requirement. For calculating the maximum current for a PV source circuit, the sum of parallel module rated short-circuit currents multiplied by 125 percent was required.

2017 NEC Change. In addition to the 125 percent method permitted by previous editions of the *Code*, a second option was added for calculating the maximum current for a PV source circuit using an industry standard method provided by a licensed professional electrical engineer.

690.11, Exception Arc-Fault Circuit Protection (Direct Current). [Solar Photovoltaic (PV) Systems]

2014 NEC Requirement. The requirements for arc-fault circuit interrupter (AFCI) protection for PV systems is found at 690.11. This section called for listed (de) arc-fault circuit interrupter, PV type, or other system components to provide equivalent protection for PV systems with de source circuits, de output circuits, or both, operating at a PV system maximum system voltage of 50 volts or greater. This PV AFCI protection is required to detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in the de PV source and dc PV output circuits. Two specific performance characteristics were included in these PV AFCI requirements.

2017 NEC Change. The requirement for PV AFCI protection at 690.11 was revised by removing the previous subsections 690.11(2) and (3). A new exception allows PV AFCI protection to be omitted for PV systems that are not installed on or in buildings where the output circuits and dc-to-dc converter output circuits are direct buried, installed in metallic raceways, or installed in enclosed metallic cable trays.

690.12 Rapid Shutdown of PV Systems on Buildings. [Solar Photovoltaic (PV) Systems]

2014 NEC Requirement. A new 690.12 titled, "Rapid Shutdown of PV Systems on Buildings" was added to the 2014 *NEC*. This section applies to PV systems installed on or in buildings. This section required PV source circuits to be de-energized from all sources within 10 seconds of when the utility supply is de-energized or when the PV power source disconnecting means is opened.

2017 NEC Change. The rapid shutdown requirements of 690.12 were revised to emphasize the primary purpose of the rapid shutdown requirements, which is to reduce shock hazard for emergency responders, and to answer questions regarding the functionality of the PV rapid shutdown device itself. The structure of 690.12 is now subdivided into four separate subsections: (A) Controlled Conductors, (B) Controlled Limits, (C) Initiation Device, and (D) Equipment.

690.13 Photovoltaic System Disconnecting Means. [Solar Photovoltaic (PV) Systems]
2014 NEC Requirement. The disconnecting means for a building or other structure supplied by a PV system was covered by the requirements of 690.13. The section had five first level subdivisions: (A) Location, (B) Marking, (C) Suitable for Use, (D) Maximum Number of Disconnects, and (E) Grouping.
2017 NEC Change. The requirements for PV disconnecting means at 690.13 received extensive revisions along with a few new provisions added. This section now has six first level subdivisions: (A) Location, (B) Marking, (C) Suitable for Use, (D) Maximum Number of Disconnects, (E) Rating, and (F) Type of Disconnect.

32. A new definition for *Functional Grounded PV System* was added at 690.2. This term is now used in ___ different locations throughout Article 690.
    a. 4
    b. 5
    c. 6
    d. 7
33. Section 690.7 went through an extensive revision this cycle to simplify these _____ requirements.
    a. maximum voltage
    b. maximum ampacity
    c. minimum voltage
    d. minimum ampacity
34. In addition to the 125 percent method permitted by previous editions of the *Code*, a second option was added for calculating the maximum current for a PV source circuit using an industry standard method provided by a licensed _____.
    a. master electrician
    b. architect
    c. professional electrical engineer
    d. all of the above
35. A new exception allows PV AFCI protection to be omitted for PV systems that are not installed on or in buildings where the output circuits and dc-to-dc converter output circuits are _____.
    a. direct buried
    b. installed in metallic raceways
    c. installed in enclosed non-metallic cable trays
    d. both a & b
36. The rapid shutdown requirements of 690.12 were revised to emphasize the primary purpose of the rapid shutdown requirements, which is to _____.
    a. reduce shock hazard for emergency responders
    b. answer questions regarding the functionality of the PV rapid shutdown device itself
    c. both a & b
    d. none of the above
37. The structure of 690.12 is now subdivided into ____ separate subsections: (A) Controlled Conductors, (B) Controlled Limits, (C) Initiation Device, and (D) Equipment.
    a. 2
    b. 3
    c. 4
    d. 5
38. The requirements for PV disconnecting means at 690.13 received extensive revisions along with a few new provisions added. This section now has ____ first level subdivisions: (A) Location, (B) Marking, (C) Suitable for Use, (D) Maximum Number of Disconnects, (E) Rating, and (F) Type of Disconnect.
    a. 4
    b. 5
    c. 6
    d. 7

690.31 (C)(1) 690.31 (Wiring) Methods Permitted. [Solar Photovoltaic (PV) Systems]
2014 NEC Requirement. Single-conductor Type USE-2 cable and single-conductor cable listed and

labeled as photovoltaic (PV) wire were permitted in exposed outdoor locations in PV source circuits for PV module interconnections within a PV array. An exception to this rule required PV source and output circuits to be guarded or installed in a raceway, where operating at maximum system voltages greater than 30 volts and installed in a readily accessible location.

2017 NEC Change. The term *listed and labeled* was replaced with *listed and identified* when describing single-conductor PV wire. A new installation requirement and references to 338.10(B)(4)(b) and 334.30 have been added to 690.31(C) (1) for PV wiring in a PV array. The exception requiring a PV wire installed in a readily accessible location within a PV array be installed in a raceway was removed.

690.35 Ungrounded Photovoltaic Power Systems

2014 NEC Requirement. The requirements for the installation of an ungrounded photovoltaic (PV) power system were located at 690.35(A) through (G).

2017 NEC Change. The requirements for an ungrounded photovoltaic (PV) power system at 690.35 have been deleted. Ungrounded systems are now defined as a functional grounded PV system.

690.41 System Grounding. [Solar Photovoltaic (PV) Systems]

2014 NEC Requirement. The section for "System Grounding" was revised into a list format for clarity. A reference to "over 50" volts was deleted since the 2014 *NEC* revised list included all types of PV systems at any voltage. The term *solidly* grounded was removed for consistency. An allowance for impedance grounding and a reference to 690.5 (ground-fault protection) were also added for clarity when grounded 2-wire and bipolar PV systems were installed.

2017 NEC Change. The provisions of 690-41 were revised to properly address the methods by which PV systems are grounded. Two new first level subdivisions were added to 690-41 - 690-41(A) addresses "PV System Grounding Configurations," while 690-41(B) covers "Ground-Fault Protection" for PV systems. To cap off this revision, the former text of 690.5 was relocated to 690-41(B) to concur with the revised grounding requirements for PV systems.

690.47 Grounding Electrode System. [Solar Photovoltaic (PV) Systems]

2014 NEC Requirement. The requirements for grounding electrode systems for PV arrays and systems were addressed at 690-47 with four first level subdivisions. The provisions included: (A) for ac systems, (B) for de systems, (C) for systems with ac and de grounding requirements, and (D) for additional auxiliary electrodes for array grounding.

2017 NEC Change. For the 2017 *NEC*, the requirements for the installation of grounding electrodes and grounding electrode conductors have been greatly simplified, while maintaining the safety of PV systems. The provisions of former 690-47(A), (B), and (C) have been abridged and incorporated into the new 690-47(A). The provisions of former 690-47(D) [now 690.47(B)] pertaining to additional auxiliary electrodes for PV array grounding have been revised to clarify that these auxiliary electrodes are permitted but not required.

690.56(C) Identification of Power Sources

2014 NEC Requirement. In conjunction with the rapid shutdown provisions of 690.12, a new 690.56(C) was added during the 2014 *NEC* revision cycle that required buildings or structures with both utility service and a PV system to have a permanent plaque or directory that includes the verbiage "PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN" when the building or structure is in compliance with 690.12 and a rapid shutdown system.

2017 NEC Change. Through an extensive revision process, 690.56(C) was divided into three list items: (C)(1) addresses rapid shutdown types; (C)(2) deals with buildings with more than one rapid shutdown type; and (C)(3) makes provisions for the rapid shutdown switch or rapid shutdown initiator (RSI). Two new figures were added in 690.56(C)(1) to illustrate new labels that are now required for the two different types of rapid shutdown systems for a PV installation. A detailed plan view diagram of the roof is required in certain situations by 680.56(C)(2) to provide illustrated guidance showing each different PV system and should include a "dotted line" around areas that remain energized after the rapid shutdown initiation switch is activated. The requirements of 680.56(C)(3) necessitate a rapid shutdown switch to have a label located directly on the RSI or no more than 1 m (3 ft) from the rapid shutdown switch that includes the words, "RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM."

200.6 Article 690, Part VII

2014 NEC Requirement. Part VII of Article 690 contained five sections: 690.57, Load Disconnect; 690.60, Identified Interactive Equipment; 690.61, Loss of Interactive System Power; 690.63, Unbalanced Interconnections; and 690.64, Point of Connection. These requirements were duplicate requirements from Article 705 or referenced sections in Article 705.
2017 NEC Change. Revisions to Part VII of Article 690 removed the majority of Part VII and replaced it with one reference to Article 705 where interconnection requirements are covered in detail. Part VII of Article 690 now contains one section, 690.59, Connection to Other Sources.

39. The term *listed and labeled* was replaced with *listed and* _____when describing single-conductor PV wire.
    a. identified
    b. marked
    c. approved
    d. labeled

40. The exception requiring a PV wire installed in a readily accessible location within a PV array be installed in a raceway was _____.
    a. added
    b. relocated
    c. revised
    d. removed

41. 690.35 Ungrounded Photovoltaic Power Systems. Ungrounded systems are now defined as a functional _____ PV system.
    a. bonded
    b. ground faulted
    c. grounded
    d. all of the above

42. Two new first level subdivisions were added to _____ addresses "PV System Grounding Configurations,"
    a. 690-41 - 690-41(A)
    b. 690-41(B)
    c. 690-41(C)
    d. all of the above

43. Two new first level subdivisions were added, _____ covers "Ground-Fault Protection" for PV systems.
    a. 690-41 - 690-41(A)
    b. 690-41(B)
    c. 690-41(C)
    d. all of the above

44. The provisions of former 690-47(D) [now 690.47(B)] pertaining to additional auxiliary electrodes for PV array grounding have been revised to clarify that these auxiliary electrodes are _____.
    a. permitted but not required
    b. permitted and required
    c. permitted and sometimes required
    d. none of the above

45. The requirements of 680.56(C)(3) necessitate a rapid shutdown switch to have a label located directly on the RSI or no more than _____ from the rapid shutdown switch that includes the words, "RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM."
    a. 1 m
    b. 3 ft
    c. both a & b
    d. none of the above

46. A detailed plan view diagram of the roof is required in certain situations by 680.56(C)(2) to provide illustrated guidance showing each different PV system and should include a "_____" around areas that remain energized after the rapid shutdown initiation switch is activated
    a. highlighted line
    b. spotted line
    c. dotted line
    d. scattered line

690.71 General. (Energy Storage Systems) [Solar Photovoltaic (PV) Systems]
2014 NEC Requirement. Storage batteries in a solar photovoltaic (PV) system had to be installed in accordance with Article 480, Storage Batteries, and with Section 690.71. Section 690.71 contained eight first level subdivisions.
2017 NEC Change. The former provisions of 690.71 for installation of PV storage battery systems have been relocated to Part III of Article 706, leaving one reference to new Article 706 at 690 .71.
Article 691 Large-Scale Photovoltaic (PV) Electric Power Production Facility
2014 NEC Requirement. The 2 014 *NEC* did not include specific regulations for large-scale PV electric power production facilities. Any *NEC* requirements regulated on these large scale PV systems had to be gleaned out of Article 690, which covers solar photovoltaic (PV) systems.
2017 NEC Change. A new Article 691 for "Large-Scale Photovoltaic (PV) Electric Power Production Facility" was added to the 2017 *NEC.* This article covers the installation of large-scale PV electric power production facilities operated for the sole purpose of providing electric supply to the utility transmission or distribution system with a generating capacity of no less than 5,000 kW.
695.6(G) Power Wiring. (Fire Pumps)
2014 NEC Requirement. The language at 695.6(G) indicated that ground-fault protection (GFP) of equipment shall not be "permitted" for fire pumps.
2017 NEC Change. The text at 695.6(G) was changed to state that ground-fault protection of equipment "shall not be installed" in any fire pump power circuit.
695.15 Surge Protection. (Fire Pumps)
2014 NEC Requirement. Surge protection was not required for fire pumps or fire pump controllers.
2017 NEC Change. A new requirement was added to 695.15 demanding a listed surge protection device (SPD) be installed in or on all fire pump controllers.
700.2 and 700.25 Branch Circuit Emergency Lighting Transfer Switch
2014 NEC Requirement. The specifications of the device used to transfer emergency lighting loads from a normal branch circuit to an emergency branch circuit were not addressed in the 2014 *NEC.*
2017 NEC Change. A new 700.25 titled, "Branch Circuit Emergency Lighting Transfer Switch" was added to allow these devices to be used to transfer emergency lighting loads supplied by branch circuits rated at not greater than 20 amperes from the normal branch circuit to an emergency branch circuit. A new definition for *Branch Circuit Emergency Lighting Transfer Switch* was also added at 700.2.
700.3(F) Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power
2014 NEC Requirement. Under the title of "Capacity" and "Selective Load Pickup, Load Shedding, and Peak Load Shaving," a sentence appeared at the end of 700.4(B) stating, "a portable or temporary alternate source shall be available whenever the emergency generator is out of service for major maintenance or repair." No prescriptive requirements existed for this requirement.
2017 NEC Change. A new first level subdivision is titled, "Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power" was added at 700.3(F) calling for emergency systems that rely on a single alternate source of power to include a permanent switching means to connect a portable or temporary alternate source of power while the single alternate source of power is disabled for maintenance or repair. This permanent switching means must be available for the duration of the maintenance or repair. This new requirement comes with an exception with four conditions.

47. A new Article 691 for "_____ -Scale Photovoltaic (PV) Electric Power Production Facility" was added to the 2017 *NEC.*
    a. small
    b. medium
    c. large
    d. none of the above
48. This article covers the installation of large-scale PV electric power production facilities operated for the sole purpose of providing electric supply to the utility transmission or distribution system with a generating capacity of no less than _____ kW.
    a. 3,000
    b. 4,000

c. 5,000
d. 10,000

49. The text at 695.6(G) was changed to state that ground-fault protection of equipment "_____ be installed" in any fire pump power circuit.
a. shall
b. might
c. shall not
d. none of the above

50. A new requirement was added to 695.15 demanding a _____ surge protection device (SPD) be installed in or on all fire pump controllers.
a. marked
b. approved
c. listed
d. identified

51. A new 700.25 titled, "Branch Circuit Emergency Lighting Transfer Switch" was added to allow these devices to be used to transfer emergency lighting loads supplied by branch circuits rated at _____ amperes from the normal branch circuit to an emergency branch circuit.
a. not greater than 15
b. not greater than 20
c. greater than 20
d. greater than 15

52. A new definition for *Branch Circuit Emergency Lighting Transfer Switch* was also added at _____.
a. 700.1
b. 700.2
c. 700.3
d. 700.4

53. A new first level subdivision is titled, "Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power" was added at 700.3(F) calling for emergency systems that rely on a single alternate source of power to include a permanent switching means to connect a _____ alternate source of power while the single alternate source of power is disabled for maintenance or repair.
a. portable
b. temporary
c. recognized
d. both a & b

54. This permanent switching means must be available for the duration of the _____. This new requirement comes with an exception with four conditions.
a. maintenance
b. repair
c. new installation
d. both a & b

700.5(E) Transfer Equipment (Emergency Systems)

2014 NEC Requirement. There was no requirement for a field marking of the short-circuit current rating of emergency system transfer equipment in Article 700 of the 2014 *NEC.*

2017 NEC Change. A new requirement was added at 700.5(E) that will now require the short-circuit current rating of the transfer equipment to be field marked on the exterior of the transfer equipment. This short-circuit current rating will be based on the specific overcurrent protective device type and settings protecting the transfer equipment.

700.10(A) Wiring, Emergency System

2014 NEC Requirement. All boxes and enclosures for emergency circuits are required to be permanently marked so they will be readily identified as a component of an emergency circuit or system.

2017 NEC Change. In addition to boxes and enclosures, these identification requirements have been expanded to exposed emergency system cables and raceway systems not associated with junction boxes or enclosures.

Receptacles supplied from the emergency system are now required to be identified by a "distinctive color or marking" on the receptacle cover plates or the receptacle.

700.10(0) Wiring, Emergency System

2014 NEC Requirement. Fire protection measures bad to be considered for emergency system feeders that were installed in assembly occupancies with an occupancy not less than 1000 persons or buildings with a height exceeding 23 m (75 ft).

2017 NEC Change. Fire protection provisions for emergency system feeders were expanded to also include health care occupancies where persons are not capable of self-preservation and educational occupancies with more than 300 occupants (in addition to high-rise buildings and those buildings with large occupancy loads).

701.6(D) Signals. (Legally Required Standby Systems)

2014 NEC Requirement. The sensor for the ground-fault signal devices was required to be located at, or ahead of, the main system disconnecting means for the legally required standby source. This sensor is designed to indicate a ground fault in solidly grounded wye, legally required standby systems of more than 150 volts to ground and circuit-protective devices rated 1000 amperes or more. The maximum setting of the signal devices must be set for a ground-fault current of I200 amperes.

2017 NEC Change. *Code* language was added to allow the ground-fault sensor to be located at an "alternate location" for systems with multiple emergency sources connected to a paralleling bus.

702.12(C) Power Inlets Rated at 100 Amperes or Greater, for Portable Generators

2014 NEC Requirement. No provisions existed in Article 702 for interlocked disconnecting means or listing requirements of power inlets for the connection of a generator source of an optional standby system.

2017 NEC Change. New language was added requiring optional standby equipment containing power inlets rated 100 amperes or more for the connection of a generator source to be listed for the intended use and be equipped with an interlocked disconnecting means. Two exceptions have been added after this new language to address instances where the inlet has been rated as a disconnecting means and for supervised industrial installations where permanent space has been identified for the portable generator to be located within line of sight of the power inlets.

Article 705, Part IV Microgrid Systems

2014 NEC Requirement. Article 705 did not address the installation of microgrid systems, intentionally islanded systems, or stand-alone systems as interconnected electric power production sources.

2017 NEC Change. A new Part IV was added to Article 705 titled, "Microgrid Systems." Microgrid systems are sometimes referred to as "intentionally islanded systems" and "stand-alone systems." Microgrids are a way to add resiliency against loss of power in premises wiring systems.

55. A new requirement was added at 700.5(E) that will now require the short-circuit current rating of the transfer equipment to be _____ on the exterior of the transfer equipment.

a. listed
b. identified
c. labeled
d. field marked

56. This short-circuit current rating will be based on the specific overcurrent protective _____ protecting the transfer equipment.

a. device type
b. settings
c. both a & b
d. ground fault

57. 700.10(A) Wiring, Emergency System. In addition to boxes and enclosures, these identification requirements have been expanded to exposed emergency system _____ systems not associated with junction boxes or enclosures.

a. cables
b. raceway
c. both a & b
d. none of the above

58. Receptacles supplied from the emergency system are now required to be _____ by a "distinctive color or marking" on the receptacle cover plates or the receptacle.

a. labeled
b. approved
c. identified
d. all of the above

59. Fire protection provisions for emergency system feeders were expanded to also include health care occupancies where persons are not capable of self-preservation and educational occupancies with more than ____ occupants.
a. 200
b. 250
c. 300
d. 500

60. *Code* language was added to allow the ground-fault sensor to be located at an "_____ location" for systems with multiple emergency sources connected to a paralleling bus
a. extra
b. replacement
c. alternate
d. substitute

2017 NEC Changes 4-Quiz Answer Sheet

1	a b c d	21	a b c d	41	a b c d
2	a b c d	22	a b c d	42	a b c d
3	a b c d	23	a b c d	43	a b c d
4	a b c d	24	a b c d	44	a b c d
5	a b c d	25	a b c d	45	a b c d
6	a b c d	26	a b c d	46	a b c d
7	a b c d	27	a b c d	47	a b c d
8	a b c d	28	a b c d	48	a b c d
9	a b c d	29	a b c d	49	a b c d
10	a b c d	30	a b c d	50	a b c d
11	a b c d	31	a b c d	51	a b c d
12	a b c d	32	a b c d	52	a b c d
13	a b c d	33	a b c d	53	a b c d
14	a b c d	34	a b c d	54	a b c d
15	a b c d	35	a b c d	55	a b c d
16	a b c d	36	a b c d	56	a b c d
17	a b c d	37	a b c d	57	a b c d
18	a b c d	38	a b c d	58	a b c d
19	a b c d	39	a b c d	59	a b c d
20	a b c d	40	a b c d	60	a b c d

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