Instructions: **Fee $100**

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. Nothing else needed.
5. 120 questions are listed in a straight order mini-section format throughout the complete quiz.

Course: 18475 2017 NEC Proposed Changes Part 1

This course is valid for these credentials:

Credential Description	Cred Code	Credit Hours
Registered/Beginner Electrician	BE	12.0
Commercial Electrical Inspector	CEI	12.0
Industrial Journeyman Electrician	IJE	12.0
Journeyman Electrician	JE	12.0
Master Electrician	ME	12.0
Residential Journeyman Electrician	RJE	12.0
Residential Master Electrician	RME	12.0
UDC-Electrical Inspector	UEI	12.0

2017 NEC Changes

Chapter One – General

New: 110.14(D) – Electrical Equipment – Tightening Torque

A new requirement was recommended to mandate the use of a torque tool to achieve the indicated torque value at electrical equipment. Many electricians use non-torqueing tools to terminate conductors on set-screw connectors in equipment. Findings of a field study presented to CMP-1 (and also published in *IAEI* magazine in July 2010) during the 2011 *Code* cycle to substantiate Informative Annex I, Recommended Tightening Torque Tables from UL Standard 486A–B, indicated that installers incorrectly tighten electrical terminations at least 75 percent of the time when not using a torque wrench. Since the reliability and safety of terminations depend on proper connection, it is essential to require the use of the proper tool. This requirement would make it clear to installers and inspectors that using torque tools is required when a torque value is indicated on electrical equipment, such as a panelboard lug.

1. This requirement would make it clear to _____ that use of a torque tool is required when a torque value is indicated on electrical equipment, such as a panelboard lug.
   a. installers
   b. inspectors
   c. both a & b
   d. none of the above

2. Installers incorrectly tighten electrical terminations at least 75 percent of the time when not using a torque wrench. The 2017 NEC includes the Recommended Tightening Torque Tables from UL Standard _____.
   a. 486A–A
   b. 486A–B
   c, 486A–C
   d. all of the above

***New:* 110.16(B) – Arc-Flash Hazard Warning – Service Equipment**

The basic warning label requirements of 110.16 have been expanded to require additional information for service equipment (other than dwelling units) rated 1200 amperes or more. Part of what this new requirement will call for at service equipment is the available fault current and clearing times at the service overcurrent

protective devices (OCPD). The available fault current must be known at the time the service equipment is installed to ensure compliance with the interrupting requirements of 110.9 and 110.10. This information is also needed to determine such things as the incident energy, minimum arc rating of clothing and personal protective equipment (PPE), and working distance from NFPA 70E, *Standard for Electrical Safety in the Workplace.* Some in the electrical industry would argue that this is an NFPA 70E issue. Substantiation for the new label requirement indicated that the requirement is properly located in the *NEC* to address the necessary installation requirements to identify incident energy and the working distance. Adding a requirement to label equipment with the available fault current and clearing times is an installation requirement and is properly located in NFPA 70 *(NEG).* The date the label was applied to the electrical service equipment is necessary as the posted available fault current can fluctuate and be affected by events beyond the control of the property owner.

An exception to this service equipment labeling requirement was added which states that labeling would not be required if an arc flash label is applied in accordance with "acceptable industry practice." Informational Note No. 3 was added to provide direction to NFPA 70E and guidance on "acceptable industry practices" for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth. Acceptance of this public input will provide the available fault current and corresponding working distance necessary where justified energized work is performed in service equipment.

3. A new sub-level (B) was added to 110.16 to require additional information to be included in the arc-flash hazard warning label specifically addressing service equipment. These new provisions were made based on the requirements in the 2015 edition of _____.

a. NFPA 70E
b. Standard for Electrical Safety in the Workplace
c. both a & b
d. none of the above

4. The available fault current must be known at the time the service equipment is installed to determine such things as the _____.

a. incident energy, minimum arc rating of clothing
b. personal protective equipment (PPE)
c. working distance from NFPA 70E
d. all of the above

5. The available fault current must be known at the time the service equipment is installed to ensure compliance with the interrupting requirements of _____.

a. 110.9
b. 110.10
c. both a & b
d. none of the above

***New:* 110.21(A)(2) – Equipment Marking – Reconditioned Equipment**

A new 110.21(A)(2) requiring reconditioned equipment to be marked with the name, trademark, or other descriptive marking, identifying the organization responsible for reconditioning the electrical equipment. This provision would also require the date of the reconditioning to be provided as well. This information will provide additional value to manufacturers, owners and authorities having jurisdiction (AHJs). Reconditioned, refurbished or remanufactured electrical equipment is widely used in all types of industry to be put back into service. These refurbishing marking requirements will give traceability of the equipment along with needed information to the purchaser, operator, and AHJ as to who is responsible for the reconditioning and when the work was performed.

6. A new 110.21(A)(2) requiring reconditioned equipment to be marked with the_____, identifying the organization responsible for reconditioning the electrical equipment.

a. name
b. trademark
c. other descriptive listing requirements
d. both a & b

7. These refurbishing marking requirements will give traceability of the equipment along with needed information to the _____ as to who is responsible for the reconditioning and when the work was performed.
   a. public
   b. operator
   c. AHJ
   d. both b & c
8. This provision would also _____ the date of the reconditioning to be provided as well.
   a. suggest
   b. recommend
   c. require
   d. all of the above

***New:* 110.26(A)(4) Working Space About Electrical Equipment — Limited Access**

A new provision for "Limited Access" was added to address equipment "located in a space with limited access," such as above a suspended ceiling or in a crawl space. This new provision has four restrictions: (1) where equipment is located above a lay-in ceiling, (2) width of the limited access working space, (3) doors or hinged panels being capable of opening a minimum of 90 degrees, and (4) space in front of the enclosure. This addition was implemented as the result of the work of a task group appointed by the *NEC* Correlating Committee to review requirements for working space of equipment that is often installed in spaces with limited access. The task group was charged with reviewing the revision to 424.66 during the 2014 *NEC* Code cycle, and exploring the feasibility of a new general requirement for the 2017 *NEC* in Article 110 for clarity and usability for all types of electrical equipment (not just duct heaters). Without this new provision for limited access, it is widely understood that strict compliance with the current 110.26(A)(1), (A)(2) and (A)(3) in ceiling spaces and crawl spaces is not feasible.

9. "Limited Access". This new provision has four restrictions that include:
   a. where equipment is located below a lay-in ceiling
   b. depth of the limited access working space
   c. both a & b
   d. none of the above
10. "Limited Access". This new provision has four restrictions that include:
   a. doors being capable of opening a minimum of 90 degrees
   b. space in front of the enclosure.
   c. hinged panels being capable of opening a minimum of 90 degrees
   d. all of the above
11. "Limited Access". Without this new provision for limited access, it is widely understood that strict compliance with the current 110.26(A)(1), (A)(2) and (A)(3) in _____ is not feasible.
   a. ceiling spaces
   b. crawl spaces
   c. both a & b
   d. dead shaft spaces

110.41(A) and (B) Inspections and Tests

A new requirement was added to Article 110 necessitating pre-energization testing of electrical equipment rated over 1000 volts upon request by the authority having jurisdiction (AHJ), along with reporting requirements. The testing could include performance and/or safety testing. This requirement was strategically placed at the end of Part III (Over 1000 Volts, Nominal) to ensure that this requirement applied only to equipment rated greater than 1000 volts. This added text was an attempt to ensure that electrical system installations of over 1000 volts perform to their design specifications and that a record for verifying the proper settings and test data would be available to the AHJ as well as the installers, operators, testers, and maintainers after the equipment is put into service.

This pre-energization testing requirement aligns with other *NEC* provisions calling for test procedures to be performed, such as 230.95(C) for testing of ground fault protection systems. This added text in Article 110 is very similar to and is modeled after the language at 225.56 for outdoor feeders and branch circuits greater than

1000 volts. When accepted during the 2011 *NEC Code* cycle, 225.56 was included to increase safety by ensuring that the initial installation of high-voltage outside feeders and branch circuits was performed properly, the protective switching and control schemes were set properly, and all acceptance testing completed. Most would argue that circuits of greater than 1000 volts installed inside a building present even greater hazards and higher life safety risks than their counterparts installed outdoors. These indoor feeders and branch circuits arguably have an even greater need for assurance that the initial installation is as designed, and the equipment will operate as intended by the original design team. Having the test data available from the initial installation provides essential information to evaluate the condition of maintenance for the life of the equipment to those who must operate, test, or maintain that same equipment.

12. New requirements were added at 110-41 for pre-energization testing and reporting of electrical equipment (over 1000 volts) upon request by the _____. Since it is located in Article 110, this will apply to all equipment rated over 1000 volts regardless of its location..

a. maintainers
b. operators
c. AHJ
d. both a & b

13. This added text was an attempt to ensure that electrical system installations of over 1000 volts perform to their design specifications and that a record for verifying the proper settings and test data would be available _____ the equipment is put into service.

a. before
b. after
c. during
d. none of the above

Chapter Two – Wiring and Protection

***Revision:* 210.8(A) – GFCI Protection**

A new provision was added to the parent text of 210.8 to indicate that measurements from receptacles to objects (such as a sink) that would qualify for GFCI protection should be measured as the "shortest path" a cord of an appliance connected to a receptacle would take without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

14. GFCI protection should be measured as the "shortest path" a cord of an appliance connected to a receptacle would take _____ piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

a. when
b. without
c. with
d. both a & b

210.8(A)(7) Ground-Fault Circuit-Interrupter Protection for Personnel

All125-volt, single-phase, 15- and 20-ampere receptacles installed within 1.8 m (6ft) of the "top inside edge of the bowl" of any dwelling unit sink (including the kitchen sink) requires GFCI protection without the measurement piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

For the 2017 NEC, revisions to this list item (7), along with an addition to the parent text of 210.8 will eliminate the necessity for GFCI protection for receptacles installed inside a cabinet (such as a receptacle for the garbage disposer) as the measurement to the sink would constitute "penetrating a cabinet door" in order to achieve this required 1.8 m (6ft) measurement. This revision makes it clear that the measurement from the receptacle to the sink ends or begins at the "top inside edge of the bowl" of the sink rather than the "outside edge" of the sink. The outside edge of a sink is three dimensional and could include the bottom of the bowl, which apparently was an unintended interpretation. In today's modern dwelling units, it is not difficult to find some unconventional sinks. This would include such things as a free-standing bowl that sits atop a countertop with no recess into the countertop at all. This revised text will help with consistent interpretation as to the method of measurement for these types of sinks. Again, literal interpretation of the previous text could have

resulted in the 1.8 m (6 ft.) measurement being addressed at the bottom of such a sink when only the "outside edge" of the sink was the driving factor.

15. All 125-volt, single-phase, 15- and 20-ampere garbage disposal receptacles installed under the sink, behind a door and within 1.8 m (6ft) of the "top inside edge of the bowl" of any dwelling unit sink _____ require GFCI protection.

a. would
b. would not
c. might
d. none of the above

210.8(8) Ground-Fault Circuit-Interrupter Protection for Personnel

Class A GCFI devices, which are designed to trip when the current to ground exceeds 4 to 6 mA (see UL 943, Standard for Ground-Fault Circuit Interrupters), have proven to be a reliable resource in reducing the number of injuries and fatalities due to electrical shock. They have saved numerous lives over the years, and they were introduced into the *Code* in the 1968 *NEC.* Class A GFCI devices have typically been associated with 125-volt, single-phase, 15- and 20-ampere applications, but what about the shock hazards and electrocutions involving higher currents and voltages, particularly in the workplace? Class A GFCI devices cannot be used where the electrical equipment employs 480 or 600 volts or is a three-phase system, yet the shock hazards exist for these applications as well.

Revisions in the 2017 *NEG* at 210.8(B) have resulted in the expansion of GFCI protection for non-dwelling unit receptacles to include all single-phase receptacles rated 150 volts to ground or less, 50 amperes or less; and three-phase receptacles rated 150 volts to ground or less, 100 amperes or less. These requirements have been expanded in recognition of the fact that shock hazards are not limited to 15- and 20-ampere, 125-volt receptacles alone at commercial/ industrial applications. Receptacles of the higher voltage and current ratings in the locations identified in 210.8(B) present similar shock hazards as those of lower voltage and current ratings.

16. The GFCI requirements at "Other Than Dwelling Units" still include coverage of 125-volt, single-phase, 15- and 20-ampere receptacles. These requirements have been expanded to include all single-phase receptacles Rated_____.

a. 150 volts to ground or less
b. 50 amperes or less.
c. 100 amperes or less.
d. both a & b

17. The GFCI requirements at "Other Than Dwelling Units" still include coverage of 125-volt, single-phase, 15- and 20-ampere receptacles. These requirements have been expanded to include all three-phase receptacles rated _____.

a. 150 volts to ground or less
b. 50 amperes or less.
c. 100 amperes or less.
d. both a & c

18. Class A GFCI devices cannot be used where the electrical equipment employs _____ volts or is a three-phase system, yet the shock hazards exist for these applications as well.

a. 277
b. 480
c. 600
d. both b & c

19. Although these devices _____ be substituted for a Class A GFCI device because of the higher tripping values (20 mA).

a. can
b. could
c. cannot
d. none of the above

20. Class A GCFI devices, which are designed to trip when the current to ground exceeds _____ mA

a. 2 to 4
b. 4 to 6
c. both a or b
d. none of the above

***New:* 210.11(C)(4) – Dwelling Units – Garage Branch Circuits**

A new requirement to require at least one 20-ampere rated branch circuit to supply dwelling unit garage 125-volt receptacle outlet(s). Previously, this branch circuit could be rated 15- or 20-ampere. Many appliances and tools used in dwelling unit garages are rated at 12- to 16-amperes or higher and demand at least a 20-ampere rated branch circuit. A 15-ampere rated branch circuit in the modern dwelling unit garage is typically not sufficient. The branch circuit supplying receptacle outlets in dwelling unit garages is now required to be a 120-volt, 20-ampere rated branch circuit. The garage receptacle outlet branch circuit is still prohibited from serving other outlets with the exception of readily accessible receptacles located outdoors.

21. A new requirement to require at least one ___-ampere rated branch circuit to supply dwelling unit garage 125-volt receptacle outlet(s).
a. 15
b. 20
c. 30
d. all of the above

***Revision:* 210.12(C) –AFCI Protection in Guest Rooms and Guest Suites**

AFCI technology that can help save lives and avoid property damage from fire-related events has been expanded to include guest rooms and guest suites of hotels and motels. Previous editions of the *Code* would extend AFCI protection to these guest quarters with a qualifying condition that "permanent provisions for cooking" must be a part of these accommodations (see 210.17, was 210.18). This new AFCI requirement does not depend on cooking provisions in order to be enforceable. The same or similar threats imposed by arcing events exist in hotel or motel guest occupancies as exist in dwelling units. In numerous cases, guest rooms and guest suites are used in the same basic fashion as school dormitories, and dormitories are already afforded the safety measures of AFCI protection.

The evolution and expansion of AFCI protection play a major role in protecting the lives and property of homeowners and their families. These families deserve the same protection while occupying a hotel room away from their home. AFCI technology is the next generation of product safety in the protection of electrical circuits. While working smoke detectors, fire extinguishers, and other safety measures provide some life-saving help, these measures are only useful after a fire has already ignited. An AFCI circuit breaker or device detects dangerous electrical conditions (arcing events) and shuts the branch circuit off before an electrical fire can ignite. The previous requirements of 210.12 were rearranged to accommodate this new requirement for guest rooms and guest suites. Requirements at 210.12(C) for AFCI protection for dormitory units were moved to 210.12(B), and the requirements at 210.12(B) for branch circuit extensions and modifications were moved to new 210.12(D).

22. New provisions were added at 210.12(C) requiring AFCI protection for all120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in _____ of hotels and motels.
a. guest rooms
b. guest suites
c. both a & b
d. none of the above

23. AFCI protection for all 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in guest rooms and guest suites of hotels and motels is required only if permanent provisions for cooking is provided.
a. true
b. false

210.52(A)(2)(1) Dwelling Unit Receptacle Outlets

When it comes to determining just how many general-use wall receptacle outlets are needed in a dwelling unit, the *Code* language found at 210.52(A)(1) through (A)(4) provides requirements and guidance. For spacing of

these required receptacles, 210.52(A)(1) states that receptacles are to be located so that "no point measured horizontally along the floor line of any *wall space* is more than 1.8 m (6ft) from a receptacle outlet." What is considered "wall space" and what is not? To answer that question, the provisions of 210.52(A)(2) step forward. During the 2011 *NEC* revision process, 210.52(A)(2)(1) was revised by adding the term "fixed cabinets" to a list of things that actually would break up a "wall space" that was 600 mm (2 ft.) or more in width. These items also include doorways and fireplaces. In reading the substantiation for adding the term "fixed cabinets," it was quite clear that the cabinets referred to were large cabinets, such as kitchen cabinets. Receptacle placement and spacing for kitchen cabinets and countertops have their set of rules at 210.52(C). The term "fixed cabinets" was added to ensure that the requirements for "1.8 m (6ft) from a receptacle outlet" wall spacing were not applied to large pantry-type cabinets occupying the space from the floor to the ceiling (with no countertop) in a kitchen area.

24. Only "fixed cabinets that do not have _____" are now considered as an item (along with doorways and fireplaces) that would not be counted as "wall space" concerning receptacle spacing and location requirements.

a. countertops
b. similar work surfaces
c. both a & b
d. none of the above

25. 210.52(A)(1) states that receptacles are to be located so that "no point measured _____ along the floor line of any *wall space* is more than 1.8 m (6ft) from a receptacle outlet."

a. horizontally
b. vertically
c. both a & b
d. none of the above

***New:* 210.71 – Meeting Room Receptacles**

New requirements for a minimum number of nonlocking-type 125-volt, 15- and 20-ampere receptacles to be installed in non-dwelling unit meeting rooms have been added. For meeting rooms with fixed walls, the receptacle outlet provisions are similar to a dwelling unit as 210.52(A)(1) through (A)(4) are referenced. A meeting room that is at least 3.6 m (12 ft.) wide and has a floor area of at least 20 m^2 (215 ft^2) would have to have at least one floor receptacle at a distance not less than 1.8 m (6 ft.) from any fixed wall. Meeting rooms with moveable room partitions will require at least one floor receptacle outlet to be installed for each 3.7 linear m (12 linear ft.) or major fraction thereof of moveable wall measured horizontally along the floor line. Currently, there is no *NEC* requirement to provide receptacle outlets in meeting rooms of commercial occupancies. A design that complies with the current minimum *NEC* requirements could result in a meeting room with no receptacle outlets at all. This addition addresses the inherent concerns relating to inadequate access to electrical power in meeting rooms. Receptacle outlets are needed to provide power along wall lines for laptop computers, displays, coffee pots, heating of catered food, and other electrical/electronic equipment.

26. A meeting room that is at least 3.6 m (12 ft.) wide and has a floor area of at least 21 m^2 (225 ft^2) but not more than 70 m^2 (760 ft^2) would have to have at least one floor receptacle at a distance not less than ____from any fixed wall.

a. 1.8 m
b. 6 ft.
c. both a & b
d. none of the above

27. Non-dwelling meeting rooms with moveable room partitions will require at least one floor receptacle outlet to be installed for each _____or major fraction thereof of moveable wall measured horizontally along the floor line.

a. 3.7 linear m
b. 6 linear ft.
c. both a & b
d. none of the above

28. New requirements for a minimum number of _____ 125-volt, 15- and 20-ampere receptacles to be installed in non-dwelling unit meeting rooms have been added.

a. nonlocking-type
b. locking-type
c. twist locking-type
d. none of the above

Revision: **230.29 – Overhead Service Conductors – Supports Over Buildings**

Revisions to 230.29 will require metal support racks or structures to be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor for grounded systems. The bonding jumper used for this bonding purpose would be required to be of the same conductor size and material as the grounded overhead service conductor. Metal racks or structures that are mounted on a roof or adjacent to a building and used to support energized conductors should be adequately bonded to limit potential shock hazards. Currently, there appears to be nothing in the *NEC* that would require these roof supports be bonded as they are not part of a service raceway or enclosure. This added language will provide installers clear bonding provisions and the AHJ a clear requirement for enforcement.

29. The bonding jumper used for this bonding purpose would be required to be _____ conductor size and material as the grounded overhead service conductor.
a. one size larger
b. one size smaller
c. of the same
d. all of the above

30. _____ that are mounted on a roof or adjacent to a building and used to support energized conductors should be adequately bonded to limit potential shock hazards.
a. Metal racks
b. Structures
c. both a & b
d. none of the above

31. Revisions to 230.29 will require metal support racks or structures to be bonded by means of a _____ to the grounded overhead service conductor for grounded systems.
a. grounding jumper
b. recognized connector
c. both a & b
d. none of the above

New: **240.67 – Arc Energy Reduction (Fuses)**

New provisions have been added to provide arc energy reduction methods of incident energy reduction for fusible switches. The benefits of an arc energy reduction requirement that reduces incident energy for circuit breakers rated 1200 amperes and greater have been well-established at 240.87. Those same methods of incident energy reduction could also be utilized with 1200 amperes and greater fusible switches. The added requirements of 240.67 are based upon the requirements in 240.87 for circuit breakers, but modified to work with fusible switches. Section 240.67(A) details the necessary documentation, and 240.67(B) addresses methods to reduce clearing times. It should be noted that this arc energy reduction requirement for fusible switches has a proposed future effective date of January 1, 2020. While de-energizing electrical equipment prior to examination or work within that equipment is the preferred procedure, NFPA 70E, *Standard for Electrical Safety in the Workplace*, recognizes and permits workers to perform some tasks within energized equipment. As with circuit breakers and 240.87, this new added requirement is intended to provide a reduced clearing time when and where justified energized work may be necessarily performed on equipment supplied by a fusible switch of 1200 amperes or greater.

32. The benefits of an arc energy reduction requirement that reduces incident energy for circuit breakers rated _____ amperes and greater have been well-established at 240.87
a. 600
b. 800
c. 1000
d. 1200

33. While de-energizing electrical equipment prior to _____ within that equipment is the preferred procedure, NFPA 70E, *Standard for Electrical Safety in the Workplace*, recognizes and permits workers to perform some tasks within energized equipment.

a. examination
b. work
c. both a & b
d. none of the above

Revision: **250.30(A)(4) – Grounding Separately Derived AC Systems – Grounding Electrode System**

Revisions were accepted for the acceptable methods of providing a grounding electrode system for a separately derived system from a grounded system. Current text at 250.30(A)(4) instills a "pecking order" for acceptable grounding electrodes for a separately derived system. Currently, "the grounding electrode shall be the nearest of one of the following: a metal water pipe grounding electrode or a structural metal grounding electrode." If these two "are not available," an exception will then allow "any of the other electrodes identified in 250.52(A) to be used if the two electrodes mentioned above are not available." The new added text at 250.30(A)(4) will allow any of the building or structure grounding electrodes described at 250.52(A) to be used as the grounding electrode for the separately derived system without an order of preference. The revised language also recognizes the water pipe and the structural metal frame as covered in 250.68(C) are not actually grounding electrodes but rather are conductors extending the grounding electrode connection.

34. Currently, "the grounding electrode shall be the nearest of one of the following: _____."

a. a metal water pipe grounding electrode
b. a structural metal grounding electrode
c. both a & b
d. none of the above

35. The revised language also recognizes the water pipe and the structural metal frame as covered in 250.68(C) are not actually grounding electrodes but rather are _____ extending the grounding electrode connection.

a. anodes
b. probes
c. conductors
d. none of the above

36. Current text at 250.30(A)(4) instills a "_____" for acceptable grounding electrodes for a separately derived system

a. hitting order
b. pecking order
c. biting order
d. none of the above

Revision: **250.52(A)(2) – Grounding Electrodes – Metal In-Ground Support Structure(s)**

Section 250.52(A) describes the conducting objects that are required to be used in a grounding electrode system with the prevailing conditions for each electrode described. In recent code cycles, performance criteria for these electrodes have been relocated to 250.68(C), leaving only qualifying conditions. The qualifying conditions for a metal frame of a building or structure [located at 250.52(A)(2)] have gone through numerous changes since the 2002 *NEC* and beyond. Two conditions exist in the 2014 *NEC* in order for a metal frame of a building or structure to qualify as a grounding electrode. The added text for the 2017 *NEC* leaves only one condition: one or more metal in-ground support structure(s) in direct contact with the earth vertically for 3.0 m (10 ft.) or more, with or without concrete encasement. The title of this subsection will change to "Metal In-Ground Support Structure(s)" to better reflect the definition of a grounding electrode, and the text will be revised to provide clarity for describing what this electrode is. The current text regarding "hold-down" bolts will be relocated to 250.68(C)(2) as performance criteria, not a qualifying condition. Typically, if a metal frame of a building or structure is driven into the ground and extends above the ground for any length, a transition from grounding electrode to grounding electrode conductor is made at the point of emergence from the earth.

37. _____conditions exist in the 2014 *NEC* in order for a metal frame of a building or structure to qualify as a grounding electrode.
    a. 1
    b. 2
    c. 3
    d. 4

38. The added text for the 2017 *NEC* leaves only one condition: one or more metal in-ground support structure(s) in direct contact with the earth vertically for _____ or more with or without concrete encasement.
    a. 2.0 m
    b. 10 ft.
    c. both a & b
    d. none of the above

39. The added text for the 2017 *NEC* leaves only one condition: one or more metal in-ground support structure(s) in direct contact _____concrete encasement.
    a. with
    b. without
    c. both a & b
    d. none of the above

40. The current text regarding "hold-down" bolts will be relocated to 250.68(C)(2) as performance criteria____.
    a. and not a qualifying condition
    b. and a qualifying condition
    c. and might be a qualifying condition
    d. all of the above

New: **250.52(B)(3) – Not Permitted for Use as Grounding Electrodes**

Decisive language was added that would prohibit the structures and/or structural reinforcing steel of an in-ground swimming pool described at 680.26(B)(1) and (B)(2) from being used as a grounding electrode for a building or structure. Detached buildings or structures with electrical power from a feeder—such as detached garages, workshops, etc.—need a grounding electrode system installed per the requirements of 250.32(A). Occasionally, these detached structures are located near in-ground permanently installed swimming pools. In certain areas of the country, the electrical installer will run a grounding electrode conductor from the electrical subpanel at the detached structure to the reinforcing steel of the conductive pool shell (belly steel) or to the structural steel of the perimeter surfaces (deck steel) and classify the pool reinforcing steel as an "other local metal underground system or structure" as described at 250.52(A)(8). Sometimes, this action is at the request of the local AHJ. This practice of using a swimming pool structure as a grounding electrode would make the swimming pool in question (and its inhabitants) a "super target" for any stray currents or ground-fault current introduced on this grounding electrode system. CMP-5 determined that it was never the intent of the *NEC* to use a pool bonding grid as a grounding electrode.

41. This practice of using a swimming pool structure as a grounding electrode would make the swimming pool in question (and its inhabitants) a "super target" for any _____ introduced on this grounding electrode system.
    a. stray currents
    b. ground-fault current
    c. none of the above
    d. both a & b

42. ____ determined that it was never the intent of the *NEC* to use a pool bonding grid as a grounding electrode.
    a. CMP-3
    b. CMP-4
    c. CMP-5
    d. CMP-6

43. Decisive language was added that would _____ the structures and/or structural reinforcing steel of an in-ground swimming pool described at 680.26(B)(1) and (B)(2) from being used as a grounding electrode for a building or structure.
    a. require

b. prohibit
c. possibly require
d. possibly prohibit

Chapter Three – Wiring Methods

***Revision:* Table 300.5 – Minimum Cover Requirements**

A new "General Note" to Table 300.5 has been recommended to resolve a potential conflict between UL 1838, *Standard for Safety for Low Voltage Landscape Lighting Systems*, and Table 300.5. The added footnote would read, "A lesser depth [other than specified by Table 300.5] shall be permitted where specified in the installation instructions of a listed low-voltage lighting system." UL 1838 permits the use of junior and hard service cords that are not rated for direct burial. As such, UL 1838 requires that the installation instructions inform the installer that the main secondary wiring is intended for shallow burial [less 150 mm (6 in.)], unless the manufacturer has provided wiring intended for direct burial. This appears to create a conflict between *NEC* 110.3(B) and Table 300.5 (column 5, row 1) since the installation instructions of listed equipment are to be followed. Per UL 1838, a conductor not identified as direct burial is to be buried less than 150 mm (6 in.); but Table 300.5 column 5 row 1 requires low-voltage landscape lighting conductors to be buried at a minimum of 150 mm (6 in.). The new footnote to the table will eliminate the conflict between Table 300.5 for listed landscape lighting systems that present no significant risk of fire or electric shock injury and are intended to be easily accessed for repair or replacement.

44. "A lesser depth [other than specified by Table_____] shall be permitted where specified in the installation instructions of a listed low-voltage lighting system."
a. 300.2
b. 300.3
c. 300.4
d. 300.5

45. UL 1838 permits the use of _____ service cords that are not rated for direct burial.
a. senior
b. junior
c. hard
d. both b & c

46. The new footnote to the table will eliminate the conflict between Table 300.5 for listed landscape lighting systems that present _____ risk of fire or electric shock injury and are intended to be easily accessed for repair or replacement.
a. minor significant
b. a significant
c. no significant
d. major significant

***Revision:* 310.15(B)(7) – Sizing Dwelling Unit Services and Feeders**

For the decades that this dwelling unit service conductor sizing provision has existed in the *NEC*, it has always applied to 120/240-volt, single-phase services and limited feeders only. For the 2017 *NEC*, a First Revision will allow the reduction in size for dwelling unit service conductors and a feeder that supplies the entire dwelling to also include systems of a 120/208-volt system to qualify as well. The original data that was used to establish the dwelling unit service conductor reduction requirements of 310.15(B)(7) was actual utility company data for 120/240-volt 3-wire single-phase systems only. Previous attempts to include 120/208-volt systems at 310.15(B)(7) have met with the argument that the grounded (neutral) conductor of a 208-volt system, which supplies only two phases of a three-phase Wye system will carry near full-line current. Other arguments against inclusion of a 120/208-volt system have included objections to the additional heat from the presence of a third current-carrying conductor as the grounded (neutral) conductor in a 120/208-volt system is a current-carrying conductor. This will be an interesting revision to watch during the public comment stage.

47. For the 2017 *NEC*, a First Revision will allow the reduction in size for dwelling unit service conductors and a feeder that supplies the entire dwelling to also include systems of a _____-volt system to qualify as well.

a. 120/240
b. 120/208
c. 120/277
d. 480/277

48. Previous attempts to include 120/208-volt systems at 310.15(B)(7) have met with the argument that the grounded (neutral) conductor of a 208-volt system, which supplies only two phases of a three-phase Wye system will carry near _____ current.

a. full-line
b. third-line
c. half-line
d. none of the above

49. Other arguments against inclusion of a 120/208-volt system have included objections to the additional _____ from the presence of a third current-carrying conductor as the grounded (neutral) conductor in a 120/208-volt system is a current-carrying conductor.

a. conduit fill
b. conductor fill
c. heat
d. current

***New:* 314.27(E) Outlet Boxes – Separable Attachment Fittings**

A new subsection (E) has been added for 314.27 to address new technology incorporating listed power supply devices, and listed locking support, and mounting receptacles and supporting means for luminaires and ceiling-suspended paddle fans to be installed in or to boxes designed for the purpose. These fittings may now be used to support and power the luminaire or ceiling-suspended paddle fan directly, thus facilitating replacement of the luminaire or ceiling-suspended paddle fan when attached in or to the box described at 314.27. This new subsection recognizes new listed technology designed to power and support luminaires and/or ceiling-suspended paddle fans from a receptacle and mounting means located in the box, rather than by direct connection to the box. This listed product will provide a secure mounting mechanism and will facilitate interchange of luminaires and ceiling-suspended paddle fans in a safe and efficient manner. It should be noted that this new language concerning locking support and mounting receptacles for luminaires is an option and not a requirement for mounting luminaires and ceiling-suspended paddle fans.

50. This new subsection recognizes new listed technology designed to power and support luminaires and/or ceiling-suspended paddle fans from a receptacle and mounting means located in the box, rather than by direct connection to the _____.

a. ceiling grid
b. building framing
c. box
d. rated fan

51. It should be noted that this new language concerning locking support and mounting receptacles for luminaires is _____ for mounting luminaires and ceiling-suspended paddle fans.

a. an option
b. a requirement
c. a new rule
d. all the above

52. A new subsection (E) has been added for 314.27 to address new technology incorporating _____ means for luminaires and ceiling-suspended paddle fans to be installed in or to boxes designed for the purpose.

a. listed power supply devices
b listed locking support
c. mounting receptacles and supporting
d. all of the above

***New:* 320.6 – Listing Requirements – Cable Wiring Methods**

New provisions have been added in a number of the cable-type wiring method articles that would require the wiring method (cable) and associated fittings to be listed and labeled. Listing is based on compliance with recognized product standards. Non-listed cables and associated fittings may not have been evaluated for compliance with such requirements; and, in some cases, lack of such compliance may make it difficult to determine acceptance in the field. For example, a non-listed cable may not function correctly with listed termination fittings. This added text will ensure that the cable will be evaluated to the appropriate product standard and be listed for use in accordance with the *NEC*. The addition of the words “and labeled” will insure that the AHJ has clear evidence that the wiring method and fittings are listed by an acceptable product evaluation organization. This new listing requirement was added for 320.6 Type AC cable; 322.6 Type FC cable; 324.6 Type FCC cable; 328.6 Type MV cable; 330.6 Type MC cable; 332.6 Type MI cable; 334.6 Type NM cable; 336.6 Type TC cable; 338.6 Type SE cable; and 340.6 Type UF cable.

53. New provisions have been added in a number of the cable-type wiring method articles that would require the wiring method (cable) and associated fittings to be _____.

a. listed
b. labeled
c. identified
d. both a & b

54. Non-listed _____ may not have been evaluated for compliance with such requirements; and, in some cases, lack of such compliance may make it difficult to determine acceptance in the field.

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

55. This added text will ensure that the cable will be evaluated to the appropriate product standard and be listed for use in accordance with the ____.

a. IBC
b. NFPA
c. NEC
d. UL

336.10(9) Uses Permitted. (Power and Control Tray Cable: Type TC)
Change at a Glance: Type TC-ER cable with a designation of "JP" will now be allowed to be installed without a raceway at dwelling units.
Code Language: 336.10 Uses Permitted. (Power and Control Tray Cable: Type TC)
Type TC cable shall be permitted to be used as follows:
(1) For power, lighting, control, and signal circuits.
(2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft.).
(3) In raceways.
(4) In outdoor locations supported by a messenger wire.
(5) For Class 1 circuits as permitted in Parts II and ill of Article 725.
(6) For non-power-limited fire alarm circuits if conductors comply with the requirements of 760-49.
(7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
(a) The cable is Type TC-ER
(b) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
(c) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
(d) The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking "TC-ER"
(e) The cable is secured at intervals not exceeding 1.8 m (6ft).
(f) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 A WG or smaller, the equipment grounding conductor must

be provided within the cable or, at the time of installation, one or more insulated conductors shall be permanently identified as an equipment grounding conductor in accordance with 250.119(B).
Exception to (7): Where not subject to physical damage, Type TCER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.
(8) Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.
(9) In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.
Exception*: Where used to connect a generator and associated equipment having terminals rated 75°C* (16~F) *or higher, the cable shall not be limited in ampacity by 334.80 or 340.80.*
Informational Note No.1: TC-ER cable that is suitable for pulling through structural members is marked "JP."
Informational Note No.2: See 725.136 for limitations on Class 2 or 3 circuits contained within the same cable with conductors of electric light, power, or Class 1 circuits.
(10) Direct buried, where identified for such use. *(was located in "Uses Not Permitted")*
Informational Note: See 310.15(A)(3) for temperature limitation of conductors

56. There are now 11 different list items under "Uses Permitted" for Type TC cable. New List Item (9) now permits Type TC-ER cable containing both power and control conductors that are identified for pulling through structural members to be installed in_____.

a. commercial garages
b. vehicle repair
c. one and two family dwelling units
d. all of the above

57. Type TC cable shall be permitted to be used as follows:

a. In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
b. The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
c. The cable is secured at intervals not exceeding 2.8 m (8ft).
d. both a & b

58. Type TC cable shall be permitted to be used as follows: (f) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized_____, the equipment grounding conductor be provided within the cable or, at the time of installation, one or more insulated conductors shall be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

a. 6 AWG or larger
b. 6 AWG or smaller
c. 8 AWG or smaller
d. 8 AWG or larger

New: **366.20 Auxiliary Gutters – Conductors Connected in Parallel**
New language was added for Article 366 with specific instruction on installing conductors in parallel in auxiliary gutters. There have been documented failures of parallel phase conductors due to inductive heating, where installed in wireways or auxiliary gutters. In addition to the requirement of each parallel phase conductor being the same length, the proper grouping of phases can reduce inductive heating and result in a more balanced load between each conductor of a parallel phase. Specific language requires parallel conductors to be installed in groups consisting of not more than one conductor per phase, neutral, or grounded conductor to prevent current imbalance in the paralleled conductors due to inductive reactance. The same parallel provisions were also added for metal wireways at 376.20 and for nonmetallic wireways at 378.20.

59. There have been documented failures of parallel phase conductors due to inductive heating, where installed in _____ gutters.

a. wireways
b. auxiliary
c. both a & b

d. none of the above

60. New language was added for Article 366 with specific instruction on installing conductors in _____ in auxiliary gutters.

a. runs
b. series
c. parallel
d. none of the above

Chapter Four – Equipment for General Use

New: 404.22 – Electronic Lighting Control Switches

A new provision requiring all electronic lighting control switches to be listed. This new provision goes on to prohibit these electronic lighting control switches from introducing current on the equipment grounding conductor during normal operation. This addition would have a future effective date of January 1, 2020. Section 404.2(C) generally requires a grounded (neutral) conductor to be installed at switch locations that control lighting loads. When CMP-9 initiated 404.2(C) in the 2011 *NEC*, it was intended to begin a process that would ultimately result in no current being intentionally introduced onto the equipment grounding system as a result of the installation of electronic switching devices, such as an occupancy sensor. Currently, existing listed products, per the manufacturer's instructions, direct the installer to utilize the "green" or bare equipment-grounding conductor to be connected to the device to act as the grounded conductor to power the electronics with 120 volts. The equipment-grounding conductor should not be used to complete this circuit under any circumstance. This new section would require the insulated grounded conductor to be installed and used with the proper listed electronic device. The future effective date provides the manufacturers a reasonable time frame to produce these switching devices with grounded conductor compatibility while being able to use existing inventory.

61. This new provision goes on to prohibit these electronic lighting control switches from introducing current on the _____ conductor during normal operation.

a. neutral
b. current carrying
c. equipment grounding
d. grounded

62. This new section would require the insulated grounded conductor to be installed and used with the proper _____ electronic device.

a. identified
b. approved
c. listed
d. marked

63. Currently, existing listed products, per the manufacturer's instructions, direct the installer to utilize the _____ equipment-grounding conductor to be connected to the device to act as the grounded conductor to power the electronics with 120 volts.

a. covered
b. green
c. bare
d. both b & c

New: 406.3(F) – Receptacle with USB Charger

New provisions have been added for Article 406 pertaining to 125-volt 15- or 20-ampere receptacles that additionally provide Class 2 power in the form of a USB charger. These new provisions require these devices to be listed and constructed such that the Class 2 circuitry is integral with the receptacle. Currently, Article 406 contains requirements for an assortment of different types of receptacles—such as an isolated-ground type receptacle, weather-resistant and tamper-resistant type receptacles—but no provisions exist requiring a receptacle providing power to Class 2 equipment to be listed. Outlet devices consisting of a Class 2 power supply and Class 2 output connector(s) are presently readily available to the public. Some of these assemblies are intended to be secured and directly connected to a duplex receptacle. The combination of the Class 2 assembly and duplex receptacle has not been investigated to national standards. The product standard for

receptacles, ANSI/UL 498, *Attachment Plugs and Receptacles*, corresponds to the required construction and to the performance requirements to evaluate the suitability of a receptacle with integral power supply with Class 2 output connectors. Requiring the use of a listed receptacle with an integral power supply with Class 2 output connectors will confirm that the installed device complies with the appropriate product standard.

64. These new provisions require Receptacles with USB Charger devices to be _____ such that the Class 2 circuitry is integral with the receptacle.
- a. listed
- b. marked
- c. constructed
- d. both a & c

65. Requiring the use of a listed receptacle with an integral power supply with Class 2 output connectors will confirm that the installed device complies with the appropriate _____.
- a. identification
- b. marking
- c. approval
- d. product standard

66. The combination of the Class __ assembly and duplex receptacle has not been investigated to national standards.
- a. 1
- b. 2
- c. 3
- d. 4

406.4(D)(4), Ex. No. 1 and Ex. No. 2 General Installation Requirements. Replacement Receptacles (AFCI)
Two new exceptions were added for the 2017 NEC following this main rule that requires AFCI protection for replacement of existing receptacles. The first exception recognizes applications where an existing two-wire receptacle (no equipment grounding conductor) is replaced, and no equipment grounding conductor can be installed. In this situation, if the panelboard where the branch circuit originates does not provide the option of a listed AFCI combination type overcurrent device, no method exists for meeting the requirement for AFCI protection for replacement receptacles (without this new exception). A GFCI receptacle is required for compliance with 406-4(D)(2)(b) and 406-4(D)(3) when replacing a non-grounding-type receptacle. At the same time, 406-4(D)(4)(1) would require a listed outlet branch circuit (OBC) type AFCI receptacle. Without this new exception, the installer was in conflict as to which *Code* rule to satisfy. The new Exception No. 1 to 406-4(D)(4) provides a resolution for this potential conflict until a receptacle that provides both GFCI and AFCI (dual function) protection simultaneously is commercially available. At the time of this writing, one manufacturer has a dual function GFCI/ AFCI receptacle commercially available. Other device manufacturers have their product submitted for listing requirements.

The second exception clarifies that the exception to 210.12(B) does not apply when replacing existing receptacles. The requirements of 210.12(B) concern AFCI protection for branch-circuit wiring in areas specified at 210.12(A) when said wiring is modified, replaced, or extended at existing dwelling units. The exception to 210.12(B) permits existing branch-circuit conductors to be modified or extended up to 1.8 m (6ft) without AFCI protection where no additional outlets or devices are installed. In a liberal interpretation, some users of the Code have claimed the exception to 210.12(B) to mean that if one were simply "to extend the conductors in an existing receptacle outlet box" [less than 1.8 m (6 ft.)], that AFCI protection could be eliminated at that particular receptacle outlet. Adding this new Ex. No.2 to 406-4(D)(4) should make it exceedingly evident that this erroneous interpretation has no validity.

Where a receptacle outlet is located in any areas specified in 210.12(A) or (B), a replacement receptacle at this outlet shall be one of the following:
(1) A listed outlet branch-circuit type arc-fault circuit interrupter receptacle
(2) A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle
(3) A receptacle protected by a listed combination type arc-fault circuit interrupter type circuit breaker
Exception No. 1: Arc-fault circuit-interrupter protection shall not be required where all of the following apply:

(1) The replacement complies with 406.4(D)(2)(b).
(2) It is impracticable to provide an equipment grounding conductor as provided by 250.130(C).
(3) A listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.
(4) GFCI/AFCI dual function receptacles are not commercially available.
Exception No.2: Section 210.12(B), Exception shall not apply to replacement of receptacles.

67. The main requirement of AFCI protection at replacement receptacles as described in the 2014 *NEC* holds true with two new exceptions added. The first new exception recognizes applications where _____ receptacle is replaced and no equipment grounding conductor can be installed.
    a. an existing two wire
    b. a new two wire
    c. an existing three wire
    d. all of the above
68. The second new exception stipulates that the exception to 210.12(B) does not apply when replacing _____ receptacles.
    a. new
    b. relocated
    c. existing
    d. all of the above

Revision: 406.12 – Tamper-Resistant Receptacles
The requirements and locations for tamper-resistant receptacles have been added to be expanded. Currently, tamper-resistant receptacles are required at dwelling units, guest rooms and guest suites of hotels and motels, and in child care facilities. The expansion would bring these safety devices to preschools and elementary education facilities; business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities; to assembly occupancies such as places of awaiting transportation, gymnasiums, skating rinks, auditoriums; and to dormitories. These expanded locations are areas that small children frequently occupy. The current exception will also be extended to these new locations. Tamper-resistant (TR) receptacles are currently limited to nonlocking-type 125-volt, 15- and 20-ampere receptacles. In the new text, “125-volt” has been removed to include all non-locking 15- and 20-ampere receptacles (not just 125-volt rated). Another interesting change to the tamper-resistant receptacle requirements is a reference to 550.13, as well as to 210.52 for areas of the dwelling unit where tamper-resistant receptacles are required. This will clarify that tamper-resistant receptacles are, indeed, required in mobile and manufactured homes.

69. The Tamper-Resistant Receptacles expansion would bring these safety devices to _____.
    a. places of awaiting transportation
    b. gymnasiums
    c. skating rinks
    d. all of the above
70. The Tamper-Resistant Receptacles expansion would bring these safety devices to _____.
    a. auditoriums
    b. dormitories
    c. service garages
    d. both a & b
71. The current Tamper-Resistant Receptacle exception will also be extended to these new locations. Tamper-resistant (TR) receptacles are currently limited to _____ receptacles.
    a. nonlocking-type 125-volt15-ampere
    b. nonlocking-type 125-volt 20-ampere
    c. locking-type 125-volt, 15- and 20-ampere
    d. both a & b
72. Another interesting change to the tamper-resistant receptacle requirements is a reference to _____ for areas of the dwelling unit where tamper-resistant receptacles are required.
    a. 550.13
    b. 210.52

c. 210.53
d. both a & b

Revision: 408.3(A)(2) – Barriers at Service Panelboards, Switchboards, and Switchgear
Panelboards have been added to the type of service equipment, along with switchboards and switchgear, that will require barriers to be placed in these service enclosures to prohibit uninsulated, ungrounded service busbars or service terminals from being exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations. Access to uninsulated live parts on the line side of a service disconnect within panelboards has been identified as a safety concern for several *Code* cycles. The added addition of panelboards would introduce a level of isolation from service-side uninsulated live parts for service panelboards in a manner similar to that currently afforded service switchboards and switchgear. Providing such protection is more readily achieved for those panelboards designed for a single-service disconnect, but is less practical for panelboards designed for multiple-service disconnects. With this in mind, the added exception would exempt this barrier provision for service panelboards with provisions for more than one service disconnect within a single enclosure as permitted by 408.36, Exceptions 1, 2, and 3. This revision is intended to complement the new construction requirement in UL 67, *Panelboards*, and address the safety concern of access to ungrounded, uninsulated live parts. This requirement for barrier-type panelboards has been in place for Canadian service equipment for many years. This will now allow an "electrically safe work condition," as defined in NFPA 70E, to be established when performing electrical work in service equipment while energized.

73. Panelboards have been added to the type of service equipment, along with switchboards and switchgear, that will require barriers to be placed in these service enclosures to prohibit uninsulated, ungrounded service busbars or service terminals from being exposed to inadvertent contact by _____ while servicing load terminations.
a. persons
b. maintenance equipment
c. both a & b
d. none of the above

74. The added addition of panelboards would introduce a level of isolation from _____-side uninsulated live parts for service panelboards in a manner similar to that currently afforded service switchboards and switchgear.
a. load
b. street
c. service
d. all of the above

75. This _____ is intended to complement the new construction requirement in UL 67, *Panelboards*, and address the safety concern of access to ungrounded, uninsulated live parts.
a. relocation
b. deletion
c. revision
d. none of the above

Revision: 422.16(B)(2) – Built-In Dishwashers
A built-in dishwasher is allowed to be cord-and plug-connected. Added revisions would allow only the receptacle outlet for a cord- and plug-connected dishwasher to be located in the space adjacent to the dishwasher. Current provisions will allow this receptacle outlet to be placed in the same space as the dishwasher or in the space adjacent to the dishwasher. UL Product Standard 749, *Household Dishwashers*, was referenced as the main reason for this added change. UL 749 requires the receptacle outlet to be installed in a location adjacent to the dishwasher and will not allow this receptacle outlet in the same space as the dishwasher, as the present edition of the *NEC* allows. This product standard also calls for a receptacle outlet to be installed within 1.83 m (6 ft.) of the appliance. With this in mind, it was amended to lengthened the cord for a built-in dishwasher from 0.9 m to 1.2 m (3 ft. to 4 ft.) to 0.9 m to 2.0 m (3 ft. to 6½ ft.), measured from the face of the attachment plug to the plane of the rear of the appliance. Some will argue that this "adjacent space" requirement will often lead to the cord passing through a cabinet divider or wall and would be in conflict with requirements in 400.8 that will not allow a flexible cord to be run through walls. This one will be interesting to watch throughout the 2017 *NEC* development process.

76. Revisions would allow only the receptacle outlet for a cord- and plug-connected dishwasher to be located in the space _____ to the dishwasher.

a. behind
b. below
c. adjacent
d. all of the above

77. This product standard also calls for a receptacle outlet to be installed within _____ of the appliance.

a. 5’
b. 6’
c. 6’-6”
d. 5’-6”

Article 425 – Fixed Resistance and Electrode Industrial Process Heating Equipment

This new article provides requirements for industrial process heating equipment. At present, the *NEC* does not provide general and specific requirements for this equipment. The new article will apply to boilers, electrode boilers, duct heaters, strip heaters, immersion heaters, process air heaters, or other approved fixed electrical equipment used for commercial and industrial process heating. It will not apply to heating and room air-conditioning for personnel spaces.

78. The new article will apply to boilers, electrode boilers, duct heaters, strip heaters, immersion heaters, process air heaters, or other approved fixed electrical equipment used for _____ process heating.

a. commercial
b. industrial
c. retail
d. both a & b

Revision: 445.11 – Marking (Generators)

This section involving a generator's nameplate marking was revised into a list format for stationary and portable generators rated more than 15 kW. The word "impedance" was replaced with the word "reactance." Generators rated more than 15 kW are now also required to be marked with the maximum short-circuit current for inverter-based generators. The requirement for the nameplate to provide the "power factor" for all stationary and portable generators rated more than 15 kW has been moved to the first sentence of 445.11 so as to apply to all sizes of generators. For stationary and portable generators rated more than 15 kW, the term "time rating" was replaced with "power rating category."

79. The word "impedance" was replaced with the word "_____." Generators rated more than 15 kW are now also required to be marked with the maximum short-circuit current for inverter-based generators.

a. transient impedances
b. transient reactances
c. reactance
d. maximum short-circuit current

Chapter Five – Special Occupancies

Relocation: 500.2 – Definitions: Hazardous (Classified) Locations

The existing definitions presently located at 500.2 have been relocated to Article 100 to comply with the *NEC Style Manual*, which states that a definition used in two or more articles is required to be located in Article 100. Some of these definitions are already located in Article 100 and duplicated at 500.2. Other definitions that applied to two or more articles in Articles 501 through 516 were placed at 500.2 for convenience to the users of these hazardous (classified) location articles; this placement also violates the *NEC Style Manual*. Some in the electrical industry will argue that definitions that are only applicable to *NEC* Chapter 5 need to remain within the .2 sections within the articles in Chapter 5 so that the information needed for the hazardous location user is readily available, since these users typically don’t get too far outside of *NEC* Chapter 5. This will be another interesting change to follow during the 2017 *NEC Code* development process.

80. The existing definitions presently located at 500.2 have been relocated to Article 100 to comply with the *NEC Style Manual*, which states that a definition used in _____ articles is required to be located in Article 100.
a. 1
b. 2
c. more than 2
d. both b & c

Revision: 501.10(B)(1) – Wiring Methods for Class I, Division 2

The wiring methods permitted for Class I, Division 2 locations have been expanded to include rigid metal conduit (RMC) and intermediate metal conduit (IMC) with listed threadless fittings. According to CMP-14, these wiring methods provide an appropriate level of safety for a Class I, Division 2 location. There seems to be little validation for currently requiring only threaded couplings and fittings for RMC and IMC in Class I, Division 2 locations since the present *Code* requirements permit cables with threadless fittings to be installed in Class I, Division 2 locations. Sealing with threaded connections at the Class I, Division 2 boundaries is already addressed at 501.15(B)(2). Cablebus was added as it provides a level of safety equivalent to the other wiring methods permitted for Class I, Division 2 locations. According to the substantiation, cablebus is similar to installed cable tray with spacing on the conductors. Cable tray is already allowed in a Class I, Division 2 location, so cablebus with insulated cables should be an allowed wiring method as well.

81. The wiring methods permitted for Class I, Division 2 locations have been expanded to include rigid metal conduit (RMC) and intermediate metal conduit (IMC) with _____ fittings.
a. marked threadless
b. approved threadless
c. listed threadless
d. identified threadless

82. The wiring methods permitted for Class I, Division 2 locations have been expanded to include the addition of electrical metallic tubing (EMT) with listed fittings.
a. true
b. false

83. According to CMP-14, these above wiring methods provide an appropriate level of safety for a ___ location.
a. Class I, Division 2
b. Class 2, Division 2
c. Class I, Division 1
d. all of the above

New: Tables 511.3(C) and 511.3(D) – Tables for Major and Minor Repair Garages

Two new tables have been added at 511.3. These tables contain detailed information on the extent of the classified locations for major and minor repair garages with heavier-than-air fuel and the extent of classified locations for major repair garages with lighter-than-air fuel, respectively. In order to align with NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*, 511.3(C) and 511.3(D) are to be replaced respectively in their entirety with a new 511.3(C) covering both major and minor repair garages where heavier than air gaseous Class I liquids are transferred or dispensed, and a new 511.3(D) covering major repair garages where vehicles using lighter than air gaseous fuels are repaired or stored. These new tables are replicas of the corresponding portions of Table 8.3.2 of NFPA 30A. These tables are similar in structure to the tables in Article 514 and should provide the same “user-friendly” format as their Article 514 counterparts.

84. Two new tables have been added at 511.3. These tables contain detailed information on the extent of the classified locations for _____ repair garages with heavier-than-air fuel.
a. major
b. minor
c. basic
d. both a & b

85. Two new tables have been added at 511.3. These tables contain detailed information on the extent of the classified locations for the extent of classified locations for major repair garages with _____, respectively.
a. heavier-than-air fuel
b. lighter-than-air fuel
c. lighter-than-fuel
d. both a & b

86. 511.3(C) and 511.3(D) are to be replaced respectively in their entirety with a new 511.3(C) covering both major and minor repair garages where heavier than air gaseous Class _____ are transferred or dispensed.
a. I liquids
b. I & II liquids
c. I fuels
d. I & II fuels

Revisions: 517.2 – Definitions: Health Care Facilities

Several definitions for health care facilities were to be updated to match recent changes to definitions in NPFA 99, *Health Care Facilities Code*, and to update extracted material references. One of the more interesting revised definitions was to the term, *Health Care Facilities*. This term now will include buildings, portions of buildings, or "mobile enclosures" in which human medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. Previously, it was difficult to include a mobile recreational vehicle (RV) or a mobile home being used on a temporary basis as a medical health care facility because "mobile enclosures" were not in the definition of a health care facility. For the 2015 edition of NFPA 99, the list of examples of occupancies that may qualify as a health care facility was removed, resulting in the same change in *NEC* Article 517. A new informational note will follow the definition of "Health Care Facilities" as this list is valuable to installers and inspectors in identifying certain types of occupancies that may qualify and require compliance with Article 517.

87. *Health Care Facilities*. This term now will include buildings, portions of buildings, or "mobile enclosures" in which human _____ care are provided.
a. medical or dental
b. psychiatric or nursing
c. obstetrical or surgical
d. all of the above

88. Previously, it was difficult to include a _____ being used on a temporary basis as a medical health care facility because "mobile enclosures" were not in the definition of a health care facility.
a. recreational vehicle
b. RV
c. mobile home
d. all of the above

89. A new informational note will follow the definition of "Health Care Facilities" as this list is valuable to installers and inspectors in identifying certain types of occupancies that may qualify and require compliance with Article _____.
a. 516
b. 517
c. 518
d. 519

517.16 Use of Isolated Ground Receptacles. (Health Care Facilities)

Isolated ground receptacles are permitted to have their grounding terminal purposely insulated from the receptacle mounting means for the reduction of electrical noise (electromagnetic interference) on the grounding circuit [see 250.146(D)]. The isolated ground receptacle grounding terminal is to be connected to an insulated equipment grounding conductor run with the circuit conductors. Once again, for the sake of the reduction of electrical noise, this isolated ground equipment grounding conductor is permitted to pass through one or more panelboards without a connection to the panelboard grounding terminal bar as well as pass through boxes, wireways, or other enclosures without being connected to such enclosures. The requirements of 406.3(D) calls for isolated ground receptacles to be identified by an orange triangle located on the face of the receptacle.

Changes were made to 517.16 for the 2014 NEC to make it clear that isolated ground receptacles were not permitted to be installed within a patient care vicinity of a health care facility. Changes to the 2011 *NEG* at 517.16 prohibited the use of isolated ground receptacles in the entire health care facility. This was a problem as NFPA 99 (Health Care Facilities Code) allows the use of isolated ground receptacles in health care facilities while forbidding their use within patient care vicinities only [see NFPA 99 6.3.2.2.7.1(A) and 6.3.2.2.7.1(B)]. New provisions were added to 517.16 pertaining to the proper installation of isolated ground receptacles located outside of a patient care vicinity. The prohibition of isolated ground receptacle inside a patient care vicinity are addressed at 517.16(A) and isolated ground receptacles installed outside a patient care vicinity are addressed at 517.16(B).

90. For the sake of the reduction of electrical noise, this isolated ground equipment grounding conductor is permitted to pass through _____ panelboards without a connection to the panelboard grounding terminal bar as well as pass through boxes, wireways, or other enclosures without being connected to such enclosures.

a. one
b. more than one
c. both a & b
d. none of the above

91. The requirements of 406.3(D) calls for isolated ground receptacles to be identified by an _____ located on the face of the receptacle.

a. orange rectangle
b. orange circle
c. orange triangle
d. none of the above

Chapter Six – Special Equipment

New: 600.34 – Photovoltaic (PV) Powered Signs

A new section and a new definition have been added to Article 600 to cover signs that are powered by a solar photovoltaic (PV) system. These types of signs are defined as a complete sign powered by solar energy consisting of all components and subassemblies for installation either as an off-grid stand-alone, on-grid interactive or non-grid interactive system. The installation rules for the PV system are found in Article 690. Signs are a special application of PV equipment requiring special installation instructions. These PV-powered signs are described and covered by UL Standard 48, *Electric Signs*, Section 4.4.4.12. This new section of *NEC* Article 600 will provide rules for field wiring and the installation and safe usage of PV-powered signs. This section is also intended to harmonize Article 600 with Article 690 and the end use of PV signs constructed per UL 48.

92. Photovoltaic (PV) Powered Signs are defined as a complete sign powered by solar energy consisting of all components and subassemblies for installation either as an _____ system.

a. off-grid stand-alone
b. on-grid interactive
c. non-grid interactive
d. all of the above

93. This new section of *NEC* Article 600 will provide rules for _____ of PV-powered signs.

a. field wiring
b. the installation
c. safe usage
d. all of the above

Deletion: Table 680.10 – Minimum Cover Depths – Swimming Pools

Do the requirements for underground wiring related to swimming pools located in 680.10 apply outside the 1.5 m (5 ft.) radius of a swimming pool? These and other questions will answered as Section 680.10 has been revised to clarify which underground wiring can or cannot be installed under and around swimming pools. This also clarifies that the wiring methods underground near swimming pools must be installed in a manner to withstand the conditions unique to the pool environment, and that only wiring related to swimming pools may

be run under the pool to feed such things as underwater wet-niche luminaires, etc. The revised text resolves some possibly conflicting language stating that only swimming pool-related wiring may be installed underground within 1.5 m (5 ft.); and then in the next sentence, 680.10 permits other wiring within the 1.5 m (5 ft.) zone limited to pool-related wiring. CMP-17 determined that all underground wiring should be installed per the burial depths of Table 300.5, thus eliminating the requirement for Table 680.10.

94. The revised text resolves some possibly conflicting language stating that only swimming pool-related wiring may be installed underground within _____.

a. 1.5 m
b 5 ft.
c. both a & b
d. none of the above

95. This also clarifies that the wiring methods underground near swimming pools must be installed in a manner to withstand the conditions unique to the pool environment, and that only wiring related to swimming pools may be run _____ the pool to feed such things as underwater wet-niche luminaires, etc.

a. along side
b. near
c. under
d. over

96. CMP-17 determined that all underground wiring should be installed per the burial depths of Table 300.5, thus _____ the requirement for Table 680.10.

a. eliminating
b. reducing
c. confirming
d. none of the above

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

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. Where installed in noncorrosive environments (such as in the interior of a dwelling unit), branch circuits wiring methods for permanently installed swimming pool pump motors only need to comply with the general requirements of wiring methods mentioned in Chapter 3 of the *NEC.*

97. Where installed in noncorrosive environments the branch circuits wiring methods for permanently installed swimming pool pump motors only need to comply with the general requirements of wiring methods mentioned in Chapter ___ of the *NEC.*

a. 2
b. 3
c. both a & b
d. none of the above

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

In the 2014 *Code* cycle, 680.22(A)(2) [previously 680.22(A)(1)] eliminated the need for a locking-type configuration. If the convenience receptacles of 680.22(A)(3) do not require a locking configuration, why would the circulation and sanitation receptacle need a locking configuration? This 1.83 m (6ft) distance is considered sufficient based on the cord lengths [typically less than 1.83 m (6ft)] of appliances and utilization equipment likely to be used around permanently installed swimming pools.

For the 2017 *NEG,* 680.22(A)(2) reduced the minimum distance of "3.0 m (10 ft.) from the inside walls of the pool" for the pool pump receptacle outlet to "not less than 1.83 m (6 ft.) from the inside walls of the pool." The requirement for the pool pump motor receptacle outlet to consist of a single receptacle configuration was also eliminated. Once again, why would the pool pump motor receptacle outlet need to be located 3.0 m (10 ft.) from the inside walls of the pool or be a single receptacle configuration if any convenience receptacle outlet cannot be located less than 1.83 m (6ft) from the inside walls of the pool and be of the duplex type configuration?

Pool pump motor receptacle outlets are still required to be GFCI-protected. GFCI receptacle devices commonly consist of the duplex configuration. The previous list format historically employed at 680.22(A)(1) was also eliminated as only two conditions remain for the pool pump motor and these remaining conditions were compiled into one sentence.

98. The requirement for the pool pump motor receptacle outlet to consist of a single receptacle configuration was also _____.
    a. revised
    b. amended
    c. eliminated
    d. moved
99. The requirement for the pool pump motor single locking receptacle has been eliminated.
    a. true
    b. false

Revision: 690.8(A)(1) – Calculation of Maximum PV Source Circuit Current

Added revisions to the calculation methods for photovoltaic (PV) systems would allow engineering supervision to be used in calculating maximum source circuit current for PV systems with a generating capacity of 100 kilowatts or greater. Current provisions only allow this current to be calculated by the sum of parallel PV module rated short-circuit currents multiplied by 125 percent. The substantiation of this revision points out that an engineer qualified to design PV systems is capable of making the necessary calculations or running the necessary simulations to develop accurate maximum circuit currents of PV source circuits based on the specifics of an installation location. While the use of short-circuit current method as the maximum current is still allowed, recent improvements in ground-fault protection could make the use of short-circuit current as the maximum current an obsolete concept. The new text allowing the calculated maximum current value using the engineering supervision method is not permitted to be less than 70 percent of the value calculated using rated short-circuit currents methods.

100. The new text allowing the calculated maximum current value using the engineering supervision method is not permitted to be less than ____ percent of the value calculated using rated short-circuit currents methods.
    a. 70
    b. 80
    c. 125
    d. 100
101. New revisions to the calculation methods for photovoltaic (PV) systems would allow engineering supervision to be used in calculating maximum source circuit current for PV systems with a generating capacity of ____ kilowatts or greater
    a. 70
    b. 80
    c. 125
    d. 100
102. Current provisions only allow this current to be calculated by the sum of parallel PV module rated short-circuit currents multiplied by _____ percent.
    a. 70
    b. 80
    c. 125
    d. 100

Article 691 – Large-Scale Photovoltaic (PV) Electric Supply Stations

Large-scale photovoltaic (PV) stations are designed for the supply of merchant power into the electricity grid. These stations are differentiated from most building-mounted and other decentralized solar power applications in that they supply power at the utility level, rather than to local users. They are sometimes referred to as *solar farms*, especially when located in agricultural areas. A *utility-scale solar system* is sometimes used to describe this type of large-scale project. The rapid increase in the number of large-scale PV electric supply stations

presents new challenges to authorities having jurisdiction (AHJs). Due to the complexity of these systems, it is unlikely that the AHJ will have expertise in the design and construction of multi-megawatt PV power plants. Many of the components of a large-scale PV electric supply station do not and cannot comply with the current requirements of Article 690 of the *NEC*. According to the substantiation, the two main drivers for this new article are: 1) elimination of AHJ professional risk when assessing compliance of large-scale PV electric supply stations, and 2) enabling system engineers to use engineering best practices in the design of large-scale PV electric supply stations.

103. Large-Scale Photovoltaic (PV) Electric Supply Stations are differentiated from most building-mounted and other decentralized solar power applications in that they supply power at the _____ level.

a. user
b. local
c. business
d. utility

104. Large-Scale Photovoltaic (PV) Electric Supply Stations are sometimes referred to as _____, especially when located in agricultural areas.

a. solar farms
b. utility-scale solar system
c. both a & b
d. none of the above

105. Many of the components of a large-scale PV electric supply station do not and cannot comply with the current requirements of Article ____ of the *NEC*.

a. 689
b. 690
c. 691
d. 692

New: 695.15 – Surge Protection for Fire Pumps

A new provision was added for fire pumps that would require a listed surge protection device to be installed in or on the fire pump controller. A surge protection device (SPD) is necessary to provide protection for the fire pump controller. According to the substantiation for this new SPD requirement, a study titled, "Data Assessment for Electrical Surge Protective Devices" commissioned by the NFPA Fire Protection Research Foundation, showed that 12% of the fire pumps tested had damage due to voltage surges. Much of this damage could have been prevented with properly sized surge protective devices. With fire pumps being so critical for life-safety, SPDs are a small price to pay to ensure these precarious devices remain in good working condition.

106. According to the substantiation for this new SPD requirement, a study titled, "Data Assessment for Electrical Surge Protective Devices" commissioned by the NFPA Fire Protection Research Foundation, showed that ____% of the fire pumps tested had damage due to voltage surges.

a. 10
b. 12
c. 15
d. 20

107. A new provision was added for fire pumps that would require a _____ surge protection device to be installed in or on the fire pump controller

a. marked
b. approved
c. listed
d. identified

Chapter Seven – Special Conditions

New: 700.3(F) – Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power for Emergency Systems

New prescriptive language was added to 700.3 detailing requirements, along with an exception, that recognizes whether a permanent switching means to connect temporarily an alternate source of power (such as a generator) is or is not required. If the emergency system relies on a single alternate source of power and this system must be disabled for maintenance or repair, the emergency system must include permanent switching means to connect a temporary alternate source of power for the duration of the maintenance or repair. The existing last paragraph in 700.4(B) provides a performance-based requirement for a portable or temporary alternate source to be available whenever the emergency generator is out of service for "major" maintenance or repair. The term *major* is very subjective, and no prescriptive requirements currently exist for this situation. Minor maintenance such as an oil change would not be considered major maintenance but could disable a generator source for several hours.

108. If the emergency system relies on a single alternate source of power and this system must be disabled for maintenance or repair, the emergency system must include permanent switching means to connect a temporary alternate source of power for the duration of the _____.
    a. maintenance
    b. repair
    c. replacement
    d. both a & b
109. Maintenance such as an oil change that could disable a generator source for several hours defines:
    a. major
    b. minor
    c. both a & b
    d. none of the above

New: 700.25 – Branch Circuit Emergency Lighting Transfer Switch

A new section was added to Article 700. This would permit emergency lighting loads supplied by branch circuits, rated at not greater than 20 amperes, to be transferred from the *normal* branch circuit to an *emergency* branch circuit using a listed branch-circuit emergency-lighting transfer switch. This provision goes on to clarify that the mechanically held requirements of 700.5(C) are not to apply to listed branch-circuit emergency-lighting transfer switches. This addition is intended to accommodate a new class of transfer switching devices intended for operation of individual branch circuits in an emergency lighting system.

During the 2011 *Code* cycle, 700.24 (now 700.25) was added to the *NEC*. This section covers the requirements for automatic load control relays (ALCR). The section specifically states: "The load control relay shall not be used as transfer equipment." These devices are evaluated in accordance with UL 924, *Standard for Emergency Lighting and Power Equipment*. These ALCRs were never intended for use as general-purpose transfer equipment, even though these devices fall within the *NEC* definition of *transfer equipment*.

Currently, listed ACLRs with transfer features are being installed in the field in violation of current *NEC* 700.25. Most of these devices have undergone no evaluation as emergency transfer switches. These devices, along with transfer-capable ALCRs, are now being listed and evaluated under UL Product Standard 1008, *Transfer Switch Equipment* as "Branch Circuit Emergency Lighting Transfer Switches" (BCELTS).

BCELTS devices will now be evaluated for comparable performance and construction requirements as those applied to traditional emergency-transfer switches when used on branch circuits rated up to 20 amperes.

110. A new section was added to Article 700 would permit emergency lighting loads supplied by branch circuits, rated at not greater than ___ amperes, to be transferred from the *normal* branch circuit to an *emergency* branch circuit.
    a. 15
    b. 20
    c. 30
    d. 40
111. A new section was added to Article 700 would permit emergency lighting loads supplied by branch circuits, rated at not greater than (reference above question) amperes, to be transferred from the *normal* branch circuit to an *emergency* branch circuit using a _____ branch-circuit emergency-lighting transfer switch.
    a. marked

b. approved
c. listed
d. identified

112. This addition is intended to accommodate a new class of transfer switching devices intended for operation of _____ branch circuits in an emergency lighting system.
a. multi
b. individual
c. several
d. none of the above

Article 706 – Energy Storage Systems

This article is to apply to all permanently installed *energy storage systems* (ESS) that may be stand-alone or interactive with other electric power production sources. An energy storage system is a device, or more than one device assembled together, capable of storing energy for use at a future time. ESS(s) include but are not limited to electrochemical storage devices (e.g., batteries), flow batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy. Currently, batteries are addressed in numerous places in the *NEC* — such as Articles 480 (historically covering lead-acid batteries) and 690 (batteries in general, not just lead acid) to PV systems, which have been appropriate over time. The current state of energy storage technology, which includes batteries, and the anticipated evolution of energy storage support the need for a singular set of requirements in the *NEC* covering such systems.

113. ESS(s) include but are not limited to _____.
a. electrochemical storage devices (e.g., batteries)
b. flow batteries & capacitors
c. kinetic energy devices (e.g., flywheels and compressed air)
d. all of the above

114. ESS(s). This article is to apply to all permanently installed *energy storage systems* (ESS) that may be _____ with other electric power production sources.
a. stand-alone
b. interactive
c. retroactive
d. both a & b

115. ESS(s) systems can have ____ output for utilization and can include inverters and converters to change stored energy into electrical energy.
a. ac
b. dc
c. both a & b
d. none of the above

Article 712 – Direct-Current Microgrids

A *direct-current microgrid* (dc microgrid) is defined as a power distribution system consisting of one or more interconnected dc power sources, dc–dc converters, dc loads, and ac loads powered by dc–ac inverters. A dc microgrid is typically not directly connected to an ac primary source of electricity, but some dc microgrids interconnect via one or more dc–ac bi-directional converters or dc–ac inverters. DC microgrids are related to the direct utilization of power from dc sources to direct-current loads—such as LED lighting, communications equipment, computers and servers, variable-speed motor drives, HVAC equipment, etc. Direct utilization of dc—whether generated by PV systems, fuel cells or other means, without intervening dc–ac and ac–dc conversion steps—leads to higher efficiencies and potentially smaller and lower-cost equipment than AC–coupled methods. The need for higher efficiency in telecom and data centers has driven these industries to implement dc microgrids in hundreds of data centers around the world. It is a trend that will likely continue as worldwide data centers use about 30 GW of electrical power, with the USA using about 10 GW.

116. A dc microgrid is typically directly connected to an ac primary source of electricity, but some dc microgrids interconnect via one or more dc–ac bi-directional converters or dc–ac inverters.

a. true
b. false

117. A *direct-current microgrid* (dc microgrid) is defined as a power distribution system consisting of _____ interconnected dc power sources, dc–dc converters, dc loads, and ac loads powered by dc–ac inverters.

a. one
b. two
c. more than one
d. all of the above

770.48(A) and (B) Optical Fiber Cables Entering Building

The point of entrance for optical fiber cables can now be extended when enclosed in rigid metal conduit (RMC) or intermediate metal conduit (IMC). Nonconductive outside plant optical fiber cables cannot be installed in PVC or EMT in risers, ducts and plenums for environmental air, and other places used for environmental air.

The provisions of 770.48(A) permits unlisted conductive and nonconductive outside plant optical fiber cables to be installed in building spaces (other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air). This outside plant optical fiber cable is only permitted to be installed in building spaces where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft.) and the cable enters the building from the outside and is terminated in an enclosure. The term *outside plant* refers to all the cables, conduits, ducts, poles, towers, repeaters, repeater huts, and other equipment located between a demarcation point in a switching facility and a demarcation point in another switching facility or the customer premises. Simply put, this is the portion of the optical fiber cable system or network that resides outside the facilities, connecting to the outside world.

118. This outside plant optical fiber cable is only permitted to be installed in building spaces where the length of the cable within the building, measured from its point of entrance, does not exceed _____ and the cable enters the building from the outside and is terminated in an enclosure.

a. 15 m
b. 50 ft.
c. both a & b
d. none of the above

119. Nonconductive outside plant optical fiber cables ____ be installed in PVC or EMT in risers, ducts and plenums for environmental air, and other places used for environmental air

a. can
b cannot
c. either a or b
d. none of the above

Chapter Eight – Communication Systems

Revision: 840.48 – Unlisted Wires and Cables Entering Buildings for Premises-Powered Broadband Communications Systems

In order to expand the coverage of Article 840, there is an addition to recognize both twisted pair and coaxial cable-based systems in addition to optical fiber-based systems. In addition to the current reference to 770.48 for installations of unlisted optical fiber cables entering buildings, new references have been added for 800.48 unlisted communications wires and unlisted multi-paired communications cables entering buildings, and 820.48 for unlisted coaxial cables entering buildings.

The term *optical network terminal (ONT)* at 840.2 was revised to *network terminal*, and the definition was revised to accommodate twisted pair-based and coaxial cable-based systems in addition to optical fiber-based systems.

Informative Annex D – Examples

Revision/New: Example D7 – Sizing of Service Conductors for Dwelling(s)

The example for sizing of service conductor for dwelling units at Example D7 was revised to clarify the use of correction and adjustment factors. The example would now include provisions for sizing dwelling unit service

conductors with no required adjustment or correction factors, and provisions with required temperature correction factors such as ambient temperature correction factors at Table 310.15(B)(2)(a). The previous table information that was located in Table 310.15(B)(7) prior to the 2014 NEC was re-inserted at Example D7. This table was added to show the dwelling-unit service conductor sizes required if there were no adjustment or correction factors to be applied.

This article is an effort to provide readers with current information about revisions that have been approved thus far in the 2017 *NEC Code* development process. Part 1 of these revisions covering key changes located in *NEC* Chapters 1 through 3 was published in the May-June 2015 issue of IAEI magazine. These changes are not set in stone as we are still in the middle of the 2017 *NEC* development process and are subject to changes based on Public Comments, etc. The final version of the 2017 *NEC* is scheduled be published in September 2016. These changes and many others will be featured in IAEI's *Analysis of Changes*, 2017 *NEC* scheduled to be published during the same time frame as the 2017 *NEC*.

120. The term *optical network terminal (ONT)* at 840.2 was revised to *network terminal*, and the definition was revised to accommodate _____ systems in addition to optical fiber-based systems.

a. twisted pair-based
b. coaxial cable-based
c. both a & b
d. none of the above

2017 NEC Changes Part 1-Quiz Answer Sheet

1	a b c d	41	a b c d	81	a b c d
2	a b c d	42	a b c d	82	a b c d
3	a b c d	43	a b c d	83	a b c d
4	a b c d	44	a b c d	84	a b c d
5	a b c d	45	a b c d	85	a b c d
6	a b c d	46	a b c d	86	a b c d
7	a b c d	47	a b c d	87	a b c d
8	a b c d	48	a b c d	88	a b c d
9	a b c d	49	a b c d	89	a b c d
10	a b c d	50	a b c d	90	a b c d
11	a b c d	51	a b c d	91	a b c d
12	a b c d	52	a b c d	92	a b c d
13	a b c d	53	a b c d	93	a b c d
14	a b c d	54	a b c d	94	a b c d
15	a b c d	55	a b c d	95	a b c d
16	a b c d	56	a b c d	96	a b c d
17	a b c d	57	a b c d	97	a b c d
18	a b c d	58	a b c d	98	a b c d
19	a b c d	59	a b c d	99	a b c d
20	a b c d	60	a b c d	100	a b c d
21	a b c d	61	a b c d	101	a b c d
22	a b c d	62	a b c d	102	a b c d
23	a b c d	63	a b c d	103	a b c d
24	a b c d	64	a b c d	104	a b c d
25	a b c d	65	a b c d	105	a b c d
26	a b c d	66	a b c d	106	a b c d
27	a b c d	67	a b c d	107	a b c d
28	a b c d	68	a b c d	108	a b c d
29	a b c d	69	a b c d	109	a b c d
30	a b c d	70	a b c d	110	a b c d
31	a b c d	71	a b c d	111	a b c d
32	a b c d	72	a b c d	112	a b c d
33	a b c d	73	a b c d	113	a b c d
34	a b c d	74	a b c d	114	a b c d
35	a b c d	75	a b c d	115	a b c d
36	a b c d	76	a b c d	116	a b c d
37	a b c d	77	a b c d	117	a b c d
38	a b c d	78	a b c d	118	a b c d
39	a b c d	79	a b c d	119	a b c d
40	a b c d	80	a b c d	120	a b c d

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List the name of each credential held by attendee_____

_____Credited 12 hrs

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Attendee passed the course with a greater than 70% score on date_____

Instructor's signature _____