

Instructions:

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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 analysis information as your reference materials.
5. 60 questions are listed in a straight order mini-section format throughout the complete quiz.

Course: 17959 2014 NEC Analysis Part 5

This course is valid for these credentials:

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

2014 NEC Analysis Part 5

690.2 Definitions. Two new definitions were added to Article 690: DC to DC Converter and Direct Current (dc) Combiner.

2011 NEC Requirement. These two terms were used in the 2011 NEC. NEC, but they were not defined in the 2011 NEC.

2014 NEC Change. Two new definitions were added to define two terms being used in quite a few locations in Article 690. DC to DC converter is a device that can be installed in either the PV source circuit or PV output circuit that can provide an output dc voltage and current at a higher or lower value than the input dc voltage and current. A direct current (dc) combiner is a device used in the PV source and PV output circuits to combine two or more dc circuit inputs, providing one dc circuit output.

690.5(A) Requirements for ground fault protection devices or systems for PV systems were revised into a list format. This ground-fault protection device or system must also be listed for providing PV ground-fault protection.

2011 NEC Requirement. Grounded dc photovoltaic arrays arc required to be provided with dc ground-fault protection (GFP) for the reduction of fire hazards. Ungrounded dc photovoltaic arrays are required to comply with 690.35, which are the provisions for ungrounded PV power systems. There were two exceptions to this GFP rule. The first exception dealt with ground-mounted or pole mounted PV arrays having not more than two paralleled source circuits and with all dc source and dc output circuits isolated from buildings. The second exception: PV arrays installed at other than dwelling units with equipment grounding conductor is sized in accordance with 690.45.

The GFP device or system had to be capable of detecting a ground-fault current, interrupting the flow of fault current, and providing an indication of the fault. Automatically opening the grounded conductor of the faulted circuit to interrupt the ground-fault current path shall be permitted if all conductors of the faulted circuit automatically and simultaneously open as well. Manual operation of the main PV dc disconnect cannot activate the GFP device or result in grounded conductors becoming ungrounded.

2014 NEC Change. The provisions for dc ground-fault protection (GFP) for grounded dc photovoltaic arrays were brought forward with some revisions. The second exception for other than dwelling units was deleted. The conditions for the GFP device or system were formatted into a list format. A fourth condition was added requiring the GFP device or system to be "listed" for providing PV ground-fault protection. A change allowing the automatic opening of the grounded conductor "for measurement purposes" or to interrupt the ground fault

current path allows for interruption of the grounded conductor to make the isolation measurement.

690.7(F) A new subsection was added for "Disconnects and Overcurrent Protection" at 690.7, Maximum Voltage, dealing with batteries and other energy storage devices.

2011 NEC Requirement. Storage batteries are addressed at Part VIII of Article 690. No provisions for disconnects and overcurrent protection existed in the 2011 NEC for other types of storage devices.

2014 NEC Change. Where energy storage device output conductor length exceeds 1.5 m (5 ft.), or where the circuits pass through a wall or partition, the installation is now required to comply with five specific provisions added to the 2014 NEC. See Code language provided for specific conditions.

690.9 "Overcurrent Protection" requirements were revised for clarity by grouping similar overcurrent protection requirements for PV systems together in order to make Article 690 easier to use.

2011 NEC Requirement. The requirements for overcurrent protection for PV source circuits were identified at 690.9. However, not all overcurrent protection requirements were addressed at this one 2011 NEC location.

2014 NEC Change. This section for "Overcurrent Protection" was revised for clarity. This was part of a series of revisions to group similar requirements for PV systems together in order to make Article 690 easier to use, Overcurrent device requirements from previous 690.8(B)(1) for "Overcurrent Device Ratings" were moved to 690.9(B) to group them with other overcurrent protection requirements.

690.10(E) "Utility-interactive systems" were removed from the requirements of having to have back-fed circuit breakers secured in place by an additional fastener. "Multimode" inverter output in stand-alone systems was added to the requirement.

2011 NEC Requirement. Plug-in type back-fed circuit breakers connected to a stand-alone inverter output in either stand-alone or utility-interactive systems were required to be secured in place by an additional fastener in accordance with 408.36(D). Circuit breakers that arc marked "line" and "load" are not permitted to be back-fed.

2014 NEC Change. The requirement for a utility-interactive system to have its back-fed circuit breakers secured in place by an additional fastener was removed from 690.10(E). Multimode inverter output in stand-alone systems was added to the requirement.

690.12 New provisions were added for rapid shutdown of PV systems on buildings.

2011 NEC Requirement. Disconnecting means provisions for PV systems are addressed in Part 111 of Article 690, but no provisions for a rapid shutdown of PV systems existed in the 2011 NEC.

2014 NEC Change. A new 690.12 entitled "Rapid Shutdown of PV Systems on Buildings" was added. This new section applies to PV systems installed on building roofs and would require that PV source circuits be de-energized from all sources within 10 seconds of when the utility supply is de-energized or when the PV power source disconnecting means is opened.

1. Select the two new definitions were added to Article 690.
 - a. DC to DC Converter
 - b. Direct Current (dc) Combiner
 - c. AC to DC Converter
 - d. both a & b
2. A _____ is a device used in the PV source and PV output circuits to combine two or more dc circuit inputs, providing one dc circuit output.
 - a. DC to DC Converter
 - b. Direct Current (dc) Combiner
 - c. AC to DC Converter
 - d. both a & b
3. _____ is a device that can be installed in either the PV source circuit or PV output circuit that can provide an output dc voltage and current at a higher or lower value than the input dc voltage and current.
 - a. DC to DC Converter
 - b. Direct Current (dc) Combiner
 - c. AC to DC Converter

- d. both a & b
 - 4. Requirements for ground fault protection devices or systems for PV systems were _____ into a list format.
 - a. removed
 - b. added
 - c. revised
 - d. relocated
 - 5. Grounded dc photovoltaic arrays are required to be provided with dc ground-fault protection (GFP) for the reduction of _____ hazards.
 - a. shock
 - b. short circuit
 - c. stray voltage
 - d. fire
 - 6. Ungrounded dc photovoltaic arrays are required to comply with 690.35, which are the provisions for _____ PV power systems.
 - a. grounded
 - b. ungrounded
 - c. both a or b
 - d. none of the above
 - 7. 690.7(F) A new subsection was _____ for "Disconnects and Overcurrent Protection" at 690.7, Maximum Voltage, dealing with batteries and other energy storage devices.
 - a. removed
 - b. added
 - c. revised
 - d. relocated
 - 8. 690.9 "Overcurrent Protection" requirements were _____ for clarity by grouping similar overcurrent protection requirements for PV systems together in order to make Article 690 easier to use.
 - a. removed
 - b. added
 - c. revised
 - d. relocated
 - 9. 690.10(E) "Utility-interactive systems" were _____ from the requirements of having to have back-fed circuit breakers secured in place by an additional fastener.
 - a. removed
 - b. added
 - c. revised
 - d. relocated
 - 10. "Multimode" inverter output in stand-alone systems was _____ to the requirement.
 - a. removed
 - b. added
 - c. revised
 - d. relocated
 - 11. 690.12 New provisions were added for _____ of PV systems on buildings.
 - a. disconnecting
 - b. grounding
 - c. protection
 - d. rapid shutdown
 - 12. 690.12 This new section applies to PV systems installed on building roofs and would require that PV source circuits be de-energized from all sources within 10 seconds of when the _____.
 - a. utility supply is de-energized
 - b. the PV power source disconnecting means is opened
 - c. both a & b
 - d. none of the above
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690.31 Section 690.31 was revised and reorganized for clarity and to bring PV wiring methods to one location. **2011 NEC Requirement.** Wiring methods permitted for PV systems were located at 690.31. Other wiring method provisions were located at 690.4 for "Installation"; and other wiring method provisions were located at 690.14 for "Additional Provisions."

2014 NEC Change. Section 690.31 was revised and reorganized to incorporate various wiring method provisions from previous 690.4 and 690.14. The previous and revised portions of 690.14 were variously incorporated into 690.13, 690.31, and others.

690.35(C) Ground-fault protection for ungrounded PV systems is required to be listed.

2011 NEC Requirement. Photovoltaic power systems are permitted to operate with ungrounded PV source and output circuits where the system complies with the specific conditions of 690.35(A) through (G). The requirements of 690.35(C) necessitates all PV source and output circuits be provided with a ground-fault protection (GFP) device or system that detects a ground fault, indicates that a ground fault has occurred, and automatically disconnects all conductors, or causes the inverter or charge controller connected to the faulted circuit to automatically cease supplying power to output circuits.

2014 NEC Change. The same GFP provisions for ungrounded PV power systems from the 2011 NEC were brought forward with one modification and a new provision for the GFP device or system to be listed for providing PV ground-fault protection. Clarification was given at 690.35(C)(1) to specify that the GFP device or system must possess the ability to detect ground fault(s) in the PV array dc current-carrying conductors and components.

690.41 System grounding requirements for PV systems have been revised into a list format for clarity.

2011 NEC Requirement. For a photovoltaic power source, one conductor of a 2-wire system with a PV system voltage over 50 volts and the reference (center tap) conductor of a bipolar system were required to be solidly grounded or to use other methods that accomplish equivalent system protection in accordance with 250.4(A). These provisions also called for utilizing equipment listed and identified for the use. An exception was present in the 2011 NEC which exempted PV systems complying with 690.35 (ungrounded PV systems with ground-fault protection).

2014 NEC Change. This section for "System Grounding" was revised into a list format for clarity. The reference to "over 50" volts was deleted since the list now includes all types of PV systems at any voltage. The term solidly grounded was removed for consistency. An allowance for impedance grounding and the reference to 690.5, Ground-Fault Protection, were also added for clarity when grounded 2-wire and bipolar PV systems are installed.

690.47(D) An auxiliary grounding electrode system is required to be installed in accordance with 250.52 and 250.54 at all ground and pole-mounted PV arrays and as close as practicable to roof-mounted PV arrays.

2011 NEC Requirement. This language at 690.47(D) was inadvertently removed from the 2011 NEC as it appeared in the 2008 NEC.

2014 NEC Change. New provisions were added at 690.47(D) for "Additional Auxiliary Electrodes for Array Grounding." This Code language appeared in some form from the 1996 to the 2008 NEC. Requirements for auxiliary grounding electrodes and 250.54 were added to the 2014 NEC that did not appear in the previous 2008 NEC. This subsection revived from the 2008 NEC requires a grounding electrode system to be installed at the location of all ground- and pole-mounted PV arrays and as close as practicable to the location of roof-mounted PV arrays. This grounding electrode system must meet the requirements of 250.52 for grounding electrodes and 250.54 for auxiliary grounding electrodes. These grounding electrodes are required to be connected directly to the array frame(s) or structure. See 690.47(D) Code text for additional requirements and two exceptions.

690.81 New 690.81 was added for listing requirements for PV wire used with systems over 600 volts but not exceeding 2000 volts.

2011 NEC Requirement. This listing requirement did not exist in the 2011 NEC.

2014 NEC Change. Products listed for photovoltaic systems are permitted to be used and installed in accordance with their listing. PV wire that is listed for direct burial at voltages above 600 volts but not exceeding 2000 volts is required to be installed in accordance with Table 300.50, Column I.

Article 694. The title, scope and appropriate text throughout Article 694 were revised by removing the word "small," leaving the subject of the article simply "Wind Electric Systems."

2011 NFC Requirement. Article 694 applied to small wind (turbine) electric systems that consist of one or more wind electric generators with individual generators having a rated power up to and including 100 kw.

2014 NEC Change. Article 694 now applies to wind (turbine) electric systems that consist of one or more wind electric generators. This article is no longer limited to wind (turbine) electric systems rated 100 kW and below.

13. 690.31 Section 690.31 was revised and reorganized for _____.
 - a. clarity
 - b. to bring PV wiring methods to one location
 - c. both a & b
 - d. none of the above
14. 690.35(C) Ground-fault protection for ungrounded PV systems is required to be _____.
 - a. approved
 - b. listed
 - c. labeled
 - d. marked
15. 690.41 System _____ requirements for PV systems have been revised into a list format for clarity.
 - a. bonding
 - b. grounding
 - c. both a & b
 - d. none of the above
16. 690.47(D) An auxiliary grounding electrode system is required to be installed in accordance with 250.52 and 250.54 at _____ arrays and as close as practicable to roof-mounted PV arrays.
 - a. ground- mounted PV
 - b. pole-mounted PV
 - c. both a & b
 - d. none of the above
17. 690.81 New 690.81 was added for listing requirements for PV wire used with systems over _____ volts
 - a. 240
 - b. 480
 - c. 600
 - d. 2000
18. 690.81 New 690.81 was added for listing requirements for PV wire used with systems not exceeding _____ volts.
 - a. 240
 - b. 480
 - c. 600
 - d. 2000
19. Article 694. The title, scope and appropriate text throughout Article 694 were revised by removing the word " _____," leaving the subject of the article simply "Wind Electric Systems."
 - a. large
 - b. medium
 - c. small
 - d. none of the above

700.8 Listed surge protective devices (SPD) are now required for emergency systems.

2011 NEC Requirement. Surge protection devices were not required for emergency systems in the 2011 NEC.

2014 NEC Change. A new 700.8 was added requiring a listed surge protective device (SPD) in or on all emergency systems switchboards and panelboards.

700.12(F) was reformatted into a list. For emergency systems, a separate branch circuit for unit equipment that is permitted (by exception) in a separate and uninterrupted area supplied by a minimum of three normal lighting circuits cannot be part of a multiwire branch circuit.

2011 NEC Requirement. Section 700.12 covers the general requirements for sources of power for emergency systems, Section 700.12(F) covers individual unit equipment for the emergency system. One of the provisions for the installation of emergency unit equipment requires the branch circuit feeding this unit equipment to be on the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches. An exception to this rule permits a separate branch circuit for unit equipment in a separate and uninterrupted area supplied by a minimum of three normal lighting circuits. This exception for a separate branch circuit can only be applied if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature. A second exception permits remote heads providing lighting for the exterior of an exit door to be supplied by the unit equipment serving the area immediately inside the exit door.

2014 NEC Change. The provisions for 700.12(F) were reformatted into a list format. A revision occurred with the exception [now 700.12(F)(2)(3), Exception] that permits a separate branch circuit for unit equipment in a separate and uninterrupted area supplied by a minimum of three normal lighting circuits. The revision to this exception makes it clear that this separate branch circuit cannot be part of a multiwire branch circuit. The previous second exception permitting remote heads providing lighting for the exterior of an exit door to be supplied by the unit equipment serving the area immediately inside the exit door has been revised into positive language and is now found at 700.12(F)(2)(6).

700.19 Branch circuits for emergency power or lighting are restricted from being part of a multiwire branch circuit.

2011 NEC Requirement. There were no provisions for multiwire branch circuits in Article 700 in the 2011 NEC,

2014 NEC Change. New provisions were added at 700.19 to prohibit multiwire branch circuits from serving emergency lighting and power circuits.

700.24 Emergency system luminaires and all external bypass controls are required to be individually listed for use in emergency systems.

2011 NEC Requirement. Lighting loads and circuits for emergency system lighting and power are covered in Part IV of Article 700. Control of emergency lighting circuits such as switching and dimmer controls are specified in Part V of Article 700. No provisions for directly controlled luminaires were included in Article 700; Section 700.24 addressed "Automatic Load Control Relay" in the 2011 NEC.

2014 NEC Change. A new section was added at 700.24 for "Directly Controlled Luminaires." This new provision requires emergency luminaires and the external bypass controls to be individually listed for use in emergency systems where emergency illumination is provided by one or more directly controlled luminaires. These directly controlled luminaires respond to an external control input to bypass normal control upon loss of normal power.

700.27 A licensed professional engineer or other qualified persons must design and select the selective coordination of the overcurrent protective devices for emergency systems.

2011 NEC Requirement. The overcurrent devices for emergency system(s) are required to be selectively coordinated with all supply side overcurrent protective devices. An exception to this rule would exempt selective coordination between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

2014 NEC Change. A provision was added to the "Selective Coordination" requirements for emergency systems to require this selective coordination be designed and selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems.

702.7(C) Where an optional standby systems power inlet is used for a temporary connection to a portable generator, a warning sign is required to be placed near the inlet to indicate the type of derived system involved (bonded neutral or floating neutral).

2011 NEC Requirement. A sign is required to be placed at the service-entrance equipment that indicates the type and location of on-site optional standby power sources. A warning sign is also required where the removal

of a grounding or bonding connection in normal power source equipment interrupts the grounding electrode conductor connection to the alternate power source(s) grounded conductor. These signage requirements are found at 702.7(A) and (B). No provision appeared in the 2011 NEC for signage at power inlets.

2014 NEC Change. A new provision was added at 702.7(C) for "Power Inlet" which requires a warning sign to be placed near the inlet when an optional standby systems power inlet is used for a temporary connection to a portable generator. This warning sign must indicate the type of derived system that the system is capable of delivering. The warning sign would indicate a separately derived (bonded neutral) system or a non-separately derived (floating neutral) system.

20. 700.8 Listed surge protective devices (SPD) are now _____ for emergency systems.
- a. required
 - b. recommended
 - c. available
 - d. none of the above
21. 700.12(F) was reformatted into a list. For emergency systems, a separate branch circuit for unit equipment that is permitted (by exception) in a separate and uninterrupted area supplied by a minimum of three normal lighting circuits _____ be part of a multiwire branch circuit.
- a. should
 - b. must
 - c. cannot
 - d. none of the above
22. 700.19 Branch circuits for emergency _____ are restricted from being part of a multiwire branch circuit.
- a. power
 - b. lighting
 - c. both a & b
 - d. none of the above
23. 700.24 Emergency system luminaires and all external by pass controls are required to be individually _____ for use in emergency systems.
- a. approved
 - b. marked
 - c. listed
 - d. labeled
24. 700.27 _____ must design and select the selective coordination of the overcurrent protective devices for emergency systems.
- a. A licensed professional engineer
 - b. Qualified persons
 - c. both a & b
 - d. none of the above
25. 702.7(C) Where an optional standby systems power inlet is used for a temporary connection to a portable generator, a warning sign is required to be placed near the inlet to indicate the type of derived system involved is a _____.
- a. bonded neutral
 - b. floating neutral
 - c. both a or b
 - d. none of the above

702.12 Portable generator (rated 15 kW or less) using a flanged inlet or other cord- and plug-type connection is not required to have a disconnecting means where ungrounded conductors serve or pass through a building or structure.

2011 NEC Requirement. Where an outdoor housed generator set is equipped with a readily accessible disconnecting means located within sight of the building or structure supplied, an additional disconnecting means was not required where ungrounded conductors serve or pass through the building or structure. This disconnecting means had to meet the requirements of 225.36 for having to be suitable for use as service equipment.

2014 NEC Change. This section for outdoor generator sets was divided into two subsections. Section 702.12(A), Permanently Installed Generators and Portable Generators Greater Than 15 kW, incorporated the previous provisions from 702.12 of the 2011 NEC. Section 702.12(B), Portable Generators 15 kW or less, is new. This new subsection permits portable generators (rated 15 kW or less) using a flanged inlet or other cord-and-plug-type connection to omit a disconnecting means where ungrounded conductors serve or pass through a building or structure.

705.12(D) Section 705.12(D) covering "Utility-Interactive Inverters" was reorganized for clarity.

2011 NEC Requirement. Section 705.12(D) covered the point of connection requirements for utility interactive inverters. See 2011 NEC for complete text.

2014 NEC Change. Section 705.12(D) was rearranged and reorganized for clarity. There are multiple options for connection to the load side of the service disconnecting means (overcurrent protection devices, taps, busbar, etc.). These revisions were made to provide a safe and systematic approach for the design and installation of these connections. See 2014 NEC for complete text.

708.52(D) Section 708.52(D) was revised to require separation of GFP time-current characteristics to conform to manufacturer's recommendations.

2011 NEC Requirement. Ground-fault protection (GFP) for operation with critical operations power systems (COPS) service and feeder disconnecting means is required to be fully selective such that the feeder device (but not the service device) will open on ground faults on the load side of the feeder device. For the 2011 NEC, a six-cycle minimum separation between the service and feeder ground-fault tripping bands had to be provided. Operating time of the disconnecting devices was required to be considered in selecting the time spread between these two bands to achieve 100 percent selectivity.

2014 NEC Change. For the 2014 NEC, the "six-cycle minimum separation between the service and feeder ground-fault tripping bands" and the "time spread between these two bands" was removed and replaced with provisions for the separation of GFP time-current characteristics required to conform to the manufacturer's recommendations. Consideration of all required tolerances and disconnect operating time is also required to achieve 100 percent selectivity.

725.2 New definition was added for power-limited tray cable PLTC.

2011 NEC Requirement. The terms power-limited tray cable or PLTC were used dozens of times in Article 725, such as at 725.179(E), but neither the term nor acronym was defined in the 2011 NEC.

2014 NEC Change. A new definition was added for power-limited tray cable (PLTC) in Article 725. This wiring method is defined as "a factory assembly of two or more insulated conductors rated at 300 volts, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket."

725.3(K) and (L) Two new conditions were added to "Other Articles" applying to Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits.

2011 NEC Requirement. Ten specific conditions of items were listed in the 2011 NEC at 725.3 for "Other Articles" that applied to Class 1, Class 2, and Class 3 circuits. See 2011 NEC for complete text.

2014 NEC Change. Two new conditions were added to "Other Articles" applying to Class 1, Class 2, and Class 3 circuits: Subsection (K) for "Installation of Conductors with Other Systems" and Subsection (L) for Corrosive, Damp, or Wet Locations."

725.154 and Table 725.154 Section 725.154 and subsections were revised and reference new Table 725.154 entitled "Applications of Listed Class 2, Class 3 and PLTC Cables in Buildings."

2011 NEC Requirement. The application requirements for Class 2, Class 3, and power-limited tray cables (PLTC) were addressed at 725.154(A) through (I). These subsections addressed plenums, risers, cable trays, industrial establishments, other wiring within buildings, cross-connect arrays, Class 2 and Class 3 cable substitutions, Class 2, Class 3, PLTC circuit integrity (CD cable or electrical circuit protective systems, and thermocouple circuits.

2014 NEC Change. The application requirements for Class 2, Class 3, and power-limited tray cables (PLTC) were revised for clarity and reduced to 725.154(A) through (C). What remains at 725.154 covers Class 2 and Class 3 cable substitutions; Class 2, Class 3, PLTC circuit integrity (CI) cable or electrical circuit

protective systems; and thermocouple circuits. The remainder of the previous requirements at former 725.154 was re-located to new 725.135 entitled, "Installation of Class 2, Class 3 and PLTC Cables." A new Table 725.154 entitled, "Applications of Listed Class 2, Class 3 and PLTC Cables in Buildings" follows these requirements with simplified, descriptive requirements in an easy-to-read table format.

26. 702.12 Portable generator rated ____ kW or less using a flanged inlet or other cord- and plug-type connection is not required to have a disconnecting means where ungrounded conductors serve or pass through a building or structure
- a. 5
 - b. 10
 - c. 15
 - d. 20
27. 705.12(D) Section 705.12(D) covering " _____ " was reorganized for clarity.
- a. Utility-Active Inverters
 - b. Utility-Interactive Converters
 - c. Utility-Interactive Inverters
 - d. none of the above
28. 708.52(D) Section 708.52(D) was revised to require separation of GFP time-current characteristics to conform to _____ recommendations.
- a. local
 - b. listing
 - c. manufacturer's
 - d. none of the above
29. 725.2 New definition was added for power-limited tray cable _____.
- a. PLTA
 - b. PLTB
 - c. PLTC
 - d. PLTD
30. 725.3(K) and (L) ____ new conditions were added to "Other Articles" applying to Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits.
- a. 2
 - b. 3
 - c. 4
 - d. 5
31. 725.154 and Table 725.154 Section 725.154 and subsections were revised and reference new Table 725.154 entitled " _____."
- a. Applications of Listed Class 2
 - b. Class 3
 - c. PLTC Cables in Buildings
 - d. all of the above

725.179(F) has been split into two list items for establishing cable survivability. Cables are tested either as CI cables or as part of an electrical circuit protective system.

2011 NEC Requirement. Class 2, Class 3, and Type PLTC cables along with nonmetallic signaling race ways installed as wiring methods within buildings are required to be listed as being resistant to the spread of fire. These cables and wiring methods had to meet the provisions of 725.179(A) through (L). Cables used for survivability of critical circuits had to be listed as circuit integrity (CI) cable. Cables that are part of a listed electrical circuit protective system are considered to meet the requirements of survivability.

2014 NEC Change. The two cable survivability methods at 725.179(F) were divided into two separate list items. Provisions for circuit integrity (CI) cables are now found at 725.179(F)(1), and requirements for electrical circuit protective systems are now addressed at 725.179(F)(2).

Article 728 New article entitled "Fire-Resistive Cable Systems" has been added to address installations of fire-resistive cables.

2011 NEC Requirement. This is a new article that did not appear in the 2011 NEC.

2014 NEC Change. A new article entitled "Fire-Resistive Cable Systems" has been added to address installations of fire-resistive cables. This new article informs the installer that there are different details when installing fire rated cables. These systems must be installed in accordance with very specific materials, supports, and requirements and are critical for the survivability of life safety circuits.

Article 750 New article, "Energy Management Systems," was added to address the types of loads permitted to be controlled through energy management systems.

2011 NEC Requirement. This did not exist in the 2011 NEC.

2014 NEC Change. A new article was added, which includes definitions, requirements for alternative-power sources, load-management provisions and field-marking requirements. The article provides a good basis for inclusion of general requirements to address the types of loads permitted to be controlled through energy management.

760.24 "Mechanical Execution of Work" requirements for fire alarm systems have been divided into two subsections and requirements for circuit integrity (CI) cables added.

2011 NEC Requirement. Fire alarm circuits have to be installed in a neat workmanlike manner. Fire alarm cables and conductors installed exposed on the surface of ceilings and sidewalls are required to be supported by the building structure in such a manner that the cable(s) will not be damaged by normal building use. These cables must also be supported by straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation of these cables must also comply with 300.4(D) for cables and raceways installed parallel to framing members (metal nail protectors).

2014 NEC Change. The 2011 NEC general provisions for mechanical execution of work for fire alarm systems were brought forward for the 2014 NEC. New provisions for "Circuit Integrity (CI) Cable" were added to new 760.24(B). Circuit integrity (CI) cables for fire alarm systems are required to be supported at a distance not exceeding 610 mm (24 in.). Where these cables are located within 2.1 m (7 ft.) of the floor, the cable must be fastened in an approved manner at intervals of not more than 450 mm (18 in.). The fire alarm cable supports and fasteners must be made of steel.

770.110 The title of 770.110 was revised to "Raceways and Cable Routing Assemblies for Optical Fiber Cables." New 770.110(0) was added to include provisions for "Cable Routing Assemblies."

2011 NEC Requirement. For the 2011 NEC, 770.110 addressed raceways for optical fiber cables installed within a building. These provisions dealt with the types of raceways permitted to be used with optical fiber cables. These raceways included raceways recognized in Chapter 3 as well as other permitted raceways such as listed plenum optical fiber raceways, listed plenum communications raceways, listed riser optical fiber raceways, listed riser communications raceways, listed general-purpose optical fiber raceways, or listed general-purpose communications raceways. Section 770.110(B) contains rules for raceway fill for optical fiber cables. Where optical fiber cables are installed in raceway without electric light or power conductors, the raceway fill requirements of Chapters 3 and 9 shall not apply.

2014 NEC Change. Besides the existing requirements for raceways for optical fiber cables installed within a building, provisions were added at 770.110(0) for "Cable Routing Assemblies." These new provisions make it clear that optical fiber cables are permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies. The existing title of "Other Permitted Raceways" used at 770.110(A)(2) has been replaced with the title "Communication Raceways." Communication raceway is a defined term in Article 800 that was added for the 2011 NEC.

Revisions to 770.154 and Table 770.154(a) delete references to raceways and cable routing assemblies.

2011 NEC Requirement For the 2011 NEC, Section 770.154 and Table 770.154(a) had permitted and non-permitted applications for listed optical fiber cables and raceways, and cable routing assembly types.

2014 NEC Change. References to optical fiber raceways, and cable routing assemblies were removed from 770.154 and Table 770.154(a) and were relocated to other appropriate sections of Article 770. A new Informational Note to Table 770.154(a) was added to inform users of the Code that cable routing assemblies are not addressed in NFPA-90A-2012, Standard for the Installation of Air Conditioning and Ventilation Systems.

32. 725.179(F) has been split into two list items for establishing cable survivability. Cables are tested _____.
- a. as CI cables
 - b. as part of an electrical circuit protective system
 - c. both a or b
 - d. none of the above
33. Article 728 New article entitled "Fire-Resistive Cable Systems" has been _____ to address installations of fire-resistive cables.
- a. relocated
 - b. removed
 - c. added
 - d. divided
34. Article 750 New article, "Energy Management Systems," was _____ to address the types of loads permitted to be controlled through energy management systems.
- a. relocated
 - b. removed
 - c. added
 - d. divided
35. 760.24 "Mechanical Execution of Work" requirements for fire alarm systems have been divided into _____ subsections and requirements for circuit integrity (CI) cables added.
- a. 2
 - b. 3
 - c. 4
 - d. none of the above
36. 770.110 The title of 770.110 was _____ to "Raceways and Cable Routing Assemblies for Optical Fiber Cables."
- a. relocated
 - b. removed
 - c. added
 - d. revised
37. New 770.110(C) was _____ to include provisions for "Cable Routing Assemblies."
- a. relocated
 - b. removed
 - c. added
 - d. revised
38. Revisions to 770.154 and Table 770.154(a) _____ references to raceways and cable routing assemblies.
- a. relocated
 - b. removed
 - c. added
 - d. deleted

New 770.180, Grounding Devices has been added for listing requirements (or be part of listed equipment) for grounding devices used for optical fiber cables.

2011 NEC Requirement. Grounding devices for optical fiber cables and listing of same was not covered in Article 770 in the 2011 NEC.

2014 NEC Change. A new section was added to Article 770 with requirements for grounding devices used for optical fiber cables. This new section stipulates that devices used to connect a shield, sheath, or non-current-carrying metallic members of an optical fiber cable to a bonding conductor or grounding electrode conductor (where bonding or grounding is required) must be listed or be part of listed equipment.

800.2 Definition of point of entrance has been revised by deleting "connected by a bonding conductor or grounding electrode in accordance with 800.100(B).

2011 NEC Requirement. Point of entrance was defined at 800.2 in the 2011 NEC as "The point within a building at which the wire or cable emerges from an external wall, from a concrete floor slab, or from a rigid metal conduit (Type RMC) or an intermediate metal conduit (Type IMC) connected by a bonding conductor or grounding electrode in accordance with 800.100(13)."

2014 NEC Change This definition was revised to identify that the wire or cable that emerges from an external wall is indeed a "communication" wire or cable. The phrase, "connected by a bonding conductor or grounding electrode in accordance with 800.100(B)" has been removed as well.

800.12 A new definition and new provisions have been added for Innerduct.

2011 NEC Requirement. In the 2011 NEC, the term, innerduct appeared at 770.12 for optical fiber cable and raceways. There was no definition for innerduct.

2014 NEC Change. A new requirement for "Innerduct" was added at 800.12. This new provision permits the different types of listed communications raceways to be installed as innerduct in any type of listed raceway permitted in Chapter 3. A new definition for innerduct was introduced at 800.2 as, "A nonmetallic raceway placed within a larger raceway," (Building Industry Consulting Service International dictionary).

800.179(G) A revision to 800.179(G) will now contain listing requirements for an "Electrical Circuit Protective System." A new definition for electrical circuit protective system has also been added to 800.2.

2011 NEC Requirement. Cables suitable for use in communications systems to ensure survivability of critical circuits during a specified time under fire conditions were required to be listed as circuit integrity (CI) cable. Cables identified at 800.179(A) through (E) that meet the requirements for circuit integrity must have the additional classification, using the suffix "CI." A definition of electrical circuit protective system did not exist in the 2011 NEC.

2014 NEC Change. The requirements at 800.179(G) were revised by adding requirements for electrical circuit protective systems and by adding two new list items. Section 800.179(0(1) now covers requirements for "Circuit Integrity (CI) Cables." In addition to an additional classification using the suffix "CI," this new provision specifies that in order to maintain the listed fire rating, circuit integrity (CI) cable shall only be installed in free air. Section 800.179(G)(2) now addresses "Fire-Resistive Cables." This provision requires circuit integrity (CI) cables that are part of an electrical circuit protective system to be fire-resistive cables identified with the protective system number and installed in accordance with the listing of the protective system. A new definition for electrical circuit protective system was also added to 800.2.

800.182 Revisions have occurred at 800.182(A), (B), and (C) as to the specific cable routing assembly being discussed in each subsection. Three Informational Notes have been deleted and replaced with one Informational note.

2011 NEC Requirement. The title of 800.182 was revised in the 2011 NEC to include both communications raceways and cable routing assemblies, but the subsequent subsection did not properly address cable routing assemblies specifically. All three subsections were followed by an informational note that basically referenced the same UL product standards for optical fiber raceways or optical fiber cable routing assemblies.

2014 NEC Change. Section 800.182(A), (B), and (C) were revised to reference the specific cable routing assembly being discussed in each subsection. Section 800.182(A) now addresses "Plenum Communications Raceways and Plenum Cable Routing Assemblies." Section 800.182(B) now addresses "Riser Communications Raceways and Riser Cable Routing Assemblies." Section 800.182(0 is specific for "General-Purpose Communications Raceways and General-Purpose Cable Routing Assemblies." Three repetitive Informational Notes have been deleted and replaced with a new Informational Note located in the main section as it applies to 800.180(A)(B) and (O).

810.6 Listing requirements for "Antenna Lead-in Protectors" have been added to Article 810.

2011 NEC Requirement. There were no provisions in Article 810 for antenna lead-in surge protection.

2014 NEC Change. New provisions were added at 810.6 that require radio and television equipment antenna lead-in surge protectors (when installed) to be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics. This antenna lead-in surge protector is required to be connected between the conductors and the grounded shield or other ground connection. Grounding must be accomplished using a bonding conductor or grounding electrode conductor installed in accordance with 810.21 (F) through the intersystem bonding termination (if present).

39. New 770.180, Grounding Devices has been added for listing requirements (or be part of _____ equipment) for grounding devices used for optical fiber cables.

- a. approved
 - b. marked
 - c. listed
 - d. labeled
40. 800.12 A new definition and new provisions have been added for _____.
- a. Outerduct
 - b. innerductless
 - c. Innerduct
 - d. none of the above
41. 800.2 Definition of point of entrance has been revised by deleting "connected by a _____ in accordance with 800.100(B).
- a. bonding conductor
 - b. grounding electrode
 - c. both a or b
 - d. none of the above
42. 800.179(G) A revision to 800.179(G) will now contain _____ requirements for an "Electrical Circuit Protective System."
- a. approval
 - b. marking
 - c. listing
 - d. labeling
43. A new definition for electrical circuit protective system has also been _____ to 800.2.
- a. relocated
 - b. removed
 - c. added
 - d. revised
44. 800.182 Revisions have occurred at 800.182 _____ as to the specific cable routing assembly being discussed in each subsection.
- a. (A)
 - b. (B)
 - c. (C)
 - d. all of the above
45. 800.182 Three Informational Notes have been deleted and replaced with _____ Informational note.
- a. 2
 - b. 3
 - c. 4
 - d. 1
46. 810.6 Listing requirements for "Antenna Lead-in Protectors" have been added to Article _____.
- a. 811
 - b. 809
 - c. 810
 - d. 812

820.3 New subsections for "Wiring in Ducts for Dust, Loose Stock, or Vapor Removal" and "Equipment in Other Space Used for Environmental Air" have been added to 820.3.

2011 NEC Requirement. Section 820.3 for "Other Articles" covered hazardous (classified) locations requirements of Chapter 5; installation and use requirements of 110.3; insinuations of conductive and nonconductive optical fiber cables of Article 770; communications circuit requirements of Article 800; network-powered broadband communications system requirements of Article 830; premises-powered broadband communications system requirements of Article 840; the alternate wiring methods of Article 830 being permitted to substitute for the wiring methods of Article 820; and the definition and the application requirements of Article 770 being permitted to apply to Article 820.

2014 NEC Change. Besides the 2011 NEC requirements brought forward, two new provisions were added to 820.3. Requirements of 300.22(A) were added for wiring in ducts for dust, loose stock, or vapor removal.

Section 300.22(A) basically states that no wiring systems of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors. The other new provision at 820.3 added the requirements of 300.22(0(3) for equipment in other space used for environmental air. Section 300.22(0(3) states that electrical equipment with a metal enclosure, or electrical equipment with a nonmetallic enclosure listed for use within an air handling space and having low-smoke and heat release properties shall be permitted to be installed in such space unless prohibited elsewhere. Proper Code references for cable routing assemblies were updated to coincide with changes in the 2014 NEC pertaining to cable routing assemblies.

820.47(A) Underground coaxial cables are required to be sectioned off from electric light, power, Class 1, or "non-power-limited fire alarm" circuit conductors.

2011 NEC Requirement. Underground coaxial cables were required to be in a separate section permanently separated by a suitable barrier from electric light or power conductors or Class 1 circuits when installed in a duct, pedestal, handhole enclosure, or manhole.

2014 NEC Change. "Non-power-limited fire alarm circuit conductors" were added to the type of conductors which underground coaxial cables are required to be sectioned off from when installed in a duct, pedestal, handhole enclosure, or manhole.

830.24 Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support network-powered broadband communications cables are required to be listed as having low smoke and heat release properties.

2011 NEC Requirement. Network-powered broadband communications (NPBC) circuits and equipment are required to be installed in a neat and workmanlike manner. NPBC cables installed exposed on the surface of ceilings and sidewalls are required to be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables are also required to be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. In the 2011 NEC, these NPBC cable installations had to also conform to 300.4(D) Cables and Raceways Parallel to Framing Members and Furring Strips, and 300.11 Wiring Methods Securing and Supporting.

2014 NEC Change. A new last sentence was added to the existing "Mechanical Execution of Work" requirements of 830.24. This new provision calls for nonmetallic cable ties and other nonmetallic cable accessories used to secure and support NPBC cables to be listed as having low smoke and heat release properties. The reference to 300.4(D) was also dropped from 830.24, as 830.3(F) already includes a requirement to comply with 300.4.

Chapter 9 Tables: Table 1 Table was revised to include provisions for cables as well as conductors.

2011 NEC Requirement. Table 1 of Chapter 9 was entitled, "Percent of Cross Section of Conduit and Tubing for Conductors."

2014 NEC Change. The title of Chapter 9, Table 1 was renamed, "Percent of Cross Section of Conduit and Tubing for Conductors and Cables."

47. 820.3 New subsections for "Wiring in Ducts for _____" have been added to 820.3.

- a. Dust
- b. Loose Stock
- c. Vapor Removal
- d. all of the above

48. 820.3 New subsections for "Equipment in Other Space Used for Environmental Air" have been ____ to 820.3.

- a. relocated
- b. removed
- c. added
- d. revised

49. Section 300.22(A) basically states that no wiring systems of any type shall be installed in ducts used to transport _____.

- a. dust
- b. loose stock
- c. flammable vapors

d. all of the above

50. 820.47(A) Underground coaxial cables are required to be _____ electric light, power, Class 1, or "non-power-limited fire alarm" circuit conductors.

- a. included with
- b. sectioned off from
- c. marked and included with
- d. all of the above

51. 830.24 Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support network-powered broadband communications cables are required to be_____.

- a. approval
- b. marking
- c. listing
- d. labeling

52. 830.24 Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support network-powered broadband communications cables must as having _____ properties

- a. low smoke
- b. heat release
- c. both a & b
- d. none of the above

53. Network-powered broadband communications (NPBC) circuits and equipment are required to be installed in a _____ manner.

- a. neat
- b. workmanlike
- c. both a & b
- d. none of the above

54. Chapter 9 Tables: Table 1 Table was _____ to include provisions for cables as well as conductors.

- a. relocated
- b. removed
- c. added
- d. revised

55. The title of Chapter 9, Table 1 was renamed, "Percent of Cross Section of Conduit and Tubing for _____."

- a. Conductors
- b. Cables
- c. both a & b
- d. none of the above

Chapter 9 Tables: Notes to Tables: Note (10). New Note (10) was added addressing the values for approximate conductor diameter and area shown in Table 5.

2011 NEC Requirement. There were nine (9) notes to the Chapter 9 Tables in line 2011 NBC None of these notes addressed approximate conductor diameter and area shown in Table 5.

2014 NEC Change. A new Note (10) was added to the Chapter 9 Notes to Tables. This new note indicates that the values for approximate conductor diameter and area shown in Table 5 are based on worst-case scenario. The information here goes on to indicate that Table 5 is based on round concentric-lay-stranded conductors. Solid and round concentric-lay-stranded conductors are to be grouped together for the purpose of Table 5, while round compact-stranded conductor values are shown in Table 5A. This new note gives the user of the Code permission to use the actual values of the conductor diameter and area if they are known.

Chapter 9 Tables: Table 4 Table 4 was rearranged with "Over 2 Wires 40%" as the first column after "Trade Size."

2011 NFC Requirement. Table 4 of Chapter 9 gives dimensions and percent area of different types of conduits and tubing. It covers 13 articles and 12 different types of conduits and tubing covering four pages in the 2011 NEC. Each of these tables list "Metric Designator" and "Trade Size" as the first and second columns. The

following columns from left to right were; "Nominal Internal Diameter," "Total Area 100%," "60%," "1 Wire 53%," "2 Wires 31%," and "Over 2 Wires 40%."

2014 NEC Change. Some of the internal diameter values changed in some of the tables due to the overall review of the tables for accuracy (see Proposal 8-92). The main change that happened to Table 4 was the rearrangement of the columns. "Metric Designator" and "Trade Size" are still the first and second columns. For the 2014 NEC, the next column is now "Over 2 Wires 40%" This is followed by "60%," "1 Wire 53%," and "2 Wires 31 %." The last two columns in the revised arrangement are "Nominal Internal Diameter," and "Total Area 100%."

Chapter 9 Tables: Table 5 Table 5 has been rearranged by repositioning the "Approximate Area" column next to "Size (AWG or kcmil)" column.

2011 NEC Change. Table 5 of Chapter 9 gives dimensions of insulated conductors and fixture wires. This information is needed to determine the maximum number of conductors that can be installed in a raceway or conduit in conjunction with Table 4, This table provides approximate area and diameter information on all insulation types for conductors installed in raceways and conduits. This table covers four pages in the 2011 NEC. The table has four main columns, with "Type" listed as the first column. This refers to the type of insulation. "Size (AWG or kcmil.)" is the second column. In the 2011 NEC, the third column is "Approximate Diameter" followed by "Approximate Area" as the last column on the far right of the table.

2014 NEC Change. Some of the approximate diameter and area values changed in the tables due to the overall review of the Chapter 9 tables for accuracy. Some missing insulation types were also added to the table (see Proposal 6-114 and Comment 6-79). Another important change that occurred with Table 5 was the arrangement of the columns. "Type" and "Size (AWG or kcmil)" are still the first and second columns. For the 2014 NEC, the next column is now "Approximate Area" followed by "Approximate Diameter."

Example D7 [Example using 310.15(B)(7)] New Example D7 was added to Informative Annex D describing how to apply revised 310.15(B) (7) by using a .83 percent age factor rather than the former Table 310.15(B)(7).

2011 NEC Requirement. Service-entrance, service-lateral and the main power feeder conductors for dwelling units served at 120/240 volts, 3-wire, single-phase were permitted to be sized by 310.15(B)(7) and Table 310.15(B)(7). The table had an ampacity rating for the service or main power feeder from 100 to 400 amperes, with wire sizes from 4 AWG to 400 kcmil copper and 2 AWG to 600 kcmil aluminum. This table was also permitted to be used for the feeder conductors that serve as the main power feeder to a dwelling unit. To use Table 310.15(B)(7) for selection of the main power feeder, this feeder would have had to supply all loads associated with the dwelling unit. There was no "Example D7" giving an example of sizing service-entrance conductors for dwelling units in the 2011 NEC.

2014 NEC Change. Table 310.15(B)(7) has been eliminated entirely, primarily by the actions of Proposal 6-49a and Comment 6-52. The parent text at 310.15(B)(7) has been revised and broken up into four list items. Rather than use previous Table 310.15(B)(7) for sizing service conductors and the main power feeder for dwelling units, the user of the Code is left with a calculation to perform. The ampacity values found at Table 310.15(B)(16) can be reduced by 17 percent (not less than 83 percent of the service or feeder rating), which will require the circular mils properties of Table 8 in Chapter 9 to be brought into the now required calculation. A new Informational Note will take users of the Code to this new Example D7 in Annex D for an example of how to perform this dwelling unit service and feeder calculation.

56. Chapter 9 Tables: Notes to Tables: Note (10) New Note (10) was added addressing the values for approximate conductor diameter and area shown in Table ____.

- a. 3
- b. 4
- c. 5
- d. 6

57. There were nine ____ notes to the Chapter 9 Tables in line 2011 NEC None of these notes addressed approximate conductor diameter and area shown in Table 5.

- a. 8
- b. 9
- c. 10

- d. 11
 - 58. Chapter 9 Tables: Table 4. Table 4 was rearranged with "Over ___ Wires 40%" as the first column after "Trade Size."
 - a. 2
 - b. 3
 - c. 4
 - d. 5
 - 59. Example D7 [Example using 310.15(B)(7)] New Example D7 was added to Informative Annex D describing how to apply revised 310.15(B) (7) by using a ___ percentage factor rather than the former Table 310.15(B)(7).
 - a. .63
 - b. .73
 - c. .83
 - d. all of the above
 - 60. Example D7 [Example using 310.15(B)(7)] New Example D7 was added to Informative Annex D describing how to apply revised 310.15(B) (7) factor rather than the former Table _____.
 - a. 310.15(B)(5)
 - b. 310.15(B)(6)
 - c. 310.15(B)(7)
 - d. 310.15(B)(8)
-

2014 NEC Analysis Part 5-Quiz Answer Sheet

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

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