



What's New in the 2014 NEC®: Arc-Fault Circuit Interrupters

Introduction

Now that the 2014 edition of the National Electrical Code® (NEC) has been published, let's take a look at what's new in the requirements for arc-fault circuit interrupters (AFCIs). All of the changes, and there are many, may be found in Section 210.12. (Note: quotations from the NEC are shown in italics.)

Definitions

To fully understand the following AFCI requirements, it is important to first understand the definition of the following words from Article 100:

Device. *A unit of an electrical system, other than a conductor, that carries or controls electricity as its principal function.*

Dwelling Unit. *A single unit, providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking, and sanitation.*

Outlet. *A point on the wiring system at which current is taken to supply utilization equipment.*

The following definitions, not from the NEC, also apply:

Home run—The home run is that portion of a branch circuit from the overcurrent device located in the load center (panelboard) to the first outlet box.

Parallel arc—A parallel arc is one which occurs between the line (hot) and the grounded (neutral) conductor or the equipment grounding conductor. It is called a parallel arc because it is in parallel with the load.

Series arc—A series arc is one which occurs due to a break in a conductor or connection. It is called a series arc because it is in series with the load.

Readily Accessible

AFCIs have test buttons, as do ground-fault circuit interrupters (GFCIs). Pushing the AFCI test button periodically is important to verify that the device is still providing arc fault protection. A device that is hidden behind obstacles or is in a hard to reach location will probably not be tested often, if at all. In recognition of the importance of periodic testing, the NEC now requires that AFCIs be installed in a readily accessible location, as are GFCIs.

Areas Requiring Protection

Code Making Panel 2 has continued its gradual expansion of areas in dwelling units that require AFCI protection by adding kitchens and laundry areas to the list in Section 210.12(A). This means, for example, that a basement light switch located in the living room at the head of the stairs leading to the unfinished basement would require arc fault protection. The same would be the case for switches controlling exterior or garage lights.

New Installations

Section 210.12(A) now lists six different ways to comply with the requirement to provide AFCI protection in specific dwelling unit areas. It is important to note that all of these methods are intended to protect the entire branch unit, in addition to cords plugged into it.

1. Combination-type AFCI circuit breaker:
(1) A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

This is the method that has been used for the past several years to meet the AFCI requirement in this section.

2. Branch/feeder-type AFCI circuit breaker + outlet branch circuit-type AFCI receptacle:
(2) A listed branch/feeder-type AFCI installed at the origin of the branch-circuit in combination with a listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet box on the branch-circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

The concept in this requirement is that:

- a. The branch/feeder-type AFCI circuit breaker located in the load center will protect the home run from parallel arcing.
- b. The outlet branch-circuit type arc-fault circuit interrupter (OBC AFCI) located in the first outlet box will protect the downstream conductors and any cords plugged into its face from both series and parallel arcing.
- c. The OBC AFCI will also provide series arc protection for the home run.

The purpose of marking the first outlet box at the time of rough-in is to ensure that the OBC AFCI gets installed in it at a later time.

3. Supplemental arc protection circuit breaker + outlet branch circuit-type AFCI receptacle:
(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

- a. *The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.*
- b. *The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.*
- c. *The first outlet box in the branch-circuit shall be marked to indicate that it is the first outlet of the circuit.*

The concept in this requirement is that:

- a. The supplemental arc protection circuit breaker located in the load center will protect the home run from parallel arcing. But in order for it to do so, there must be sufficient arcing fault current to cause the circuit breaker to trip instantaneously; therefore, the home run may not exceed 50 ft for 14 AWG and 70 ft for 12 AWG conductors.

- b. The OBC AFCI located in the first outlet box will protect the downstream conductors and any cords plugged into its face from both series and parallel arcing.
- c. The OBC AFCI will also provide series arc protection for the home run.

The purpose of marking the first electrical box at the time of rough-in is to ensure that the OBC AFCI gets installed in it at a later time. Requiring the home run to be continuous ensures that all downstream conductors will be protected by the OBC AFCI.

It should be noted that at the time of this writing Underwriters Laboratories® (UL®) has yet to issue an Outline of Investigation for supplemental arc protection circuit breakers, nor are any known to be on the market.

4. System combination-type AFCI

(4) A listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:

- a. *The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.*
- b. *The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.*
- c. *The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.*
- d. *The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and shall be listed as such.*

The concept in this requirement is that:

- a. The branch-circuit overcurrent device (circuit breaker) located in the load center will protect the home run from parallel arcing. But in order for it to do so there must be sufficient arcing fault current to cause it to open instantaneously, therefore, the home run may not exceed 50 ft for 14 AWG and 70 ft for 12 AWG conductors.
- b. The OBC AFCI located in the first outlet box will protect the downstream conductors and any cords plugged into its face from both series and parallel arcing.
- c. The OBC AFCI will also provide series arc protection for the home run.
- d. Testing the branch-circuit overcurrent device and OBC AFCI together and listing them will ensure that the pair will provide arc fault protection for the home run.

The purpose of marking the first outlet box at the time of rough-in is to ensure that the OBC AFCI gets installed in it at a later time. Requiring the home run to be continuous ensures that all downstream conductors will be protected by the OBC AFCI.

It should be noted that at the time of this writing UL has yet to issue an Outline of Investigation for system combination-type AFCIs, nor are any known to be on the market.

5. Outlet branch circuit-type AFCI receptacle + steel wiring method:
(5) If RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

This was Exception No. 1 in the 2011 edition and was simply changed to positive text.

6. Outlet branch circuit-type AFCI receptacle + concrete encasement:
(6) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

This was exception No. 2 in the 2011 edition and was simply changed to positive text.

Other 210.12(A) Changes

Exception No. 3 in the 2011 edition is now simply titled "Exception" and remains otherwise unchanged. The Informational Notes have been updated.

Branch Circuit Extensions or Modifications

An exception has been added to Section 210.12(B).

Exception: AFCI protection shall not be required where the extension of the existing conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices.

This exception makes changing out a load center or adding a short extension to a branch circuit less burdensome.

Dormitory Units

The requirements for arc fault protection have been extended to dormitory units.

(C) Dormitory Units. All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets installed in dormitory unit bedrooms, living rooms, hallways, closets, and similar rooms shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

For More Information

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Schneider Electric USA, Inc.
800 Federal Street
Andover, MA 01810 USA
888-778-2733
www.schneider-electric.us

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