Understanding the 2014 NEC® for AFCI protection
An **arc fault** is an unintended arc created by current flowing through an unplanned path. Arcing creates excessive heat that can easily ignite surrounding material, such as wood framing or insulation, resulting in a hazardous fire.

**Understanding the code**

Per section 201.12 of the 2014 NEC Arc Fault Circuit Interrupter Protection is expanded to include kitchens and laundry room areas in addition to other areas specified in previous versions of the code for dwelling units. Additionally, the new code will now require AFCI protection for dormitory units. The use of AFCI receptacles are permitted for use in new construction with some restrictions.

**AT A GLANCE**

- The 2014 NEC allows 6 different installation methods to provide AFCI protection in new construction (see pages 8-9)
- Each application has preferred installation methods based on level of protection and practicality
- The 2011 NEC allowed for the use of OBC AFCI receptacles to be used in renovation applications per 406.4(D)(4) and 210.12(B)
AFCI Protection Options

An **AFCI breaker** protects the entire circuit including connected cords from its origin in the load center for both parallel and series arcs.

![AFCI Breaker](image)

An **Outlet Branch Circuit (OBC) AFCI receptacle** can protect all downstream wire and appliances from both parallel and series arcs, but only protects from series arcs upstream in the home run.

![Outlet Branch Circuit](image)

Home Run only protected from series arcs
- Parallel arc protection
- Series arc protection

For homerun wiring restrictions see the NEC 210.12(A)

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**Parallel arc protection**
**Series arc protection**
Arc faults could potentially ignite surrounding material resulting in potentially deadly fires

Typical causes of arc faults

1. Arcing in installed electrical wiring from physical damage such as:
   - Wires accidentally punctured by nails or screws
   - Cables that are stapled tightly against wall stud
   - Animals and vermin chewing through wiring insulation
   - Heat, humidity and voltage stress

2. Arcing at loose connections or joints in the circuit or at outlets

3. Arcing in appliance or extension cords
   - Bent or crimped cords
   - Brittle or aged cords
   - Cords under or behind furniture

4. Arcing internal to appliances or electrical devices
   - Defective products
   - Damaged or products at end of life
Tight staple can pierce insulation

Inadvertent nails can puncture wire behind wall

Animals can chew through insulation

Electrical cords can be damaged under or behind furniture
Code compliant installations for new construction

Protection Using AFCIs
The 2014 NEC allows for various methods to protect a circuit using arc fault technology 210.12(A)

1. **Combination AFCI Breaker**
   A combination AFCI Breaker can be used at the panel
   
   **Advantage:** Protects the whole circuit from the source
   
   **Disadvantage:** Legacy loadcenters may not accommodate AFCI breakers

2. **Branch Feeder AFCI Breaker with AFCI Receptacle**
   A listed branch feeder type AFCI breaker installed at the origin of the branch circuit in combination with a listed AFCI receptacle
   
   **Advantage:** Protects the whole circuit from the source, allows local reset of the receptacle
   
   **Disadvantage:** Requires two AFCI devices which can be costly, and requires the AFCI receptacle to be located at the first outlet

3. **“Supplemental Arc Protection” Breaker with AFCI Receptacle**
   A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed AFCI receptacle at the first outlet
   
   **Advantage:** Allows for local reset of the receptacle
   
   **Disadvantage:** Supplemental arc protection breakers are not currently available. Also there are limitations in homerun length, must be continuous and requires the AFCI receptacle to be located at the first outlet

4. **“System combination-type AFCI”**
   A listed tested pair that includes an AFCI receptacle with identified thermal magnetic circuit breaker, and the OBC AFCI must be installed at the first outlet
   
   **Advantage:** Allows for local reset of the receptacle
   
   **Disadvantage:** Tested combinations of AFCI receptacles and upstream branch breakers are not currently available, there are limitations in homerun length, must be continuous and requires the AFCI receptacle to be located at the first outlet
5. **Metal conduit or armored cable to first AFCI Receptacle**

   Requires installation of armored cable (RMC, IMC, EMT, TYPE MC or TYPE AC) for the homerun portion of the branch circuit

   **Advantage:** Allows for local reset in most cases

   **Disadvantage:** Installation of conduit can be costly, and may be difficult to identify first receptacle in the circuit during remodel or retrofit

6. **Conduit in concrete with AFCI Receptacle**

   Metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 2 inches of concrete for the portion of the branch circuit between the branch circuit overcurrent device and the first outlet

   **Advantage:** Allows for local reset in most cases

   **Disadvantage:** Limited applications and installation of conduit in concrete can be costly

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**AFCI breaker and OBC AFCI receptacle**

AFCI breakers and/or AFCI receptacles can be used to protect a circuit under various conditions per the 2014 NEC
Technological Maturity
Arc Fault technology saves lives and has been an industry standard in new construction for over 15 years. Today’s arc fault technology has been proven through arc fault breakers and has gone through several iterations to reduce unwanted tripping due to interference from devices or appliances. Arc fault circuit interrupters have been established as a stable technology which can be used in conjunction with various loads through the home in both AFCI breakers and AFCI receptacles.

Considerations for New Construction
Due to the restrictions of use per the 2014 NEC, there are several considerations to take into account when deciding whether to use an AFCI receptacle or a combination AFCI breaker:

• **Length Restrictions** – Due to length restrictions, (50’ for #14 wire, 70’ for #12 wire) AFCI receptacles must be placed within the specified distances to the load centers per the 2014 NEC.

• **Location of the First Receptacle** – The AFCI receptacle must be placed as the first outlet. Care must be taken to ensure this location is easily accessible, it cannot be blocked by any furniture or appliances and the location must make logical sense for the end user should the device need to be reset.

• **Wiring Practices** – The use of AFCI receptacles may require a contractor to change their wiring practices, specifically for circuits, such as lighting, that requires AFCI protection. A circuit that was typically run from the panel with an AFCI breaker may now need to feed off the AFCI receptacle that is located at the first outlet in a continuous circuit.

The last word
Remember your local (AHJ) Authority Having Jurisdiction (inspector) has the ultimate say in the application and use of electrical equipment per the prevailing Electrical Code.
It’s clear arc fault protection saves lives by mitigating arcing that could be an ignition source of a fire. The 2014 code mandates AFCI protection in designated areas of dwelling units and dormitories and allows several installation methods. It’s important to consider the application and then choose the best installation method to provide the preferred form of protection.

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