PROTECTION AT THE **POINT OF USE**

AFCI Receptacles Fast Becoming a Better Option

legrand®

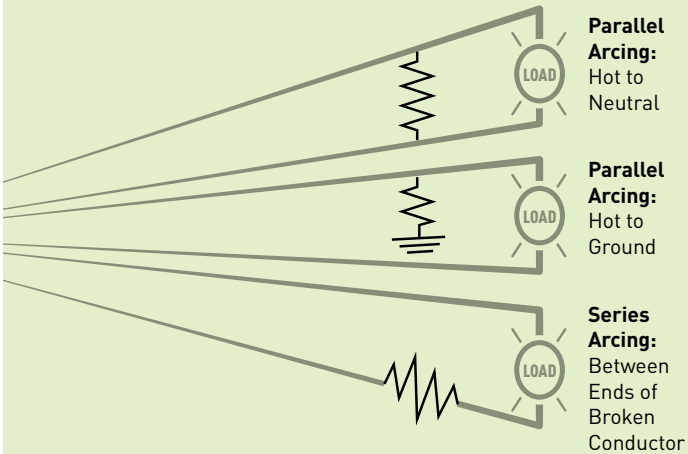
Let's Get to the Point

The United States Fire Administration (USFA) recently reported that 23,900 home fires involved some type of electrical failure or malfunction in 2014. Those fires resulted in 325 deaths, 925 injuries, and nearly a billion dollars in direct property damage. Astoundingly, more than 50% of these fires could have been prevented by the use of arc-fault circuit interrupters (AFCIs), according to the Consumer Product Safety Commission (CPSC).

New advances in AFCI technology, including the development of new code-approved AFCI and dual-function AFCI/GFCI receptacles, are providing contractors and homeowners easier-to-use and more cost-effective AFCI options. AFCIs bring a higher level of protection to today's homes, many of which are increasingly overburdened by the growing electrical demands of our high-tech and appliance-rich lifestyles.

Electrical protection devices have come a long way since the first GFCIs were introduced in the early 1970s; these were primarily used to protect people from electric shocks around swimming pools. Today, GFCIs are required protection in areas where water and electricity meet, such as in bathrooms, kitchens, laundry rooms and garages.

The need for AFCI protection surfaced years later, thanks in large part to a CPSC study in the late 1980s that revealed 80% of all electrical fires were caused by electrical arcing. Electrical fires due to electrical arcing spread quickly in the wiring behind walls, cause more damage than other types of fire and are twice as deadly.



Parallel Arcing: Hot to Neutral

Parallel Arcing: Hot to Ground

Series Arcing: Between Ends of Broken Conductor

As defined by UL®, an arc fault is an unintentional arcing condition in a circuit. Arcing creates high-intensity heating that can ignite surrounding material such as wood framing or insulation.

Common Causes of Arc Faults

The most common causes (of non-operational electrical arcs) cited in the CPSC report were damaged insulation in fixed wiring and appliance cords. AFCIs mitigate the effects of arcing faults by functioning to de-energize the circuit when an arc fault is detected.

Insulation in cables can be severed if a staple is misapplied.

A drill bit or nail can sever the insulation of cable inside a wall.

Inappropriate use of extension cords, such as placement under rugs or in a door jamb, can result in damaged conductors.

Wear and tear of appliance power cords can eventually lead to damaged conductors.

Furniture pushed against the plug of an appliance cord can stress conductors and damage insulation.

Arc Fault Circuit Interrupter (AFCI) Devices

There are multiple types of AFCI devices on the market, including:

OUTLET BRANCH-CIRCUIT AFCI OR AFCI RECEPTACLE—UL defines this as a device intended to be installed as the first outlet in a branch circuit. It is intended to provide protection to downstream branch-circuit wiring, cord sets and power-supply cords against the unwanted effects of arcing. This device also provides protection to upstream branch-circuit wiring. It is intended to be provided with or without receptacle outlets.

COMBINATION AFCI OR COMBINATION AFCI CIRCUIT BREAKER— An AFCI that complies with the requirements of both branch/feeder and outlet circuit AFCIs. It is intended to protect downstream branch-circuit wiring and cord sets, as well as power supply cords.

Note: Some of these AFCIs are available as dual-function AFCI/GFCI devices.

National Electrical Code® (NEC®) for AFCIs

The first National Electrical Code® (NEC®) for AFCIs came out in 1999, and it required AFCI circuit breakers be installed in new homes to protect electrical circuits feeding the bedroom. AFCI technology has continued to evolve, and in 2008 the code was further expanded to many other circuits in the home.

In 2014, the NEC expanded AFCI protection (Sections 210.12 and 406.4(D)(4)) to include even more circuits in the home. AFCIs are now required in many areas of new and remodeled homes, including bedrooms, family rooms, dining rooms, living rooms, kitchens, sunrooms, hallways and similar rooms or areas.

Section 210.12 of the 2014 and 2017 NEC requires arc-fault circuit interrupter protection in newly constructed dwelling units, dormitory units and on dwelling unit branch circuits that are extended or modified. The arc-fault circuit interrupter shall be installed in a readily accessible location.

DWELLING UNITS—All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter.

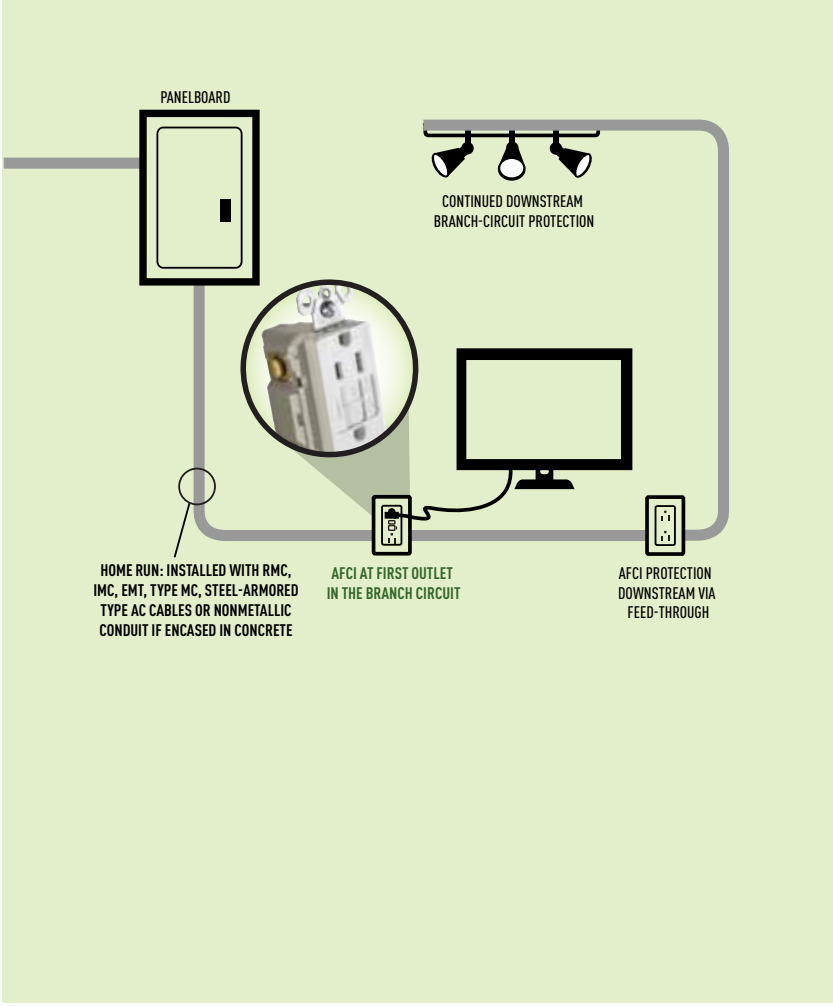
DORMITORY UNITS—All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets installed in dormitory unit bedrooms, living rooms, hallways, closets and similar rooms shall be protected by a listed arc-fault circuit interrupter.

NOTE: HOTEL GUEST ROOMS AND GUEST SUITES— Guest rooms and guest suites that are provided with permanent provisions for cooking shall have branch circuits installed to meet the rules for dwelling units (including AFCI protection).

Methods for Meeting NEC® Requirements with AFCI and AFCI/GFCI Receptacles

NEW CONSTRUCTION

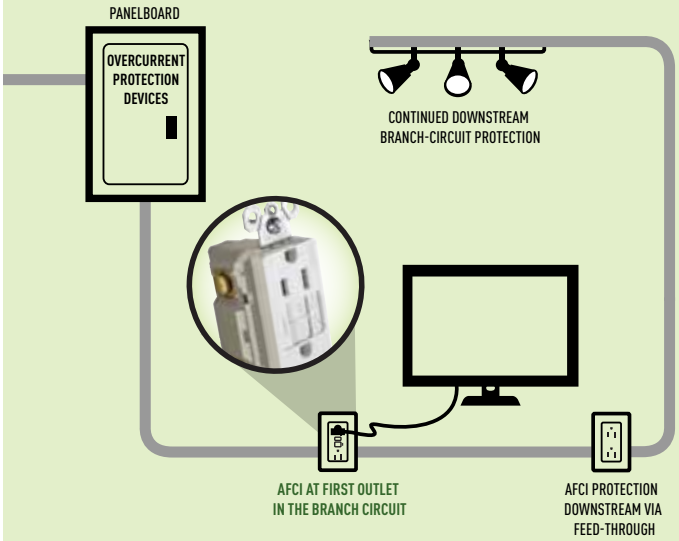
- It is permissible to meet NEC requirements in new construction if rigid metal conduit (RMC), intermediate metal conduit (IMC), electrical metallic tubing (EMT) conduit, Type MC, or steel-armored type AC cables and metallic boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, and an outlet branch-circuit AFCI receptacle is installed at the first outlet to provide protection for the remaining portion of the branch circuit.
- It is also permissible to meet this requirement if a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than two inches of concrete for the portion of the branch-circuit overcurrent device and the first outlet, and an outlet branch-circuit AFCI receptacle is installed at the first outlet to provide protection for the remaining portion of the branch circuit.



Methods for Meeting NEC® Requirements with AFCI and AFCI/GFCI Receptacles

BRANCH-CIRCUIT EXTENSIONS OR MODIFICATIONS

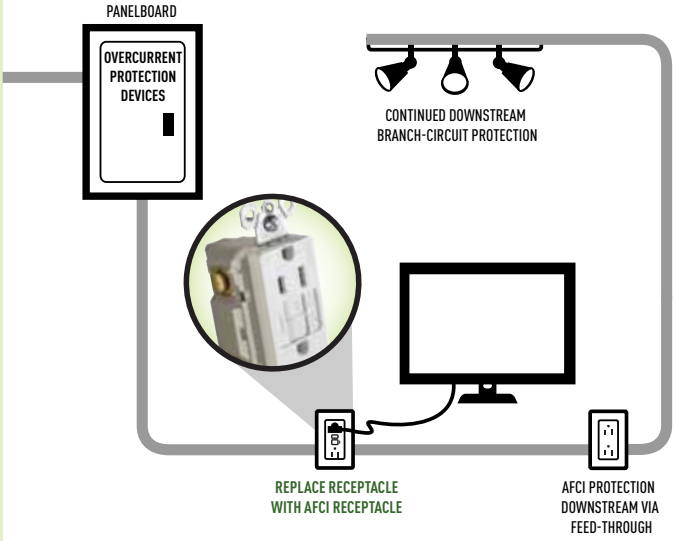
When branch-circuit wiring is modified, replaced or extended, it is permissible to meet the NEC requirement with a listed outlet branch-circuit AFCI receptacle located at the first receptacle outlet of the existing branch circuit.



REPLACEMENTS

Where a receptacle outlet is supplied by a branch circuit that requires AFCI protection, it is permissible to meet the NEC requirement with a replacement receptacle that is one of the following:

1. A listed outlet branch-circuit type AFCI receptacle
2. A receptacle protected by a listed outlet branch-circuit type AFCI receptacle



Note: Section 406.4 (D)(4) requires AFCI protection when a receptacle is replaced.

RECEPTACLES ARE A CODE-APPROVED ALTERNATIVE TO AFCI BREAKERS

An important aspect of the 2014 and 2017 NEC embraces the latest development in AFCIs—the use of outlet branch-circuit AFCI receptacles. AFCI receptacles resemble GFCI receptacles and provide protection that's similar to AFCI breakers.

AFCI receptacles provide a much more convenient way of protecting a house. They are designed to recognize many types of potentially hazardous arc faults and respond by interrupting power, reducing the likelihood of the home's electrical system being an ignition source of a fire. Like a GFCI receptacle, an AFCI receptacle is located at the point of use, therefore TEST and RESET are controlled locally, and the indicator light can be easily seen.

Benefits of AFCI Receptacles

The 2014 and 2017 NEC require both AFCI and GFCI protection on circuits supplying electricity to kitchens and laundry rooms. A convenient way to meet this requirement is to use a dual-function AFCI/GFCI receptacle. This device provides both AFCI and GFCI protection.

While AFCI and dual-function AFCI/GFCI receptacles and AFCI breakers perform similar functions—identifying potential threats and interrupting power—they are different in several distinct ways. AFCI and dual-function AFCI/GFCI receptacles provide the following benefits:

1. **REDUCE CALLBACKS—**AFCI and AFCI/GFCI receptacles are easier to use because they are installed in the living space. Homeowners can see the indicator light, and TEST and RESET are controlled locally. This means less confusion for the homeowner and therefore fewer callbacks for the contractor.

2. **IDENTIFY AND SOLVE PROBLEMS FASTER—**Identifying and fixing problems is much easier when the AFCI or AFCI/GFCI receptacle is at the point of use. When called to diagnose and fix a tripped AFCI circuit, electrical contractors have a quick and simple visual point of reference to isolate, identify and solve the problem.

Benefits of AFCI Receptacles

3 **MINIMIZE INVENTORY—**Unlike AFCI breakers, which must match the brand of the breaker box, AFCI receptacles fit in any standard electrical wall box, reducing the amount of inventory needed on the truck and saving trips to the electrical distributor.

4 **EASIER TO INSTALL—**AFCI breakers are larger than standard circuit breakers, which can make installation more difficult. Additionally, AFCI breakers require the use of an extra neutral pigtail wire, which has proven difficult to terminate in many installations.

An AFCI receptacle can be installed in any electrical wall box just like a standard receptacle. This reduces inventory, ordering complexity and time.

AFCI receptacles and AFCI/GFCI receptacles can be installed on a circuit with shared neutrals on the line side. This is a common challenge seen in remodel applications. Circuit breakers have problems in these situations.

5 **SAVE MONEY—**With fewer callbacks, less inventory needed on the truck and faster installation, AFCI receptacles are a less expensive, code-approved alternative to AFCI breakers.

Learn more about AFCI and Dual-Function AFCI/GFCI Receptacles.
Visit legrand.us/passandseymour/afci-gfci-info and **afcisafetyreceptacles.org**