



FOX

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Technical note 102,

AFCI Breakers - How they work

Arc fault circuit breakers are designed to recognize the current signatures of parallel arcing conditions that could cause property damage. There are two types of arcing conditions, series and parallel. Series arcing is characterized by currents in the 5 to 15 amp range, this is due to the current being limited by a load. Parallel arcing involves the hot and neutral or ground wires and is characterized by much higher current signatures, 50 to 100 plus amps. A ground wire is not necessary for AFCI breakers, they will protect 2 wire circuits. A current signature is a wave form that implies a particular situation on the power lines. For instance a noisy electric drill will produce a current signature characterized by short, fast, cyclical current spikes.

All AFCI breakers on the market sense parallel arcing conditions. Series arcing is extremely difficult to detect, many loads like vacuum cleaners, hair dryers and electric tools produce signals that are very similar to series arcing conditions. Currently, breakers are designed to ignore these signals to avoid nuisance tripping. Manufacturers are working hard to produce devices that can determine the difference between series arcing and nuisance currents.

AFCI and GFCI devices are sometimes confused as being similar in nature, they are not. GFCI devices are designed to protect people from electrical shock. They do this by measuring the difference current between the hot and neutral lines, they use analog circuitry to do this. Any small difference in current (6 mA) indicates that a separate current path has been established, possibly through a human to ground, the device interrupts the source current instantly. An AFCI device actually digitizes the current signal and processes this information in a microprocessor chip, a decision is made based on stored information and the device is opened in an abnormal current situation. AFCI devices will also interrupt when ground currents exceed 30 mA. This is why a "wiggy" will trip an AFCI device when placed between the hot and ground circuits. This is not a valid test for AFCI devices because the arc sense circuit is not being stimulated. Also if there is a wiring problem there could be a shock hazard.

AFCI devices do work, they limit the instantaneous energy in a branch circuit a lot better than a thermo-magnetic breaker, they offer an expanded level of property protection and will continue to improve, as did the GFCI devices 20 years ago.