The Circuit Detective-Solve AFCI Tripping

AFCI Circuit Breaker Troubleshooting

An arc-fault circuit interrupter (AFCI) is a circuit breaker* located in your electrical panel that serves the functions of a normal breaker but also senses hazardous arcing on its circuit and will trip off for this. It can be identified by the special colored test-button near its handle. (Ground-fault breakers also have a button, so read with a magnifying glass to be sure which kind your breaker is.)

> *A different device is now allowed away from your breaker panel. It resembles the familiar GFCI receptacles. (Its installation is more strict, however.) It is called an "outlet/ branch-circuit type of AFCI" or simply AFCI outlet or AFCI receptacle.

AFCI breakers began to be required by Code in 2002 for new wiring supplying bedrooms. The areas to be protected were expanded in 2008 (where that national Code has been adopted locally) to most rooms of the home. The areas left out of the requirement were garage, bathroom, kitchen, and laundry;

these were already required to have ground-fault protection for receptacles.

It is relevant to AFCI circuit breaker troubleshooting that most AFCIs have a level of ground-fault protection built into them as well. (When this level becomes standardized to meet Code for GFCI protection, such AFCIs will make it possible to meet both AFCI and GFCI codes simultaneously.)

The Five Possible Causes of an AFCI Breaker Tripping

A standard breaker will trip for an overload, a short circuit, or overheating at itself (the first three causes below). To solve their tripping usually involves sorting out which of these three causes is at work. But with an arc-fault breaker, there can be two additional causes to add to the list (the fourth and fifth below):

1. An Overload -- when electrical usage would have begun to overheat a circuit's wires
2. A Short Circuit -- very high current resulting from a fault on the circuit
3. An Overheating Breaker -- when the breaker itself has poor contacts or connections

4. A Ground-Fault -- smaller leakage off of the intended circuit. In this I include shock hazards, neutral to ground faults, and the differing current on the neutral wire when it is being shared by another circuit.
5. An Arc-Fault -- sparking happening on the circuit or its lights or appliances

Troubleshooting an AFCI That Trips

Which of the five causes has tripped an AFCI breaker can be quite important in how you go about solving the problem. Some AFCI brands may have an indicator on them that will show (if you haven't already reset!) whether the cause of the last trip was an arc-fault or not. But you will still need to know what to fix and where. The table below also shows some additional causes having to do with the breaker itself or with long-standing things about the wiring in the house.

CAUSE:	A F C I S Y M P T O M						SOLUTION:
	Trips right away	**Trips within 5 sec.**	**Trips in 1 min. to 1 month**	**Trips when any small load runs on the circuit**	**Trips when some-thing runs on another circuit**	**Never trips, even when "TEST" is pushed**	
1 Overload	--	--	yes	--	--	--	Reduce wattage in use on circuit
2 Short circuit	yes	yes	--	--	--	--	Short
3 Overheating AFCI	--	--	yes	--	--	--	Replace AFCI and put in diff. location in panel
4 Ground-fault	yes	yes	--	yes	--	--	Ground fault
(4) Neutral shared with another circuit	yes	--	--	yes	yes	--	Call experienced electrician
5 Arc- fault	--	--	yes	--	--	--	See C below
AFCI device miswired	yes	--	--	yes	--	yes	AFCI's own white goes to neutral bar, circuit white to "load neut"
Bad AFCI	rare	--	--	--	--	yes	Replace

NOTES to narrow down which cause:

A. To tell whether immediate tripping is from a ground-fault versus a short circuit, you might have to temporarily replace the AFCI breaker with a standard breaker (putting the solid white wire from the AFCI's terminal into the panel's neutral/ground bar). If the standard breaker holds, then the problem is more often a ground-fault, less often an arc-fault.
B. In the case of an arc-fault device introduced into an existing home, a common cause of tripping will be that the neutral of the circuit is mixed somewhere with the neutral of another circuit ["(4)" above]. The two common places this mixing of neutrals would occur are at a 2-gang or 3-gang switch box where both circuits are present, or in a 3-way switch system where the neutral for the light(s) has been borrowed (improperly) from the other circuit.
C. Although I have never yet been called to find the location of an actual arc that was tripping an AFCI, here is what could be done. As long as you do not leave it in place beyond your time of vigilant searching, a standard breaker could be put in the panel in place of the AFCI. You might then be able to hear, see, or smell signs of heat or arcing; blinking lights on the circuit would give additional clues. I am comfortable suggesting what might sound like playing with fire, because few cases of arcing are ever able to start fires. In most homes (most don't have AFCIs), when arcing at connection points ("series" arcing) has been happening for a while, it does commonly show itself eventually as a partial outage of the circuit, from the arcing point on. This can then be troubleshot more easily.

D. Some appliance models, during their normal operation, have been known to trip an AFCI, by its sensitivity to either arcing (in flat-screen TV, vacuum, other motor) or to ground-faults (in treadmill, fluorescent lights). There may not be anything wrong with the appliance or breaker, unfortunately.
E. If the AFCI breaker lets you reset it and does not repeat its tripping, you do not need to know or to worry about the cause. For the record, it was probably an overload or arc-fault that was only a one-time event.

By the 2014 Code anyone (including homeowners) replacing a receptacle in most rooms of a house will be required to make it be arc-fault protected. This will have to be accomplished by installing a costly device there or earlier in the circuit. No more "if it's broken, just replace it."

"I'm a retired police Lieutenant so writing a note to a detective is familiar to me. What wasn't familiar, (because I just found your site and bought your e-book), was how to troubleshoot an AFCI! The information posted on your site confirmed my solution. Now I'll have your Circuit Down to follow in the future." -Mike

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