

NEMA Position on Compatibility between Smoke Alarms and AFCI's

Background

The 2002 and 2005 editions of the National Electrical Code® require arc-fault circuit interrupter (AFCI) protection for all 15 and 20 ampere branch circuits that supply outlets in dwelling unit bedrooms. This requirement includes the 15 or 20 ampere circuit that supplies the smoke alarm located in the bedroom.

Code Making Panel 2 has addressed numerous comments to exempt smoke alarm circuits from AFCI protection. In each and every case, the panel rejected the comments and stated that the intent is to have protection on all 15 and 20 ampere circuits that supply the designated areas.

NFPA 72 Action

During the current cycle of NFPA 72 – National Fire Alarm Code, the household committee accepted a proposal (72-530) stating that smoke alarms cannot be supplied through an AFCI protected circuit. NEMA, in accordance with the direction and position established over two NEC® cycles, voted negative on the NFPA 72 committee action.

Purpose of AFCI Protection

The NEC established the requirement for AFCIs to provide protection of branch circuits from low-level arcing faults. The arcing fault hazard and the need for the protection has been studied and investigated by NEMA, CPSC, NASFM, UL and others. AFCI's are a form of circuit protection in the same manner as overload and short circuit protection. The primary function of an AFCI is to improve protection of the circuit by detecting arcing conditions that reduce the incidence of fires of electrical origin.

AFCI/Smoke Alarm Compatibility

During the NFPA 72 ROP processing, there were claims that smoke alarms were “nuisance” tripping AFCIs. The information was anecdotal at best, but was taken seriously by all involved parties.

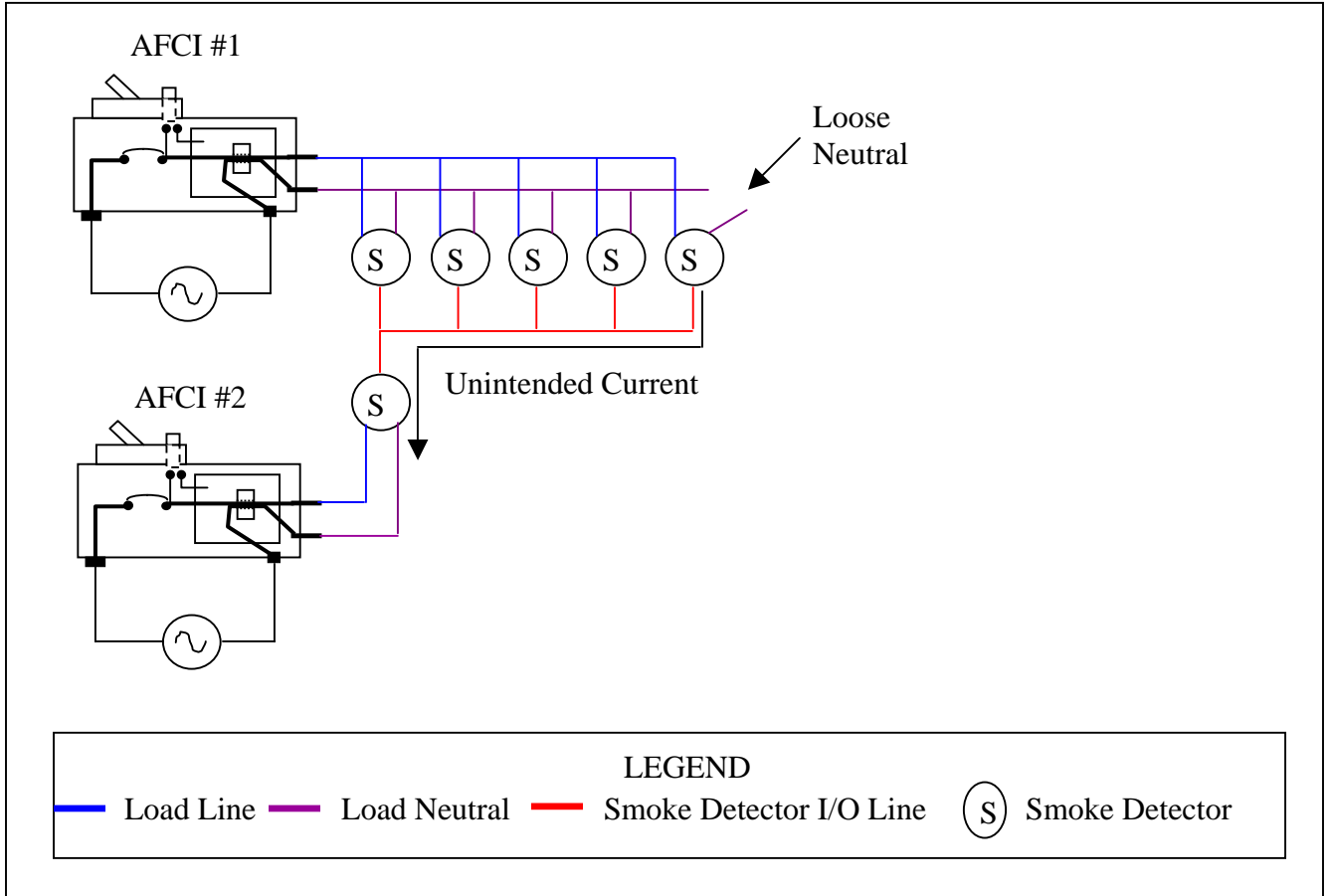
Two significant actions were taken by LVDE AFCI manufacturers regarding these claims. Each manufacturer went back through their company reports of field complaints and found that they had no verified nuisance tripping calls regarding smoke alarms. Given the number of AFCIs installed, this is a significant point. Secondly, several of the major AFCI manufacturers began thoroughly investigating the claims in their laboratories. The findings of the manufacturers were consistent with one another and found that there is no compatibility issue with a properly wired smoke alarm installation.

There was no tripping of the AFCI during normal operation or during alarm conditions. This included circuits with interconnected smoke alarms wired per the manufacturers instructions.

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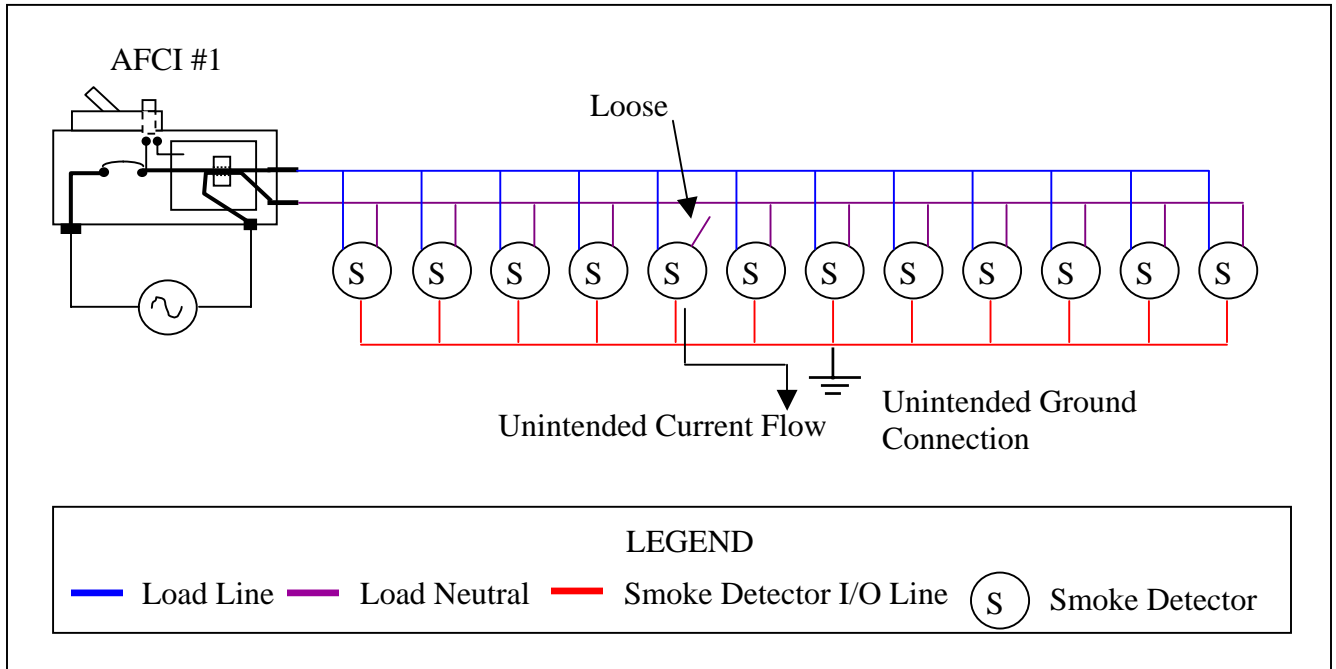
There were situations simulated where the AFCI could be forced to trip. In both situations, the smoke alarm installation had to be improperly wired. The following two diagrams outline those situations:

Figure 1 – Smoke Alarms supplied through two different circuits



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Figure 2 – Single Circuit Installation



The following points can be made regarding smoke alarm and AFCI compatibility:

- There have been no verified cases of incompatibility between smoke alarms and AFCIs in the field
- Laboratory testing shows that there is no compatibility issue
- Improper wiring of the smoke alarms can trip an AFCI – however this is a condition that should be detected and should be corrected in the field
- The current levels drawn by a smoke alarm (even by multiple devices in alarm condition) are insufficient to even be in the arc detection region of an AFCI.

There is NO COMPATIBILITY ISSUE BETWEEN AFCIs AND SMOKE ALARMS

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Power Supply Reliability

The installation of an AFCI does not decrease the reliability of the power circuit. AFCIs are compatible with smoke alarms and the circuit performs as intended.

It should also be noted that NFPA 72 has addressed the issue of loss of AC power (due to any cause) in the requirements for smoke alarms. Those requirements are summarized as follows:

- 11.6.1(1) - A commercial light and power source along with a secondary battery source that is capable of operating the device for at least 24 hours in the normal condition followed by 4 minutes of alarm.
- 11.6.4 Secondary (Standby) Power Source. If the secondary power source is a battery, the following conditions shall be met:
 - (1) The secondary power source shall be supervised and shall cause a distinctive audible or visible trouble signal upon removal or disconnection of a battery or a low-battery condition.
 - (2) Acceptable replacement batteries shall be clearly identified by the manufacturer's name and model number on the unit near the battery compartment.
 - (3) A rechargeable battery used as a secondary power source shall meet the following criteria:
 - (a) Be automatically recharged by an ac circuit of the commercial light and power source
 - (b) Be recharged within 4 hours where power is provided from a circuit that can be switched on or off by means other than a circuit breaker or within 48 hours where power is provided from a circuit that cannot be switched on or off by means other than a circuit breaker
 - (c) Provide a distinctive audible trouble signal before the battery is incapable of operating the device(s) for alarm purposes
 - (d) At the battery condition at which a trouble signal is obtained, be capable of producing an alarm signal for at least 4 minutes followed by not less than 7 days of trouble signal operation
 - (e) Produce an audible trouble signal at least once every minute for 7 consecutive days

It is clear that the NFPA 72 committee has taken extraordinary steps to ensure that the smoke alarm has a sufficient power supply regardless of the means of loss of AC power.

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Summary

AFCI's provide increased fire protection for the electrical installation. There is no evidence that the circuit supplying smoke alarms should be exempt from these increased protection requirements. AFCIs are circuit protection and the level of circuit protection is clearly within the purview of the NEC[®].

Power supply reliability for smoke alarms is not impacted by the installation of an AFCI. At the same time, the likelihood of the branch circuit being a source of an electrical fire is decreased.