



*A NEMA Low Voltage Distribution Equipment Section Document
ABP 11-2016*

Compatibility between Smoke Alarms and Arc-Fault Circuit Interrupters

Published by

National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

www.nema.org

© 2016 National Electrical Manufacturers Association. All rights, including translation into other languages, reserved under the Universal Copyright Convention, the Berne Convention for the Protection of Literary and Artistic Works, and the International and Pan American copyright conventions.

NOTICE AND DISCLAIMER

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among every person participating in the development of this document.

NEMA standards and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this publication. While NEMA administers the process and establishes rules to promote fairness in the development of consensus, it does not write the document and it does not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in its standards and guideline publications. NEMA disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document.

NEMA disclaims and makes no guaranty or warranty, express or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any of your particular purposes or needs. NEMA does not undertake to guarantee the performance of any individual manufacturer or seller's products or services by virtue of this standard or guide.

In publishing and making this document available, NEMA is not undertaking to render professional or other services for or on behalf of any person or entity, nor is NEMA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

NEMA has no power, nor does it undertake to police or enforce compliance with the contents of this document. NEMA does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety-related information in this document shall not be attributable to NEMA and is solely the responsibility of the certifier or maker of the statement.

Foreword

This is an update to a NEMA white paper originally published in 2005. To ensure that a meaningful publication was being developed, draft copies were sent to a number of groups within NEMA having an interest in this topic. Their resulting comments and suggestions provided vital input prior to final NEMA approval and resulted in a number of substantive changes in this publication. This publication will be periodically reviewed by the Molded Case Circuit Breaker Product Group of the Low Voltage Distribution Equipment Section of NEMA for any revisions necessary to keep it up to date with advancing technology. Proposed or recommended revisions should be submitted to:

Senior Technical Director, Operations
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, VA 22209

This white paper was developed by the Molded Case Circuit Breaker Product Group of the Low Voltage Distribution Equipment Section of NEMA. Approval of this white paper does not necessarily imply that all members of the Product Group voted for its approval or participated in its development. At the time it was approved, the Molded Case Circuit Breaker Product Group had the following members:

ABB Inc.—Wichita Falls, TX
Eaton Corporation—Pittsburgh, PA
General Electric—Plainville, CT
Siemens Industry, Inc.—Norcross, GA
Schneider Electric USA—Andover, MA

Background—Purpose of AFCI Protection

The *National Electrical Code*[®] (*NEC*) established the requirement for arc-fault circuit interrupters (AFCI) to provide protection of branch circuits from arcing faults. The arcing-fault hazard and the need for the protection has been studied and investigated by NEMA, Consumer Product Safety Commission, National Association of Fire Marshalls, UL, and others. AFCIs 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.

The 2014 *NEC* requires AFCI protection for all 15 and 20 ampere branch circuits that supply outlets or devices 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. This requirement includes the circuit that supplies the smoke alarm located in these rooms or areas.

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.

AFCI/Smoke Alarm Compatibility

In the past there have been claims that smoke alarms were “nuisance” tripping AFCIs. These claims were not supported by actual data, and as a result were considered anecdotal. However, given the importance of this issue, it was taken seriously by all involved parties.

Two significant actions were taken by 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, some of the 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 manufacturer’s instructions.

There are situations where the improper or inadequate wiring of smoke alarms may actually be detected by AFCI devices. In these situations, some may perceive that the AFCI device has malfunctioned in some manner, when in fact, the AFCI device has actually detected a wiring problem that may have otherwise gone initially unnoticed. In these situations, the presence of AFCI devices serves to enhance safety. The following two diagrams show how a loose neutral connection for example, would be detected by an AFCI device:

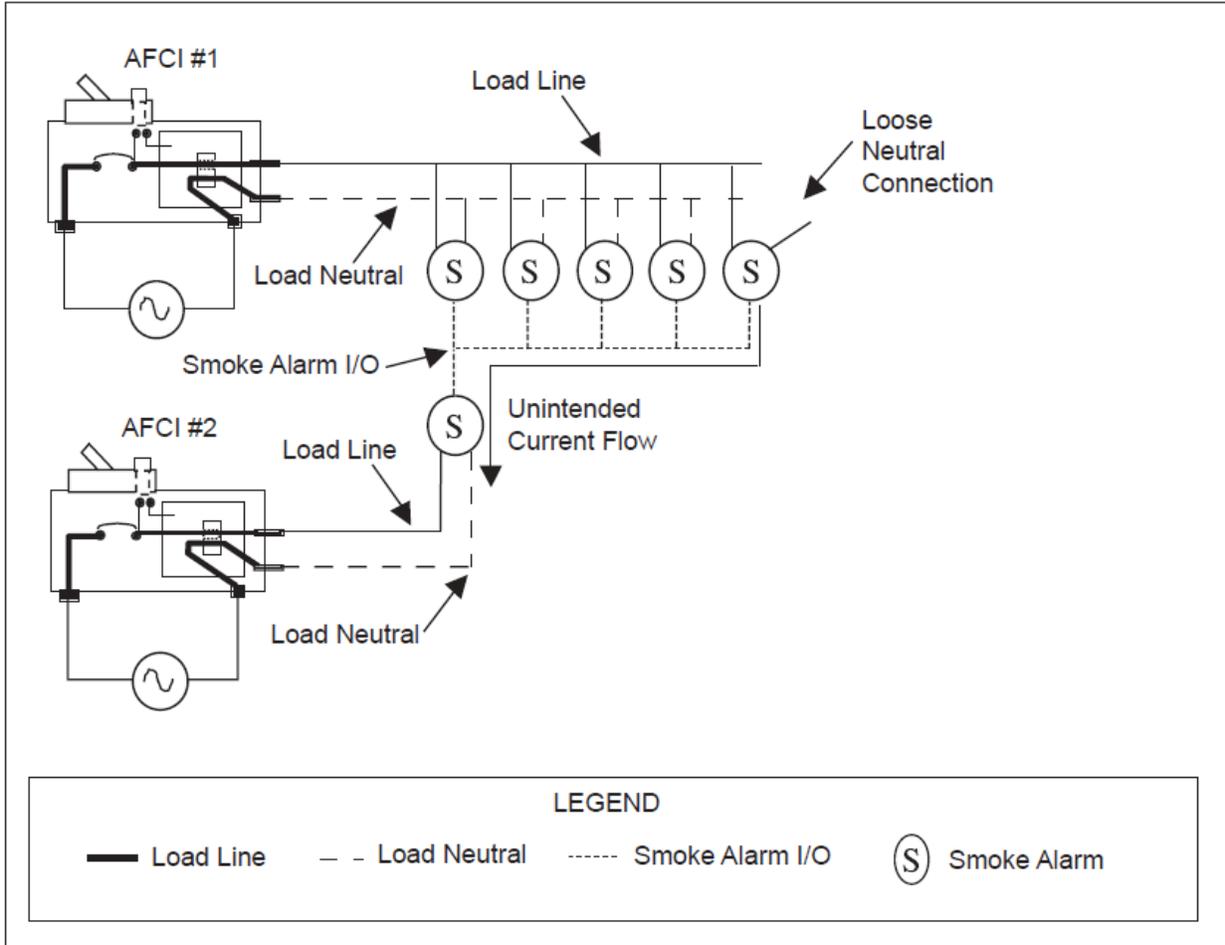


Figure 1
Smoke Alarms Supplied Through Two Different Circuits

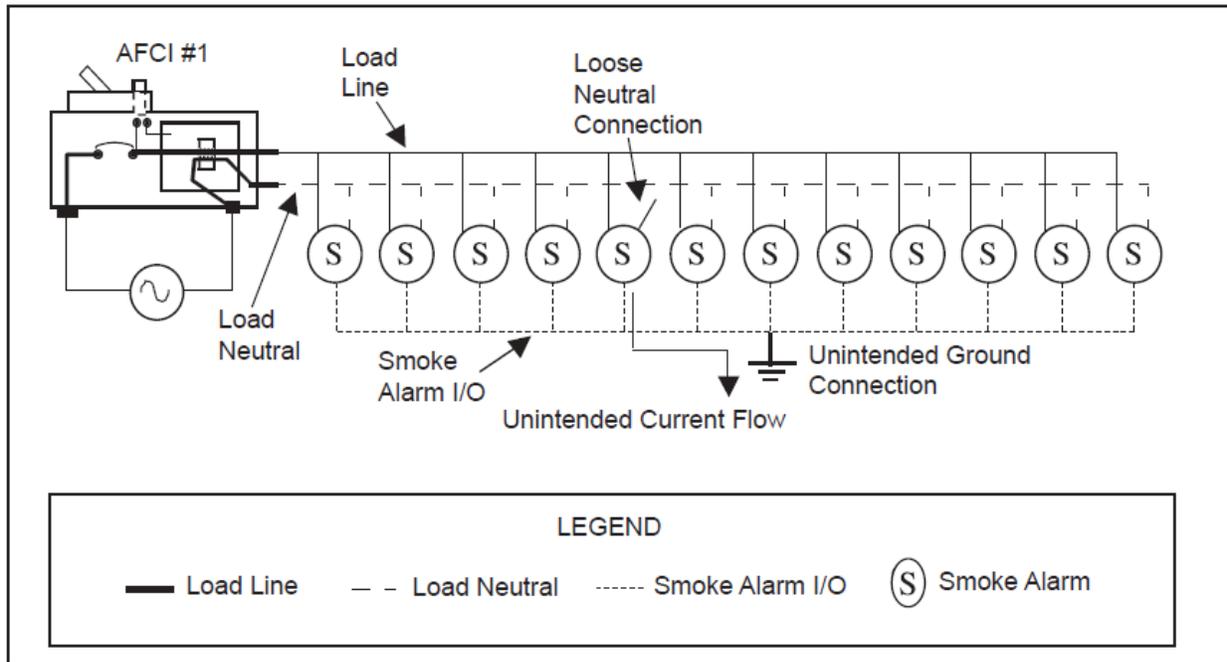


Figure 2
Single Circuit Installation

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 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

Power Supply Reliability

It should be noted that the National Fire Protection Agency's NFPA 72 National Fire Alarm and Signalling Code has addressed the issue of loss of AC power (due to any cause) in the requirements for smoke alarms. Those requirements are summarized in the following section of the 2013 Edition of NFPA 72:

29.6.1 Smoke and Heat Alarms. Smoke and heat alarms shall be powered by the following means:

A commercial light and power source along with a secondary power source that is capable of operating the device for at least seven days in the normal condition, followed by four minutes of alarm.

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 cause of the loss of AC power. The installation of an AFCI does not decrease the reliability of the power circuit.

Summary

AFCIs 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 due to the presence of AFCI devices.

§