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Avoid Arc-Flash Occurrences by Following Industry Standards

National Electrical Manufacturers Association

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Avoid Arc-Flash Occurrences by Following Industry Standards

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Foreword

This is an update to a NEMA white paper originally published in 2003. 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:

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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

1 Introduction

The hazards of arc flash have received considerable attention in recent time for a number of reasons. When an arcing fault occurs, the harmful results can be devastating and deadly for those who are not properly prepared. Because of the potentially long-term effects, not only is the individual impacted, but also the family and employer. Equipment damage is usually considerable, frequently resulting in extended down time for the installation. Awareness of this hazard has arisen through industry forums such as the IEEE IAS Electrical Safety Workshop and NFPA training conferences. Industry codes and standards have also included measures to reduce the effects of arc flash. These codes and standards help facility operators to take preventive steps.

The purpose of this paper is to introduce the nature of the hazard and the industry codes and standards that address arc flash. It also introduces the requirements with which facilities must comply.

2 The Arc-Flash Hazard

NFPA 70E-2015, *Standard for Electrical Safety in the Workplace* defines the arc-flash hazard as "a dangerous condition associated with the possible release of energy caused by an electric arc." An arc flash is an explosion involving an electric arc operating at temperatures of several thousand degrees Celsius and a pressure wave created by the arc. Within a few milliseconds, the energy from this explosion can cause severe burns and damage to hearing, vision, taste and smell. Molten metal particles, equipment parts and other loose items are expelled from the arc area. As a result, multiple trauma effects can occur that frequently prevent the worker from returning to work and may cause hardship for the family in relationships and financial issues, as well as medical treatment issues. These effects sometimes result in death.

Many electricians "take pride" in their ability to work on energized equipment without incident. Perhaps they and their employers are not aware of the risk they are taking. One unexpected condition can initiate the explosion, which is over before reaction time permits escape. Appropriate training and preparation can be done to minimize the effects of an arc-flash event. The potential hazardous energy associated with an arc flash can be calculated. Personal protective equipment (PPE) intended for use in the environment can be used. In fact, these steps of performing the calculations, providing the training, preparation and PPE are now industry requirements.

3 Industry Standards

The primary industry standards that address the arc-flash hazard are these.

- OSHA, 29 Code of Federal Regulations Part 1910, Subpart S
- NFPA 70E, *Standard for Electrical Safety Requirements for Employee Workplaces*®
- ANSI/NFPA 70, *National Electrical Code® (NEC)*
- IEEE 1584, *Guide for Performing Arc-Flash Hazard Calculations*

The Occupational Safety & Health Administration (OSHA) was created to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance. OSHA 29 CFR Part 1910.333 states in part that "Safety related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment or circuits which are or may be energized…" Although a number of related requirements are included within OSHA standards, OSHA field personnel also reference the requirements of NFPA 70E to enforce safety related to arc flash.