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IEEE Standard Test Procedure for Determining Circuit Integrity Performance of Fire Resistive Cables in Nuclear Facilities

IEEE Power and Energy Society

Sponsored by the
Insulated Conductors Committee

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IEEE Std 1844™-2015

IEEE Standard Test Procedure for Determining Circuit Integrity Performance of Fire Resistive Cables in Nuclear Facilities

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Approved 5 December 2015

IEEE-SA Standards Board

Abstract: Standardization of circuit integrity cable testing is beneficial to cable manufacturers, distributors, and users. Uniform procedures, consistent, repeatable results, and measureable test acceptance criteria are required to allow comparisons among competing products and to allow selection of the correct product for the application. In nuclear power facilities, electrical cables are relied upon to safely control the plant systems. Circuit integrity cables serve as fire-resistive protection for electrical circuits. Circuit integrity cables with a 1-h or 3-h ratings are expected to protect the electrical circuit from the effects of severe fire conditions to allow for achieving and maintaining safe shutdown conditions and suppression activities.

Keywords: cable, circuit integrity, IEEE 1844™, motor-operated valves, MOV, safe shutdown, vertical furnace, safety systems, test protocol, wire

PDF: ISBN 978-1-5044–0666-6 STD20782
Print: ISBN 978-1-5044-0667-3 STDPD20782

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Introduction

This introduction is not part of IEEE Std 1844™-2015, IEEE Standard Test Procedure for Determining Circuit Integrity Performance of Fire Resistive Cables in Nuclear Facilities.

Circuit integrity cables are considered passive fire-resistive features when installed in nuclear facilities to meet requirements for protection of safe-shutdown systems or components from the effects of fire. To achieve and maintain safe-shutdown conditions, cables must function under normal conditions and under fire conditions.

This standard provides a test procedure for determining the electrical functionality performance for fire resistive cable for specific fire exposure durations and subsequent hose stream application. The purpose of this standard is to establish criteria to determine the circuit integrity performance of a fire resistive cable system. This standard is not meant to determine the flame propagation characteristics or fire stop capability of wire or cable systems. This standard is also not meant to determine the protection afforded to cables by tray covers, conduits, coatings or fire barrier material. This standard provides a test procedure to obtain a fire resistive time rating for a specific cable and cable support feature configuration. This standard does not support a definition of a generic cable configuration that will bound a range of cable configurations. Results of testing along with manufacturer and testing laboratory experience will help support a determination of what range of cable configurations will be bounded by a specific test cable configuration.

This standard does not qualify cable support features independent of a fire resistive cable. The interaction between fire resistive cables and cable support features can significantly affect the performance of the circuit integrity for fire resistive cables. US. Nuclear Regulatory Commission Information Notice 2006–02, "Use of Galvanized Supports and Cable Trays with MEGGITT Si 2400 Stainless-Steel-Jacketed Electrical Cables," identifies issues associated with degraded fire resistive cable performance due to their interaction with cable support features. US. Nuclear Regulatory Commission Information Notice 2013–02, "Issues potentially affecting nuclear facility fire safety," identifies certification issues encountered by Underwriters Laboratories (UL) under UL 2196, "Test for Fire Resistive Cables," and ULC-S139, "Standard Method of Fire Test for Evaluation of Integrity of Electrical Cables." In UL Release 12PN-51, a consistent two-hour fire resistive rating on products and systems originally certified could not be achieved.

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1. Overview

1.1 Scope

This standard provides a method for subjecting energized cable systems to a standard fire exposure to obtain a time rating. Types of cable include power, control, instrumentation and communication cables. Acceptance criteria are based on the cable maintaining functionality throughout the prescribed test.

1.2 Purpose

The purpose of this standard is to establish criteria to determine the circuit integrity performance of fire resistive cable systems.

1.3 Applications

This standard applies to multi-conductor cables and single insulated conductors that are allowed to be installed in cable tray, conduit, free air, or to other cable and conductors for which passing circuit integrity test conditions to the requirements of this standard is desired. Cable test assemblies that pass this standard are intended to represent "fire-rated cables" for protection of nuclear facility safe-shutdown systems or components from the effects of fire. Use of these cables in a regulatory application may require the review and approval by the authority having jurisdiction.