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IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications

IEEE Industry Applications Society

Sponsored by the
Petroleum & Chemical Industry Committee

IEEE
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USA

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Approved 16 June 2011

IEEE-SA Standards Board

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Abstract: Specific testing requirements for qualifying electrical resistance heating cables and heating devices for use in industrial applications, as well as a basis for electrical and thermal design, are included in this standard. Unclassified applications and explosive atmosphere applications that use both Divisions and Zone methods of classification are included.

Keywords: constant wattage heating cables, electrical design, heating cable, heat loss, heat tracing, IEEE 515, parallel heating cables, pipelines, series heating cables, self-regulating heating cables, surface heating devices, thermal design, trace heater, trace heating, vessel heater

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Introduction

This introduction is not part of IEEE Std 515-2011, IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications.

The scope of this standard includes specific testing requirements for qualifying electrical resistance heating cables and heating devices for use in industrial applications, as well as a basis for electrical and thermal design. Applications include unclassified and both Division and Zone classified areas.

This document was first published as a recommended practice in 1983. In 1989, it was elevated to a standard, and Division 1 heating cables were added.

In 1997, this standard was expanded to include American classified zone heaters. A 32-week benchmark test was added to provide a thermal shock cycling test. This test established a minimum performance criteria for new products, offered a system to validate product temperature ratings claimed by manufacturers, and provided a minimum acceptable level of quality/performance by the heating devices.

The 2004 revision added a 12-week temperature cycling test as an alternative to the 32-week benchmark test. This revision also aligned the tolerance on sheath temperature for T-rating with the IEC 60079-30 5 K and 10 K tolerances (IEC 60079-30-1:2007 [B15][a] and IEC 60079-30-2:2007 [B16]).

This revision includes subsequent harmonization with international standards and has expanded the sections on maximum sheath temperature determination and design.

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[a] The numbers in brackets correspond to those of the bibliography in Annex A.

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Participants

At the time this IEEE standard was originally completed, the Electrical Resistance Heat Tracing for Industrial Applications Working Group had the following membership:

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Dusty Brown, *Co-Chair*

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Ben Johnson
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Larry Stehling
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The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

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Richard DeBlasio, *DOE Representative*
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Contents

IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications

1. Overview

1.1 Scope

This standard provides requirements for the testing, design, installation, and maintenance of electrical resistance trace heating in general industries as applied to pipelines, vessels, pretraced and thermally insulated instrument tubing and piping, and mechanical equipment. The electrical resistance trace heating is in the form of series trace heaters, parallel trace heaters, and surface heating units. In this standard, the terms *hazardous (classified) locations* and *potentially flammable atmospheres* refer to the same conditions. The requirements also include test criteria to determine the suitability of these heating devices utilized in industrial applications as applied in unclassified (ordinary) and hazardous (classified) locations.

1.2 Purpose

The provisions of this standard should ensure that process, fluid, or material temperatures are maintained and provide electrical, thermal, and mechanical durability to the trace heating system, such that in normal use, its performance is reliable and poses no danger to the user or surroundings. This standard is to serve as a complementary document to the current version of those national and international standards addressing electrical resistance trace heating.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ASTM D5025-05, Standard Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials.[1]

ASTM D5207-09, Standard Practice for Confirmation of 20-mm (50-W) and 125-mm (500-W) Test Flames for Small-Scale Burning Tests on Plastic Materials.

IEC 60079-20-1, Explosive Atmospheres—Part 20-1: Material Characteristics for Gas and Vapour Classification—Test Methods and Data.[2]

IEC 60079-20-2, Explosive Atmospheres—Part 20-2: Material Characteristics—Combustible Dusts Test Methods.

NFPA 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.[3]

NFPA 499, Recommended Practice for the Classification of Combustive Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.

3. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary: Glossary of Terms & Definitions*[4] should be consulted for terms not defined in this clause.

ambient temperature: The temperature surrounding the object under consideration. Where an electrical heating device is enclosed in thermal insulation, the ambient temperature is the temperature exterior to the thermal insulation.

braid: Interwoven metallic covering or other equivalent electrically conductive material surrounding the trace heater.

certifying agency: Organization that validates that equipment meets tests and standards.

cold lead: An electrically insulated conductor used to connect a heating conductor to the branch-circuit conductors and designed so as not to produce appreciable heat.

connections: Terminations and splices used to attach a heating device to power wiring or to connect sections of devices.

[1] ASTM publications are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA (http://www.astm.org/).
[2] IEC publications are available from the Sales Department of the International Electrotechnical Commission, Case Postale 131, 3 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse (http://www.iec.ch/). IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.
[3] NFPA publications are published by the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, USA (http:// www.nfpa.org/).
[4] The *IEEE Standards Dictionary: Glossary of Terms and Definitions* is available at http://shop.ieee.org.