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INTERNATIONAL STANDARD



**Electrical resistance trace heating systems for industrial and commercial applications –
Part 1: General and testing requirements**

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ELECTRICAL RESISTANCE TRACE HEATING SYSTEMS FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS –

Part 1: General and testing requirements

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IEC/IEEE 62395-1 has been prepared by IEC technical committee 27: Industrial electroheating and electromagnetic processing, in cooperation with Petroleum & Chemical Industry Committee of the IEEE Industrial Applications Society, under the IEC/IEEE Dual Logo Agreement between IEC and IEEE. It is an International Standard.

This document is published as an IEC/IEEE Dual Logo standard.

This first edition cancels and replaces the second edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes, apart from general revisions of IEC 62395-1 and harmonization with IEEE 515 [1]¹ and IEEE 515.1 [2], with respect to the previous edition:

- a) Added control and monitoring requirements for fire sprinkler systems and safety showers.
- b) Provided a supplemental ice bath method for verification of rated output.
- c) Provided constructional and type test requirements for glands used to terminate heating devices to an exposed enclosure.

The text of this International Standard is based on the following IEC documents:

Draft	Report on voting
27/1182A/FDIS	27/1186/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with the rules given in the ISO/IEC Directives, Part 2, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications/.

A list of all parts in the IEC 62395 series, published under the general title *Electrical resistance trace heating systems for industrial and commercial applications*, can be found on the IEC website.

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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¹ Numbers in square brackets refer to the Bibliography.

INTRODUCTION

IEC/IEEE 62395-1 provides the essential requirements and testing appropriate to electrical resistance trace heating equipment used in industrial and commercial applications. While some of this work already exists in national or international standards, this document has collated much of this existing work and added considerably to it.

IEC/IEEE 62395-2 provides detailed recommendations for the system design, installation and maintenance of electric trace heating systems in industrial and commercial applications.

It is the objective of the IEC/IEEE 62395 series that, when in normal use, electrical trace heating systems operate safely under their defined conditions of use, by

- a) employing heaters of the appropriate construction and meeting the test criteria detailed in IEC/IEEE 62395-1. The construction includes a metallic sheath, braid, screen or equivalent electrically conductive covering;
- b) operating at safe temperatures when designed, installed, and maintained in accordance with IEC/IEEE 62395-2.
- c) having at least the minimum levels of overcurrent and earth-fault protection required in IEC/IEEE 62395-1 and IEC/IEEE 62395-2.

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ELECTRICAL RESISTANCE TRACE HEATING SYSTEMS FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS –

Part 1: General and testing requirements

1 Scope

This part of IEC/IEEE 62395 specifies requirements for electrical resistance trace heating systems and includes general test requirements.

This document pertains to trace heating systems that can comprise either factory-fabricated or field-assembled (work-site) units, and which can be series and parallel trace heaters or surface heaters (heater pads and heater panels) that have been assembled and/or terminated in accordance with the manufacturer's instructions.

This document also includes requirements for termination assemblies and control methods used with trace heating systems.

This document provides the essential requirements and testing appropriate to electrical resistance trace heating equipment used in industrial and commercial applications. The products complying with this document are intended to be installed by persons who are suitably trained in the techniques required and that only trained personnel carry out especially critical work, such as the installation of connections and terminations. Installations are intended to be carried out under the supervision of a qualified person who has undergone supplementary training in electric trace heating systems.

This document does not include or provide for any applications in potentially explosive atmospheres.

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This document does not cover induction, impedance or skin effect heating.

Trace heating systems are grouped into different types of applications and the different conditions found during and after installation necessitate different requirements for testing. Trace heating systems are usually for a specific type of installation or application. The product type grouping, applications and product attributes are indicated in Table 1.

NOTE Trace heating systems intended for use in explosive atmospheres are the subject of IEC/IEEE 60079-30-1 [3] and IEC/IEEE 60079-30-2 [4].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60519-1, *Safety in installations for electroheating and electromagnetic processing – Part 1: General requirements*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-11-3:2012, *Fire hazard testing – Part 11-3: Test flames – 500 W flames – Apparatus and confirmational test methods*

IEC/IEEE 62395-2:2024, *Electrical resistance trace heating systems for industrial and commercial applications – Part 2: Application guide for system design, installation and maintenance*

ISO 7240-2:2017, *Fire detection and alarm systems – Part 2: Fire detection control and indicating equipment*

ANSI/UL 864, *Standard for Control Units and Accessories for Fire Alarm Systems – Control and Indicating Equipment*

ASTM D 5025-20, *Standard Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials*

ASTM G155-21, *Standard practice for operating xenon arc light apparatus for exposure of non-metallic materials*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO, IEC and IEEE maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEEE Standards Dictionary Online: available at <http://dictionary.ieee.org>

NOTE 1 General definitions are given in the International Electrotechnical Vocabulary, IEC 60050 (all parts) [5]. Terms relating to industrial electroheat are defined in IEC 60050-841 [6].

NOTE 2 The terms defined in this Clause 3 are used both in IEC/IEEE 62395-1 and IEC/IEEE 62395-2.

3.1 ambient temperature
temperature surrounding the object under consideration

Note 1 to entry: Where trace heaters or surface heaters are enclosed in thermal insulation, the ambient temperature is the temperature exterior to such thermal insulation.

3.1.1 maximum ambient temperature
highest specified ambient temperature

3.1.2 minimum ambient temperature
lowest specified ambient temperature

Note 1 to entry: Heat-loss calculations in IEC 62395-2 are based on the minimum ambient temperature.

3.2 branch circuit
portion of the wiring installation between the overcurrent device protecting the circuit and the trace heater(s) or surface heater(s)

3.3 cold lead
electrically insulated conductor or conductors used to connect a trace heater or surface heater to the branch circuit and designed so that it does not produce significant heat

**3.4
connection**

termination or splice used to attach trace heaters or surface heaters to power wiring or to connect sections of these devices

**3.5
dead-leg**

segment of process piping segregated from the normal flow pattern for the purpose of providing a heat loss reference

**3.6
design loading**

minimum power that meets the design requirements, in the specified adverse conditions (minimum ambient and maximum wind velocity), after voltage and resistance tolerances and appropriate safety factors have been considered

[SOURCE: IEC/IEEE 60079-30-1:2015, 3.6]

**3.7
electrically conductive covering**

metallic braid, metallic sheath, or alternative covering with sufficient conductivity so that, when bonded to ground, it will allow a ground fault protective device to operate under a fault condition

**3.8
end termination**

termination, which can be heat producing, applied to a trace heater at the end opposite to that where the power is supplied

**3.9
factory-fabricated unit**

trace heater unit or set or surface heater unit or set, including the necessary terminations and connections, assembled by the manufacturer

**3.10
field-assembled unit**

trace heaters or surface heaters supplied unterminated with terminating components to be assembled at the work site

**3.11
heat loss**

energy flow from a workpiece, pipe, vessel or equipment to its surroundings

**3.12
heat sink**

part that conducts and dissipates heat away from a workpiece

Note 1 to entry: Typical heat sinks are pipe shoes, pipe supports and items of large mass such as valve actuators or pump bodies.

**3.13
heat transfer aids**

thermally conductive materials, such as metallic foils or heat transfer compounds used to increase the heat-transfer efficiency from trace heaters or surface heaters to the workpiece

**3.14
heater pad**

surface heater, comprising series or parallel connected elements having sufficient flexibility to conform to the shape of the surface to be heated

3.15

heater panel

non-flexible surface heater, comprising series or parallel connected elements fabricated to conform to the general shape of the surface to be heated

3.16

heating device

trace heater or surface heater

3.17

heating device set

heating device assembled with the associated parts necessary to connect it to a source of electrical supply

3.18

integral component

component such as a heat shrink termination, a cold lead connection, a moulded end seal or a splice, which conforms to the general shape of the trace heater or surface heater and is exposed to the same environment as the trace heater or surface heater, which can be factory-fabricated or field-assembled, and which is not intended to be re-used in the event of a repair or modification

3.19

low risk of mechanical damage

installations and applications where only lower levels of impact and deformation are expected to occur

3.20

maximum continuous exposure temperature (trace heater de-energized)

highest allowable continuous temperature to which the trace heating system can be exposed as declared by the manufacturer

3.21

maximum intermittent exposure temperature

highest allowable intermittent temperature to which a trace heater can be exposed, as declared by the manufacturer

3.22

maximum maintain temperature

specified maximum workpiece or process temperature the trace heater can maintain as declared by the manufacture

3.23

maximum continuous operating temperature

specified maximum workpiece temperature, the trace heater, can operate continuously when energized as declared by the manufacturer

3.24

maintain temperature

specified temperature of a workpiece or process that the trace heaters shall be able to maintain

3.25

maximum sheath temperature

maximum temperature of the outermost continuous covering of the trace heater or surface heater

3.26

maximum withstand temperature

maximum continuous exposure temperature or the maximum intermittent exposure temperature (energized or de-energized) whichever is higher, as declared by the manufacturer

3.27

minimum installation temperature

minimum temperature at which the trace heating system can be handled and installed

3.28

MI trace heater

mineral insulated metal sheathed trace heater typically containing one or more heating conductors

3.29

operating voltage

actual voltage applied to the trace heater or surface heater when in service

3.30

outdoor exposure

exposure to outdoor conditions of ultraviolet light and moisture

3.31

overjacket

continuous layer of material applied over the trace heater or surface heater to provide mechanical or environmental protection

3.32

parallel trace heater

heating elements that are electrically connected in parallel, either continuously or in zones, so that the power output per lineal length is maintained, irrespective of any change in length for the continuous type or for any number of discrete zones

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3.33
rated output

total power or the power per unit length or power per unit surface area of the trace heater or surface heater at rated voltage, temperature, and length or area

3.34

rated voltage

voltage assigned by the manufacturer to which operating and performance characteristics of trace heaters or surface heaters are referred

3.35

routine test

test that is carried out by the manufacturer of the trace heater or surface heater on all trace heaters or surface heaters during or after the production process

3.36

series trace heater

heating elements electrically connected in series with a single current path and with a specific resistance at a given temperature for a given length