

Electrical resistance trace heating systems for industrial and commercial applications —

Part 1: General and testing requirements

ICS 25.180.10

National foreword

This British Standard is the UK implementation of EN 62395-1:2006. It is identical to IEC 62395-1:2006. Together with BS EN 60079-30-1:2007, it supersedes BS 6351-1:1983 which is withdrawn.

The design and installation of electrical resistance trace heating systems previously contained in BS 6351-2:1983, BS 6351-3:1983 and BS EN 62086-2:2005 are now contained in BS EN 60079-30-2:2007 and DD IEC/TS 62395-2:2008.

The UK participation in its preparation was entrusted to Technical Committee PEL/27, Electroheating.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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**Electrical resistance trace heating systems
for industrial and commercial applications
Part 1: General and testing requirements
(IEC 62395-1:2006)**

Systèmes de traçage par résistance
électrique pour applications industrielles et
commerciales
Partie 1: Exigences générales et d'essai
(CEI 62395-1:2006)

Elektrische Begleitheizungen
Trace-Widerstandsheizungen
für industrielle und gewerbliche Zwecke
Teil 1: Allgemeine Anforderungen
und Prüfanforderungen
(IEC 62395-1:2006)

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of document 27/533/FDIS, future edition 1 of IEC 62395-1, prepared by IEC TC 27, Industrial electroheating equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62395-1 on 2006-09-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2007-06-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2009-09-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62395-1:2006 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

IEC 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 standard has collated much of this existing work and added considerably to it.

IEC/TS 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 IEC 62395 that, when in normal use, electrical trace heating systems should operate safely under their defined conditions of use, by

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

Some tests of Part 1 differ from similar tests developed by TC 20 and are to be reviewed in the future. These and other tests are almost identical to the tests given in IEC 62086-1:2001¹ and are duplicated in Part 1 for completeness (see notes in the text).

¹ Permission to reproduce the text of several tests from IEC 62086-1:2001 that are not specific to explosive gas atmospheres has been granted by TC 31.

ELECTRICAL RESISTANCE TRACE HEATING SYSTEMS FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS –

Part 1: General and testing requirements

1 Scope and object

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

This standard pertains to trace heating systems that may comprise either factory-fabricated or field-assembled (work-site) units, and which may be series heater cables, parallel heater cables, heater pads or heater panels that have been assembled and/or terminated in accordance with the manufacturer's instructions for connection to voltage supplies up to and including 450-750 V.

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

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

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

Trace heating systems can be 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 certified for a specific type of installation or application. Typical applications for the different types of installation include, but are not limited to:

- a) installations of trace heating for surface heating on pipes, vessels and associated equipment – applications include:
 - freeze protection and temperature maintenance;
 - hot water lines;
 - oil and chemical lines;
 - sprinkler system mains and supply piping;
- b) outdoor exposed area installations of trace heating – applications include:
 - roof de-icing;
 - gutter and down-spout de-icing;
 - catch basins and drains;
 - rail heating²;
- c) installation with embedded trace heating – applications include:
 - snow melting;
 - frost heave protection;
 - floor warming;

² Further evaluation may be required to address application specific conditions such as fluctuations in impressed voltage and voltage spikes.

- energy storage systems;
 - door frames;
- d) installations with trace heating inside conduit or piping – applications include:
- snow melting – in conduit;
 - frost heave protection – in conduit;
 - floor warming – in conduit;
 - energy storage systems – in conduit;
 - internal trace heating for freeze protection of potable water lines;
 - enclosed drains and culverts.

2 Normative references

The following referenced documents are indispensable for the application 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 60050-841:2004, *International Electrotechnical Vocabulary (IEV) – Part 841: Industrial electroheat*

IEC 60068-2-9, *Environmental testing – Part 2: Tests – Guidance for solar radiation testing*

IEC 60519-1:2003, *Safety in electroheat installations – Part 1: General requirements*

IEC 60519-10:2005, *Safety in electroheat installations – Part 10: Particular requirements for electrical resistance trace heating systems for industrial and commercial applications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-841 and in IEC 60519-10, some of which are repeated here, as well as the following, apply.

3.1

ambient temperature

average temperature of air or another medium in the vicinity of the equipment

NOTE Where electrical trace heaters are enclosed in thermal insulation, the ambient temperature is the temperature exterior to such thermal insulation.

[IEV 826-10-03, modified]

3.2

branch circuit

that portion of the wiring installation between the overcurrent device protecting the circuit and the trace heater(s)

3.3 connections (terminations)

3.3.1

cold lead (for trace heater)

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

3.3.2

end termination

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

3.3.3

integral components

factory-fabricated or field-assembled electrical terminations and connections, such as heat shrink terminations, moulded end seals or splices, which conform to the general shape of the trace heater and are exposed to the same environments as the trace heater

3.3.4

power termination

termination applied to the end of a trace heater at which the power is supplied

3.3.5

tee

electrical connection of trace heaters, in series or in parallel, to accommodate a branch in the circuit and resembling the shape of a capital T

3.4

dead leg

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

3.5

design loading

minimum power that will meet the design requirements, in the worst conditions, after voltage and resistance tolerances and appropriate safety factors have been considered

3.6

factory-fabricated unit or set

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

3.7

field-assembled unit or set

trace heaters supplied in bulk with terminating components to be assembled at the work site

3.8

heat loss

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

3.9

heat sink

part that conducts and dissipates heat away from a workpiece

NOTE Typical heat sinks are pipe shoes, pipe supports and items of large mass such as valve actuators or pump bodies.

3.10

heat transfer aids

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

3.11

heater pad

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

3.12

heater panel

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

3.13

high limit temperature

maximum allowable temperature of the system, including piping, fluid and trace heating system

3.14

maximum ambient temperature

highest ambient temperature at which the trace heater is operable and should perform according to specified requirements

3.15

maximum withstand temperature

maximum operating or exposure temperature that does not adversely affect the thermal stability of the trace heater and its component parts

3.16

metallic covering

metallic sheath, braid, screen or equivalent electrically conductive covering used to provide an electrical path to operate an electrical protection device and may also provide additional physical protection for a trace heater

3.17

minimum ambient temperature

lowest ambient temperature specified at which the trace heater is operable and performs according to specified requirements

NOTE Heat-loss calculations in IEC/TS 62395-2 are based on the minimum ambient temperature.

3.18

operating voltage

actual voltage applied to the trace heater when in service

3.19

overjacket

continuous layer of material applied outside the metallic sheath, screen or armouring to protect against corrosion

3.20

parallel trace heater(s)

heating elements electrically connected in parallel, with the heating element either continuous or in discrete units or zones, such that the watt density per unit length is not significantly changed with any change in circuit length

3.21

power density (linear or surface)

power output in watts per linear metre for trace heater cables and cable units, and in watts per square metre for trace heater pads and panels and trace heater pad and panel units

3.22

rated output

total power or power per unit length or unit surface area of the trace heater, at rated voltage, temperature, length or area which is normally expressed in watts, watts per metre or watts per square metre

3.23

rated voltage

voltage to which operating and performance characteristics of trace heaters are referred

3.24

routine test

test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria

[IEV 151-16-17]

3.25

series trace heater(s)

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

3.26

sheath

uniform and continuous metallic or non-metallic outer covering enclosing the trace heater, used to provide protection for the cable against influence from the surroundings (corrosion, moisture, etc.)

NOTE See overjacket (3.19).

3.27

sheath temperature

temperature of the outermost continuous covering that may be exposed to the surrounding atmosphere

3.28

stabilized design

concept where the temperature of the trace heater will, by design and use, stabilize below the limiting temperature, under the most unfavourable conditions, without the need for a protective system to limit the temperature

3.29

start-up current

current of a trace heater immediately upon energizing

3.30

system documentation

information typically provided by the supplier to allow satisfactory understanding, installation and safe use of the trace heating system

3.31

temperature controller

device or combination of devices incorporating a means of sensing temperature and of controlling the power supplied to the trace heater