# IEC/TS 62395-2

Edition 1.0 2008-06

# TECHNICAL SPECIFICATION

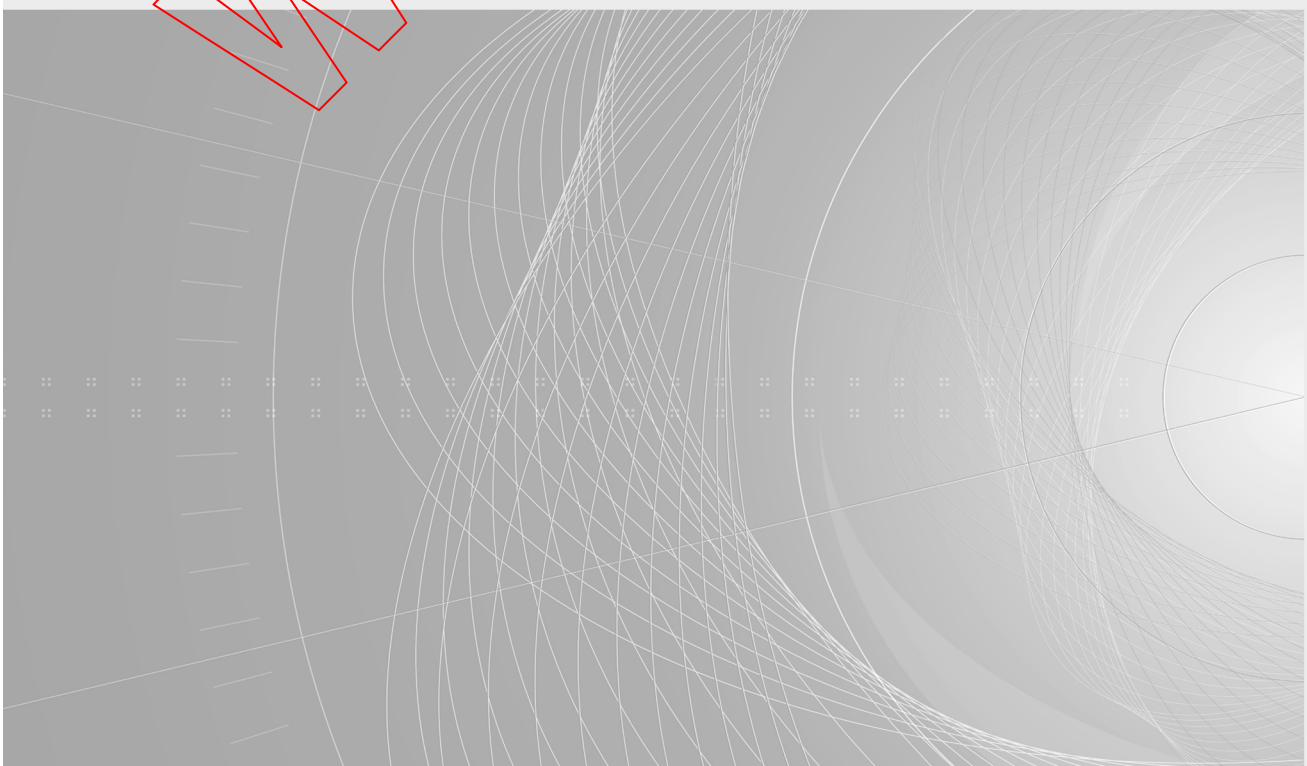
# SPÉCIFICATION TECHNIQUE



**Electrical resistance trace heating systems for industrial and commercial applications –**
**Part 2: Application guide for system design, installation and maintenance**

**Systèmes de traçage par résistance électrique pour applications industrielles et commerciales –**
**Partie 2: Guide d'application pour la conception, l'installation et la maintenance du système**





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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX XC

ICS 25.180.10

ISBN 2-8318-9776-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# ELECTRICAL RESISTANCE TRACE HEATING SYSTEMS FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS –

## Part 2: Application guide for system design, installation and maintenance

## FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62395-2, which is a technical specification, has been prepared by IEC technical committee 27: Industrial electroheating equipment.

The text of this technical specification is based on the following documents:

| Enquiry draft | Report on voting |
|---|---|
| 27/582/DTS | 27/606A/RVC |

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

# 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, maintenance and repair of electrical resistance trace heating systems in industrial and commercial applications which can include piping, vessels, roofs and concrete slab heating 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 so as to meet the test criteria and requirements detailed in IEC 62395-1. 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 IEC/TS 62395-2;

c) having at least the minimum levels of overcurrent and ground fault protection requirements in IEC 62395-1 (2006) (4.3).

# ELECTRICAL RESISTANCE TRACE HEATING SYSTEMS FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS –

## Part 2: Application guide for system design, installation and maintenance

## 1 Scope and object

This part of IEC 62395 provides detailed recommendations for the system design, installation, maintenance and repair of electrical resistance trace heating systems in industrial and commercial applications. This technical specification does not include or provide for any applications in potentially explosive atmospheres.

This specification pertains to trace heating systems that may comprise either factory constructed or field (work-site) assembled 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 V/750 V.

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

Trace heating systems can be grouped into different types of installations. These are characterized by different requirements for testing and are usually certified for a specific type of installation or application. Typical applications for the different types of installation are as follows:

a) Installations of trace heating on pipes, vessels and associated equipment. Applications include:
   – freeze protection and temperature maintenance;
   – hot water lines;
   – oil and chemical lines;
   – sprinkler systems.
b) Outdoor exposed area installations of trace heating. Applications include:
   – roof de-icing;
   – gutter and downspout de-icing;
   – catch basins and drains;
   – rail heating.
c) Installation with embedded trace heating. Applications include:
   – snow melting;
   – floor warming;
   – frost heave prevention;
   – underground thermal energy storage systems;
   – door frames.
d) Installations with trace heating inside conduit or piping. Applications include:
   – snow melting – in conduit;
   – floor warming – in conduit;
   – frost heave prevention – in conduit;

- underground thermal energy storage systems – in conduit;
- internal trace heating 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, *International Electrotechnical Vocabulary – Part 841: Industrial electroheat*

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

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

## 3 Terms and definitions

For the purposes of this document, the referenced terms and definitions are given in IEC 60519-1, IEC 62395-1 and IEC 60050-841.

## 4 Surface heating of vessels and piping systems

### 4.1 Application description

#### 4.1.1 General

Piping and vessels are often provided with surface-mounted trace heating systems to maintain water above freezing-point and to maintain process fluids and gases at given temperature levels. The trace heaters compensate for heat losses to the environment that are reduced but not eliminated by thermal insulation.

#### 4.1.2 Environmental conditions

Attention should be directed to the surrounding environmental conditions, especially for systems that are exposed to sunlight (ultraviolet exposure), coastal atmospheres (corrosive salt spray and high humidity), and chemical atmospheres such as oil refineries and chemical plants.

Equipment subject to ultraviolet exposure may degrade due to surface oxidation, which can possibly lead to surface embrittlement and cracking. Corrosive atmospheres can affect the same exposed surfaces and can accelerate degradation of surfaces that are also susceptible to ultraviolet exposure. Chemical exposure can affect all equipment, whether covered by thermal insulation or not.

The trace heating equipment for piping and vessels is often protected from corrosion and ultraviolet exposure to some degree by the thermal insulation. However, these systems can have components that are exposed to the environment such as electrical connection components and weather barrier around the thermal insulation. The selection of trace heating equipment shall include a review of the suitability of equipment to the expected environmental conditions.

#### 4.1.3 Trace heating systems considerations

Trace heating systems can range from simple pipe freeze protection in commercial buildings to large complex piping/vessel systems in industrial facilities. The details required for design can vary based on the complexity of the application. Control systems and requirements for monitoring can also vary depending on the control and design requirements.

Trace heating equipment should be chosen that is suitable for the application. For example, plastic piping typically has only a small range of exposure temperatures. The trace heating and control system shall keep the piping temperature within the allowed range. Higher temperature processes shall utilize trace heating and thermal insulation equipment that are suitable for the maximum exposure temperatures.

Particular attention should be given to the materials of piping systems, as well as the trace heating systems, as related to an effective earth-leakage/ground-fault return path. The use of non-metallic, lined or coated piping systems may complicate the earth-leakage/ground-fault return path. The electrical return paths established at the time of installation may become degraded due to corrosion during long-term operation.

### 4.2 Design information – General

#### 4.2.1 General

The requirements for system design varies from simply following installation instructions for freeze protection to the development of electrical, control and monitoring, and trace heating system layouts for large, detailed, complex installations such as industrial facilities. While each design component requires individual treatment, the final system shall be evaluated as an integration of these component parts.

Trace heating system design shall conform to all IEC requirements for the use of electrical equipment and with the requirements of this technical specification. Consideration should be given to the maintenance of the trace heating systems to maintain energy efficiency and to routine testing of the installed systems for safe and proper operation.

Persons involved in the design and planning of electric trace heating systems should be suitably trained in all techniques required.

#### 4.2.2 Electrical system design

The evaluation of electrical resistance heating systems includes an initial assessment of energy requirements and the associated electrical distribution equipment. The selection of the type of trace heating equipment and the control equipment affects the requirements of the electrical system design. Additional information is given in 4.4.

#### 4.2.3 Control and monitoring

##### 4.2.3.1 General

Controls for trace heating systems are often specified to reduce total energy usage and/or to maintain particular processes within a narrow band. Monitoring systems are used to verify correct system operation and in many cases to provide an indication of electrical problems or temperatures that are out of range. Subclause 4.2.3 describes the basic types of controls and monitoring and defines critical applications relative to the control systems. Specific design of control systems is given in 4.5.

##### 4.2.3.2 Recommendations for control

The recommendations for control and monitoring are defined by the type of application.

a) Type I