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Explosive atmospheres -
Part 30-2: Electrical resistance trace heating - Guidance on application for design, installation and maintenance

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IEC/IEEE 60079-30-2 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres, in cooperation with the Petroleum & Chemical Industry Committee of the IEEE Industrial Applications Society under the IEC/IEEE Dual Logo Agreement.

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

Users of this document are advised that interpretation sheets clarifying the interpretation of this document can be published. Interpretation sheets are available from the IEC webstore and can be found in the "history" tab of the page for each document.

This second edition of IEC/IEEE 60079-30-2 cancels and replaces the first edition of IEC/IEEE 60079-30-2 published in 2015.

This edition includes the following significant technical changes with respect to the previous edition:

a) a general review and updating of the first edition;

b) the addition of Annex I - Other applications of trace heating in explosive atmospheres.

The significance of changes between IEC/IEEE 60079-30-2, Edition 1.0 (2015) and IEC/IEEE 60079-30-2, Edition 2.0 (this document) is as listed below:

		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
The addition of Annex I - Frost heave prevention	Annex I		X	

NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version.

Explanations:

A) Definitions

Minor and editorial changes

clarification

decrease of technical requirements

minor technical change

editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

Extension addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous document. Therefore, these will not have to be addressed for products in conformity with the preceding edition.

Major technical changes addition of technical requirements

increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be addressed for products in conformity with the preceding edition. For these changes additional information is provided in clause B) below.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

B) Information about the background of 'Major technical changes'

None.

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

Draft	Report on voting
31/1868/FDIS	31/1894/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/.

This document is to be used in conjunction with IEC/IEEE 60079-30-1, *Explosive atmospheres - Part 30-1: Electrical resistance trace heating - General and testing requirements.*

A list of all parts of IEC 60079 series, under the general title *Explosive atmospheres,* 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.

1 Scope

This part of IEC 60079 provides guidance for the application of electrical resistance trace heating systems in areas where explosive atmospheres can be present, with the exclusion of those classified as requiring Equipment Protection Level (EPL) Ga or Da (traditional relationship to Zone 0 and Zone 20 respectively). This document also provides guidance for explosive atmospheres incorporating the Division method of area classification that can be applied by some users of this document.

NOTE Information on the Division method is given in NFPA 70® [1] and CSA C22.1 [2].

This document provides recommendations for the design, installation, maintenance and repair of trace heating systems including associated control and monitoring equipment. It does not cover devices that operate by induction heating, skin effect heating or direct pipeline heating, nor those intended for stress relieving.

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 60050-426, *International Electrotechnical Vocabulary (IEV) - Part 426: Explosive atmospheres*

IEC 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirements*

IEC 60079-14, *Explosive atmospheres - Part 14: Electrical installations design, selection and erection*

IEC 60079-15, *Explosive atmospheres - Part 15: Equipment protection by type of protection "n"*

IEC 60079-17, *Explosive atmospheres - Part 17: Electrical installations inspection and maintenance*

IEC/IEEE 60079-30-1:2025, *Explosive atmospheres - Part 30-1: Electrical resistance trace heating - General and testing requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-426, IEC 60079-0 and IEC/IEEE 60079-30-1 and the following apply.

ISO and IEC 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

3.1
minimum ambient temperature
<trace heating>
lowest ambient temperature specified at which trace heating is operable and performs according to specified requirements (and on which heat-loss calculations are based)

3.2
dead leg
<trace heating>
segment of process piping segregated from the normal flow pattern for the purpose of providing a heat loss reference

3.3
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

4 Application considerations

4.1 General

This part of IEC 60079 supplements the requirements specified in IEC 60079-14, IEC 60079-17 and IEC/IEEE 60079-30-1.

For trace heating systems that are to be installed in locations where EPLs Gb, Gc, Db or Dc are required, and/or to cover the requirements in Annex E of IEC/IEEE 60079-30-1, full details of the area classifications are specified. Where special considerations apply or where site conditions can be especially onerous, these conditions are detailed in the trace heating specification. Additional guidance specific to frost heave environments is given in Annex I.

The specification for heating systems to be installed on mobile equipment or skid units (for example, relocatable structures) should accommodate the adverse conditions in which the trace heating system can be used.

Where any parts of the trace heating system are likely to be exposed, those parts should be suitable for the environment.

4.2 Corrosive areas

All components of electric trace heating systems should be selected verifying that they are compatible with any corrosive materials that can be encountered during the lifetime of the system. Trace heating systems operating in corrosive environments have a higher potential for failure than in non-corrosive environments. Deterioration of the thermal insulation system is made worse by corrosion of the weather barrier and the possibility of moisture leaks soaking the thermal insulation.

4.3 Process temperature accuracy

4.3.1 Type I

A Type I process is one for which the temperature should be maintained above a minimum point. Ambient sensing control may be acceptable. Large blocks of power may be controlled by means of a single temperature controller and an electrical distribution panel board. Heat input can be provided unnecessarily at times and wide temperature excursions should be tolerable. Energy efficiency can be improved through the use of dead leg control or ambient proportional control techniques (see 6.14).

4.3.2 Type II

A Type II process is one for which the temperature should be maintained within a moderate band. Control by mechanical thermostats is typical.

4.3.3 Type III

A Type III process is one for which the temperature should be controlled within a narrow band. Electronic controllers using thermocouple or resistance-temperature detector (RTD) process temperature sensors facilitate field (work site) calibration and provide maximum flexibility in the selection of temperature alarm and monitoring functions. Heat input capability can be provided to preheat an empty pipe or raise the fluid temperature, or both, within a specified range and time interval. Type III systems require strict adherence to flow patterns and thermal insulation systems.

Temperature-sensing systems such as fiber optic distributed temperature sensing can enhance the safety and reliability of the temperature-sensitive fluid applications.

4.4 Installation considerations

If failure of any part of the trace heating system can result in a safety or process problem, then the trace heating system can be considered as a critical component of the total process. The temperature control and circuit monitoring requirements of an application may be defined according to the temperature control types described in 4.3.

When trace heating is critical to the process, circuit monitoring for correct operation, malfunction alarms, and back-up trace heaters should be specified. Spare or back-up controllers can be specified to be automatically activated in the event of a fault being indicated by the monitoring/alarm system. Back-up trace heaters can allow maintenance or repairs to be performed without a process shutdown and can be used to enhance reliability.

5 Thermal insulation

5.1 General

The selection, installation and maintenance of thermal insulation is a key component in the performance of an electrical trace heating system. The thermal insulation system is normally designed to limit heat loss with the trace heating system compensating for the remainder. Therefore, problems with thermal insulation have a direct impact on the overall system performance.

The primary function of thermal insulation is to reduce the rate of heat transfer from a surface that is operating at a temperature other than ambient. This reduction of energy loss can:

– reduce operating expenses;
– improve system performance;
– increase system output capability.

Prior to any heat loss analysis for an electrically traced pipeline, vessel or other mechanical equipment, a review of the selection of the thermal insulation system is recommended. The principal areas for consideration are as follows:

– selection of a thermal insulation material;
– selection of a weather barrier (cladding);
– selection of the economic insulation thickness with consideration for optimum trace heater design;
– selection of the proper insulation size.

Information about the equivalent thickness of insulating cements is given in Annex H.

5.2 Selection of insulating material

The following are important aspects to be considered when selecting an insulation material. These factors should be considered and the selection optimised according to the operator's criteria:

- temperature rating;
- thermal conductivity, λ, of the insulation;
- mechanical properties;
- chemical compatibility and corrosion resistance;
- moisture resistance;
- health risks during installation;
- fire resistance;
- toxicological properties when exposed to fire;
- costs.

Insulation materials commonly available include:

- expanded silica;
- mineral fiber;
- cellular glass;
- urethane;
- fiberglass;
- calcium silicate;
- polyisocyanurate;
- perlite silicate;
- rock wool;
- aerogel.

For soft insulants (mineral fiber, fiberglass, etc.), actual pipe size insulation may be used in many cases by banding the insulation tightly. Care should be taken to prevent the trace heater from being buried within the insulation, which can cause damage to the trace heater or restrict proper heat transfer. As an alternative, the next largest pipe size insulation that can easily enclose pipe and electric trace heater is also acceptable. Rigid insulation (calcium silicate, expanded silica, cellular glass, etc.), may be pipe-size insulation if board sections are cut to fit the longitudinal joint. This type of installation technique is commonly referred to as an extended leg installation. Alternatively, the next largest insulation size may be selected to accommodate the trace heater. In all cases, the insulation size and thickness should be clearly specified.

Insulation for valves, flanges, pumps, instruments, and other irregularly shaped equipment may be constructed for the particular configuration. This can be fabricated from block, insulation segments or flexible removable covers.

Non-insulated or partially insulated pipe supports or equipment require additional heat input to compensate for the higher heat loss. Insulating cements or fibrous materials should be used to fill cracks and joints. Where insulating cements are used for total insulation of an irregular surface, a proportionally thicker layer of insulating cement may be applied to achieve the desired insulating capability.

5.3 Selection of weather barrier (cladding)

Proper operation of an electrically trace heated system depends upon the insulation being dry. Electric tracing normally has insufficient heat output to dry wet thermal insulation. Some insulation materials, even though removed from the piping and force dried, never regain their initial characteristics after once being wet.

Straight piping can be weather-protected with metal jacketing, polymeric, or a mastic system. When metal jacketing is used, it should be smooth with formed, modified "S" longitudinal joints. The circumferential end joints should be sealed with closure bands and supplied with sealant on the outer edge or where they overlap (see Figure 1).

Jacketing that is overlapped or otherwise closed without sealant is not effective as a barrier to moisture. A single, unsealed joint can allow a considerable amount of water to leak into the insulation during a rainstorm, therefore specifications for elastomeric water sealing of cladding should be suitable for long term exposure to the environmental conditions.

The type of weather barrier used should, as a minimum, be based on a consideration of the following:

– effectiveness in excluding moisture;
– corrosive nature of chemicals in the area;
– fire protection requirements;
– durability to mechanical abuse;
– cost.

5.4 Selection of economical thickness to provide optimum trace heating design

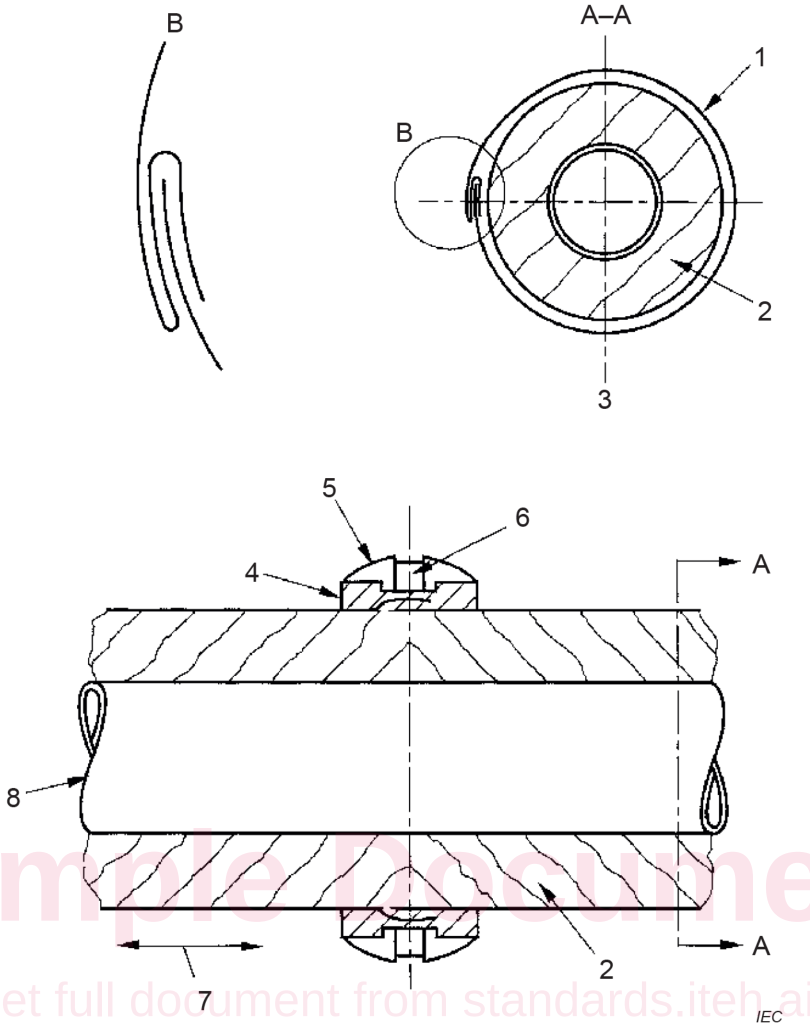
At a minimum, an economic consideration of the insulation weighs the initial costs of the materials and installation against the energy saved over the life of the insulation. It should be noted that the actual insulation thicknesses do not always correspond exactly to the nominal insulation thickness. When choosing the insulation size, considerations should be made as to whether or not the actual pipe-size insulation is suitable for accommodating both pipe and trace heater.

The insulation thickness selected for economic consideration of non-traced portions of a system does not necessarily provide for an optimum or acceptable trace heating system design and installation. Consideration of the electric trace heating design should be made in conjunction with the selection of insulation. Selection of an optimum insulation thickness for electric traced lines can do the following:

– reduce the power output level necessary for each trace heater;
– increase the length of trace heater circuits;
– decrease the number of circuits required;
– decrease the total power required for electric trace heater systems.

5.5 Double insulation

The double insulation technique may be employed when the pipe temperature exceeds the maximum allowable temperature of the trace heater. Prevention of the freezing of condensate in high temperature steam lines when these lines are not in use is a typical application. It consists of locating the trace heater between two layers of insulation surrounding the pipe. The essence of the double-insulation technique is to determine the correct combination of inner and outer insulation type and thickness that results in an acceptable interface temperature for the trace heater. This relationship is illustrated in Figure 2. Note that maximum ambient temperature conditions should be used in this determination. Consideration should be given to joint installation and alignment of the inner insulation to account for thermal expansion of the piping.



Key

1 metal jacket

2 insulation

3 metal jacket insulated pipe

4 mastic sealer

5 closure band

6 insulated strap

7 movement

8 pipe

Figure 1 – Thermal insulation - Weather-barrier installation