
Električne naprave za eksplozivne plinske atmosfere – Segrevanje sledi z električno upornostjo – 2. del: Vodilo za zasnovo, inštalacijo in vzdrževanje

Electrical apparatus for explosive gas atmospheres – Electrical resistance trace heating – Part 2: Application guide for design, installation and maintenance

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Titre : CEI 62086-2 Ed. 2.0: Matériel électrique pour atmosphères explosives gazeuses – Traçage par résistance électrique – Partie 2: Guide d'application pour la conception, l'installation et la maintenance

Titre : IEC 62086-2 Ed. 2.0: Electrical apparatus for explosive gas atmospheres - Electrical resistance trace heating – Part 2: Application guide for design, installation and maintenance

Note d'introduction

Introductory note

ATTENTION	ATTENTION
CDV soumis en parallèle au vote (CEI) et à l'enquête (CENELEC)	Parallel IEC CDV/CENELEC Enquiry

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES –
ELECTRICAL RESISTANCE TRACE HEATING –****Part 2: Application guide for design,
installation and maintenance**

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International Standard IEC 62086-2 has been prepared by IEC technical committee 31: Electrical apparatus for explosive atmospheres.

The general revisions and updating of Edition 1 are as a result of National comments received. The main technical differences apart from the general revision and updating from Edition 1 are:

- a) Corrections.
- b) Extensive revision and additions to Part 2 for design and installation recommendations.

The text of this standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for the approval of this standard 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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date¹⁾ 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

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¹⁾ The National Committees are requested to note that for this publication the maintenance result date is

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES – ELECTRICAL RESISTANCE TRACE HEATING –

Part 2: Application guide for design, installation and maintenance

1 Scope

This part of IEC 62086 provides guidance for the application of electrical resistance trace heating systems in areas where explosive gas atmospheres may be present, with the exception of those classified as zone 0.

It provides recommendations for the design, installation, maintenance and repair of trace heating equipment and 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.

This part supplements the requirements specified in IEC 62086-1.

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 60050-426, *International Electrotechnical Vocabulary (IEV) – Part 426: Electrical apparatus for explosive atmospheres*

IEC 60079-0:2004, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 60079-7:2001, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety 'e'*

IEC 60079-10:2002, *Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas*

IEC 60079-14:1996, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installations in hazardous areas (other than mines)*

IEC 60079-17:1996, *Electrical apparatus for explosive gas atmospheres – Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)*

IEC 62086-1: 200X, *Electrical apparatus for explosive gas atmospheres – Electrical resistance trace heating – Part 1: General and testing requirements*

3 Definitions

For the purposes of this part of IEC 62086, the definitions in IEC 62086-1, IEC 60050-426, IEC 60079-0, and IEC 60079-7 apply.

4 Application considerations

4.1 General

This standard supplements the requirements of IEC 60079-14 and IEC 60079-17.

Where trace heating systems are to be installed in explosive gas atmospheres, full details of the hazardous area classification(s) (IEC 60079-10) shall be specified. The specification shall state the zone of risk (1 or 2), gas group (IIA, IIB or IIC) and temperature classification in accordance with IEC 60079-0. Where special considerations apply or where site conditions may be especially onerous, these conditions shall be detailed in the trace heating specification.

Where trace heating systems are to be installed on mobile equipment or interchangeable skid units, the specification for these trace heating systems should accommodate the worst conditions in which the trace heating system may be used.

Where any parts of the trace heating system are likely to be exposed to ultraviolet radiation, those parts should be suitable for use in such conditions.

4.2 Corrosive areas

All components of electric trace heating systems should be examined to verify that they are compatible with any corrosive materials that may 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 pipeline and vessel leaks soaking the thermal insulation. Particular attention should be given to the materials of piping systems, as well as the electric trace heating systems, as related to the effective earth-leakage/ground-fault return path. The use of non-metallic or lined or coated piping systems may further complicate the earth-leakage/ground-fault return path and special consideration should be given to these piping systems. Earth-leakage/ground-fault return paths established at the time of installation may become degraded due to corrosion during the operation of the plant.

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 control device and an electrical distribution panel board. Heat input may be provided unnecessarily at times and wide temperature excursions should be tolerable. Energy efficiency may be improved through the use of dead-leg control techniques (see 6.13).

4.3.2 Type II

A Type II process is one for which the temperature should be maintained within a moderate band. Control by pipeline sensing 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 pipe-sensing controllers using thermocouple or resistance-temperature detector (RTD) units facilitate field (work site) calibration and provide maximum flexibility in the selection of temperature alarm and monitoring functions. Heat input capability may 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.

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 may be considered to be 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 Clause 4.3, together with the circuit monitoring criticality as described in Table 1.

Table 1 – Process types

Is trace heating a critical component of the process?	Desired accuracy of process temperature control		
	Above a minimum point Type I	Within a moderate band Type II	Within a narrow band Type III
Yes = Critical (C-)	C – I	C – II	C – III
No = Non-critical (NC-)	NC – I	NC – II	NC – III

When trace heating is critical to the process, circuit monitoring for correct operation, malfunction alarms, and back-up (redundant) trace heaters should be considered. 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. This is sometimes known as "redundancy". Back-up trace heaters may allow maintenance or repairs to be performed without a process shutdown and may be used to enhance reliability.

5 Thermal insulation

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5.1 General

The selection, installation and maintenance of thermal insulation should be considered a key component in the performance of an electrical trace heating system. The thermal insulation system is normally designed to prevent the majority of heat loss with the trace heating system compensating for the remainder. Therefore, problems with thermal insulation will 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 may

- 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 insulation system is recommended. The principal areas for consideration are as follows:

- selection of an insulation material;
- selection of a weather barrier (cladding);
- selection of the economic insulation thickness;

- selection of the proper insulation size.

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 fibre;
- cellular glass;
- urethane;
- fibreglass;
- calcium silicate;
- polyisocyanurate;
- perlite silicate.

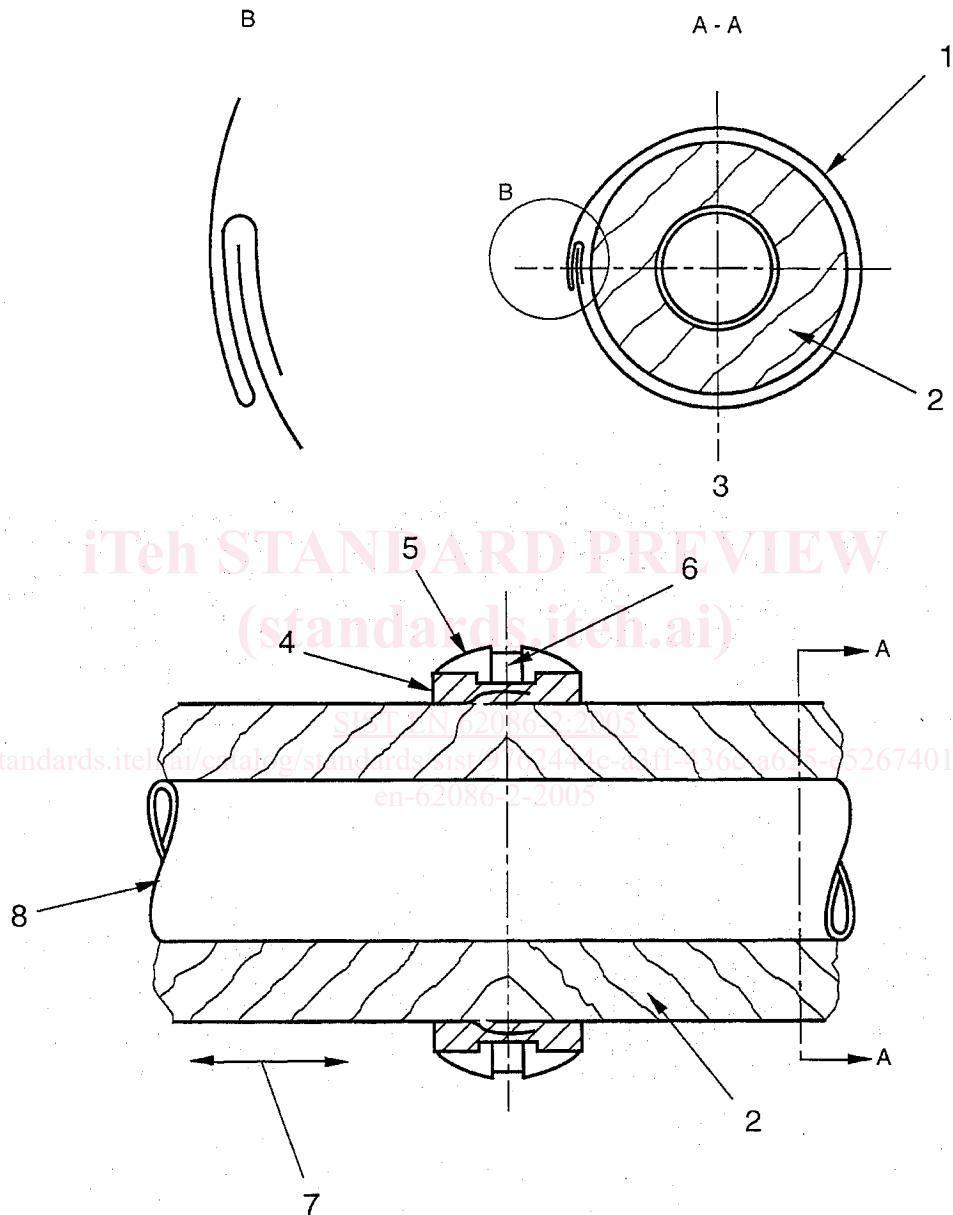
For soft insulants (mineral fibre, fibreglass, etc.), actual pipe size insulation may be used in many cases by banding the insulation tightly. Care should be taken to prevent the trace heater from being buried within the insulation, which may cause damage to the trace heater or may restrict proper heat 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.

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 may 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.



Key

- | | |
|---------------------------------|---------------------|
| 1 – Metal jacket | 5 – Closure band |
| 2 – Insulation | 6 – Insulated strap |
| 3 – Metal jacket insulated pipe | 7 – Movement |
| 4 – Mastic sealer | 8 – Pipe |

Figure 1 – Thermal insulation – Weather-barrier installation

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

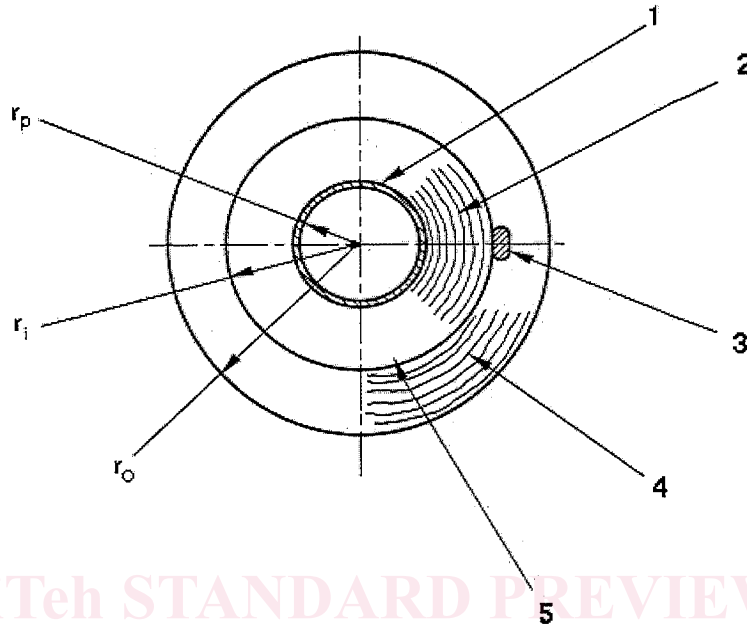
- effectiveness in excluding moisture;
- corrosive nature of chemicals in the area;
- fire protection requirements;
- durability to mechanical abuse;
- cost.

5.4 Selection of economical thickness

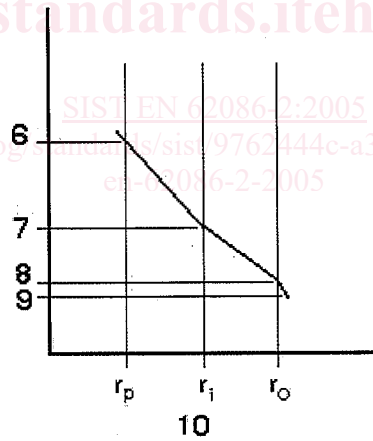
At a minimum, an economic consideration of the insulation will weigh the initial costs of the materials and installation against the energy saved over the life of the insulation. It should be noted that the actual insulation thicknesses do not always correspond exactly to the nominal insulation thickness. 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.

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 will result in an acceptable interface temperature for the trace heater. This relationship is illustrated in Figure 2. Note that maximum ambient temperature conditions should be considered in this determination.



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Key

- | | |
|----------------------------|--|
| 1 – Pipe | 6 – Maximum temperature pipe |
| 2 – Inner insulation layer | 7 – Interface temperature |
| 3 – Heat tracer | 8 – Outer insulation surface temperature |
| 4 – Outer insulation layer | 9 – Ambient temperature |
| 5 – Metal foil (aluminium) | 10 – Radius |

Figure 2 – Typical temperature profile