

## GENERAL SPECIFICATION

### ELECTRICAL

#### GS EP ELE 331

|                           |
|---------------------------|
| <b>Tape trace heating</b> |
|---------------------------|

|      |         |                                            |
|------|---------|--------------------------------------------|
|      |         |                                            |
|      |         |                                            |
| 03   | 10/2012 | Minor Changes                              |
| 02   | 01/2011 | Minor changes                              |
| 01   | 10/2005 | Addition of "EP" root to GS identification |
| 00   | 10/2004 | First issue                                |
| Rev. | Date    | Purpose of the revision                    |

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## 1. Scope

This specification defines the minimum technical requirements for the design, the construction, the manufacture, the supply, the installation, the inspection and the testing (FAT and pre-commissioning) of an electrical trace heating tape system for installation on Company facilities located onshore or offshore.

The Trace Heating system shall include the transformers and distribution boards, together with all necessary heating elements (trace heat tapes), junction boxes, cable glands, thermostats, fixing materials, labels, markers and associated documentation.

## 2. Reference documents

The reference documents listed below form an integral part of this General Specification.

Design and engineering shall conform as a minimum requirement to the current edition of the following in preference order:

- Applicable laws, and regulations of the country in which the system will be operated. In cases where no "local" regulations exist, the French laws and regulations shall be used
- Company Particular Specifications and data sheet (if any)
- Company General Specifications
- Applicable International Electro-technical Commission (IEC) Standards
- Applicable CENELEC Standards.

Applicable recognised standards and codes (e.g. UTE-NFC, BSI, VDE, etc.) where IEC publications have not yet been issued.

### External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

| Reference                    | Title                                                                                                                                                                  |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC 60050                    | International Electrotechnical Vocabulary                                                                                                                              |
| IEC 60071-1                  | Insulation co-ordination - Part 1: Definitions, principles and rules                                                                                                   |
| IEC 60079 (Parts 30-1; 30-2) | Explosive atmospheres - Parts 30-1; 30-2                                                                                                                               |
| IEC 60332-3-22               | Tests on electric and optical fibre cables under fire conditions - Part 3-22: Tests for vertical flame spread of vertically-mounted bunched wires or cables-Category A |
| IEC 60519-10                 | Safety in electroheat installations - Part 10: Particular requirements for electrical trace heating systems for industrial and commercial applications                 |
| IEC 60529                    | Degrees of protection provided by enclosures (IP code)                                                                                                                 |

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| Reference             | Title                                                                                                               |
|-----------------------|---------------------------------------------------------------------------------------------------------------------|
| IEC 60706             | Guide on maintainability of equipment                                                                               |
| IEC 61000 (All Parts) | Electro Magnetic Compatibility (EMC) - All Parts                                                                    |
| IEC 62262             | Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) |
| IEC 62395 (All Parts) | Electrical resistance trace heating systems for industrial and commercial application - All Parts                   |

### Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

| Reference     | Title                                                          |
|---------------|----------------------------------------------------------------|
| GS EP ELE 079 | Electrical apparatus for potentially explosive gas atmospheres |
| GS EP ELE 137 | Distribution boards                                            |
| GS EP ELE 141 | Power transformers                                             |
| GS EP ELE 161 | Electrical cables                                              |
| GS EP ELE 221 | Electrical Control System (ECS)                                |
| GS EP INS 110 | Instrumentation for package units                              |

## 3. Environmental Conditions

The equipment installed outdoor shall be designed to operate in an ambient temperature corresponding to the maximum outside temperature of the site of installation as defined in the project specific environmental data.

The minimum degree of protection of enclosures shall comply with the following (according to IEC 60529):

- Indoor equipment IP 21
- Outdoor equipment IP 55
- Exposed decks IP 56.

The minimum degree of protection against external mechanical impacts shall be IK08 (according to IEC 62262).

Selection of electrical apparatus for hazardous areas shall be done in accordance with the Company Specification GS EP ELE 079.

## 4. Technical Requirements

Detailed design shall be performed by Manufacturer including all installation requirements.

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## 4.1 Design

The trace heating systems shall be suitable for installation and operation as defined in the hazardous area classification drawings.

The 230 V - 50 Hz, 3-phase, 4-Wires tracing system shall have a neutral earthed and distributed (TT system).

TNS system 400 V/230 V - 50 Hz, 3-phase, 5-Wires may be considered.

When required, the heat tracing system shall be split into two systems, one supplied by the normal network and the other supplied by an essential network.

The size, length, process/fluid and thermal insulation data of each pipe requiring trace heating will be given in the P&I Diagrams, Piping G.A. and Isometric Drawings.

Sufficient length shall be provided to allow for pipe expansion and contraction.

Thermal insulation to the trace heat pipes will be carried out by others.

Critical instrument impulse lines (small diameter lines from piping tapping points to the instrument) shall be double traced with a redundant power supply (two breakers, two wirings, etc.).

Two types of trace heating systems shall be considered:

- Winterisation Protection
- Maintained design temperature (according to Process requirements):
  - Minimum temperature
  - Range of temperature (minimum and maximum).

## 4.2 Heat transfer calculations

The selected heat tracing system shall provide the thermal output greater than the maximum heat loss calculated at the minimum design temperature for all traced equipment. The calculation shall be performed without the use of heat transfer cement.

The heat density shall be such that the temperature limits for pipe insulation are not exceeded.

Heat loss from pipes shall be calculated from insulation Manufacturer's specification tables using a minimum of 115% of the calculated required watts to cover the assumptions made, normal wind factor and a safety margin.

Manufacturer's computer programs based on job data shall be used for heat transfer calculations.

Thermal performance of the heat tracing system shall be achieved with a  $\pm 10\%$  voltage variation of the power supply with regard to the rated voltage.

Minimum design temperature to be maintained in heat-traced piping is the temperature shown on the flow diagrams for process piping.

A clear definition of the heating zone/ circuits shall be performed inside the calculation note.

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## 4.3 Control

### 4.3.1 Local control

The trace heating control requirements shall be satisfied by using self-regulating type heating elements (trace heat tape). The heating element terminal boxes shall be fed from trace heating distribution boards. Other solutions are subject to Company approval.

Pipe which might contain flowing and non-flowing products shall not be traced by the same heating circuit or combined under control of a single thermostat.

Pipe which is located indoors and outdoors and/or above and below grade shall not be combined under the same heating circuit or controlled by a single thermostat.

The feed to each winterisation trace heating distribution board and/or trace heat element will be controlled by a frost thermostat supplied by the Manufacturer.

### 4.3.2 Control system

When required by project, electrical heat tracing will have its own control system. The system will ensure the energisation of heating cables as well as their control and monitoring (voltage, current, temperature, ground fault, etc.).

The heat tracing system will be considered as a package P3 type (refer to [GS EP INS 110](#) Instrumentation for package unit).

Depending on the location and the power to be fed, the system may be centralised or distributed.

In case of distributed system, a central controller will be located in each technical room, collecting all information and allowing the control and the modification of the distributed systems on site by means of a HMI (Human Machine Interface) or equivalent.

The controllers located in each technical room will communicate with a central supervisory system located in the CCB (Central Control Building) or preferably will interface with ECS system.

## 4.4 Trace Heating Elements (Trace Heat Tapes)

The tape, when installed in hazardous areas, shall have a tinned copper overbraid as per [IEC 60079-30-1 § 4.1](#) and an overall flame retardant outer sheath.

Mineral insulated cables shall be used only with Company written approval.

Fiber-wrap heating cable technology shall not be used in hazardous areas.

Electric heat tracing circuits, which could reach or exceed 80% of the tape temperature class under conditions of failure of piping, equipment, or control failure, shall be equipped with a separate, dedicated over-temperature thermostat.

This thermostat shall be of manual reset type and when operated shall de-energise the heating elements and initiate an alarm. The thermostat shall be in compliance with the requisitions of [IEC 60079-30-1 § 4.4.3](#).

Heating cables longer than 100 m for winterization protection and 60 meters otherwise shall be fabricated in multiple sections with cold junction splices made in an accessible junction box.

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Thermal insulation lagging entry kits shall be provided to prevent the tape/cable from being damaged whenever insulation and cladding material are removed.

Each element (trace heat tape) shall be indelibly marked every metre giving as a minimum the Manufacturers name, certification details & number, type of heat trace tape, voltage, watts/metre and metric indication.

#### 4.5 Junction Boxes

Junction boxes shall be suitable for mounting on pipe brackets, and certified as being suitable for the area being installed in. Junction boxes shall be complete with internal earth continuity plate and external earth stud,

They shall be easily accessible.

Neither junction boxes nor other electrical item shall be installed underneath thermal insulation.

Each box shall have drain and breather fittings. Its terminations shall be for 10 mm<sup>2</sup> core and all opening shall be minimum M25.

Each box shall have a label stating the electrical circuit references and its supply panel name.

Junction boxes shall be installed as close as possible to the pipe in order to limit the heating cable length outside the thermal insulation. Preferred solution is a junction box with integrated cable duct.

#### 4.6 Distribution Boards

The boards shall be designed and provided by the Contractor as per **GS EP ELE 137**.

Each board shall be supplied from either normal or essential network depending on service.

If the trace heating system requires more that 50 kVA, it shall have a dedicated isolating dry type transformer (as per **GS EP ELE 141**) between the network and the trace system distribution board.

Main power distribution boards for trace heating shall be installed in an electrical room.

For onshore installation, outdoor local distribution boards may be provided, subject to Company approval.

All main traced equipment (drums, vessel, etc.) shall have a dedicated feeder circuit-breaker.

Traced piping shall be organised according to process systems, each system shall be protected by a dedicated breaker.

A maximum of 10 trace heating cables per breaker is allowed.

Each outgoing circuit shall be protected by double pole circuit breaker (maximum 32 A) with 30 mA earth leakage protection (MCB/ELCB units).

#### 4.7 Thermostats

When winterisation system is required, it shall be controlled by an ambient thermostat.

Self regulating tape systems do not require any thermostat, unless particular process requirement (according to fluid characteristics).

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Thermostats shall have a minimum contact rating of 10 A per pole.

Direct power switching by thermostat is prohibited.

The thermostats shall be located so as to be easily accessible for maintenance.

RTD sensors can be used instead of thermostats with Company approval.

#### 4.8 System Tagging

Each heater assembly shall be factory tagged with a permanently stamped, legibly written, tag securely attached to the junction box end of the "cold" section. The tag shall state the heater identification as indicated on the electrical data sheet, "hot" section length, voltage and amperes.

The Manufacturer shall provide sign/markers to identify all trace heated pipes at suitable location (one every 50 m straight line and one at every bent) after the installation of pipe insulation.

### 5. Installation

The Manufacturer shall supervise works related to installation, pre-commissioning and commissioning of the trace heating system carried out by the Contractor.

The Trace Heating elements shall be installed according to Manufacturer requirements and instructions. They shall be arranged to facilitate the removal of valves or dismantling of flanges without damaging or cutting the elements.

On elbow pipe, the cable shall be placed on the external part of the pipe. See Appendix 3.

For flanges, the additional length shall be at least twice the pipe perimeter. See Appendix 4.

For non isolated supports, in order to compensate the losses, an additional cable loop shall be installed, with a length at least six times the support length. See Appendix 6.

Before any installation, Contractor/Manufacturer shall verify that the pipe is ready to receive the trace heat cable without any problem (pipe finished, tested, clean, as per isometrics, etc.).

### 6. Inspection and Testing

All equipment covered by this specification shall be subject to inspection and testing.

Testing and inspection shall be carried out on all system components to show that they comply with all design requirements and the codes and standards of this specification. Type tests will not be required if the Manufacturer can produce Type Test Certificates for the same equipment.

In addition to the above tests, the complete system shall be tested on site to verify that it meets the design objectives.

Pre-commissioning tests shall be performed before and after installation of thermal insulation.

### 7. Documentation

The Contractor/Manufacturer shall prepare and supply the following drawings:

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Installation drawings (plan and elevations) and/or isometric drawing which shall clearly indicate the following:

- Process Line and tracer identification numbers
- Location of temperature sensing element hot-cold junction, if applicable and power supply point
- Representation of all flanges, valves, tap lines, drains, pumps, instruments, and equipment nozzles
- Junction boxes included to sectionalize tracing for maintenance such as at pumps and removable spools
- Heater characteristics: Length, type, load, inrush, etc.
- Control system description
- Single line diagram of complete system
- Calculation notes (thermal and electrical)
- Distribution Boards Schedules and wiring diagrams
- FAT report (Factory Acceptance Test)
- Pre-commissioning/commissioning procedures
- Maintenance manual
- As per **GS EP ELE 079** requirement.

## 8. Other references

Following documents are applicable:

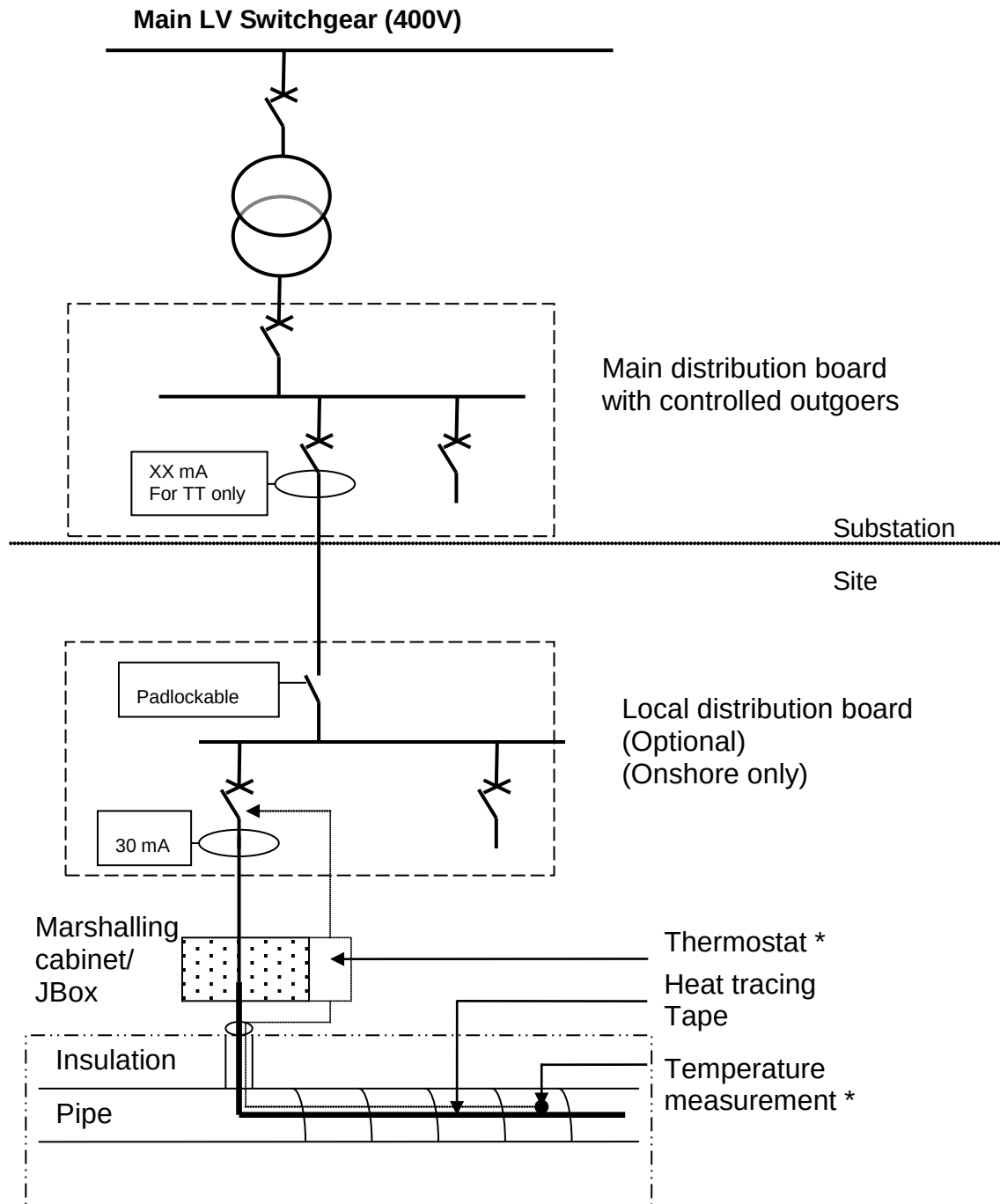
- External documents: [IEC 60050](#), [IEC 60071-1](#), [IEC 60079-30-2](#), [IEC 60332-3-22](#), [IEC 60519-10](#), [IEC 60706](#), [IEC 61000 \(all parts\)](#), [IEC 62395 \(all parts\)](#)
- Total General Specifications: **GS EP ELE 161**, **GS EP ELE 221**.

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**Appendix 1**
**Appendix 1 Typical one line diagram**


\*: To be defined by Process

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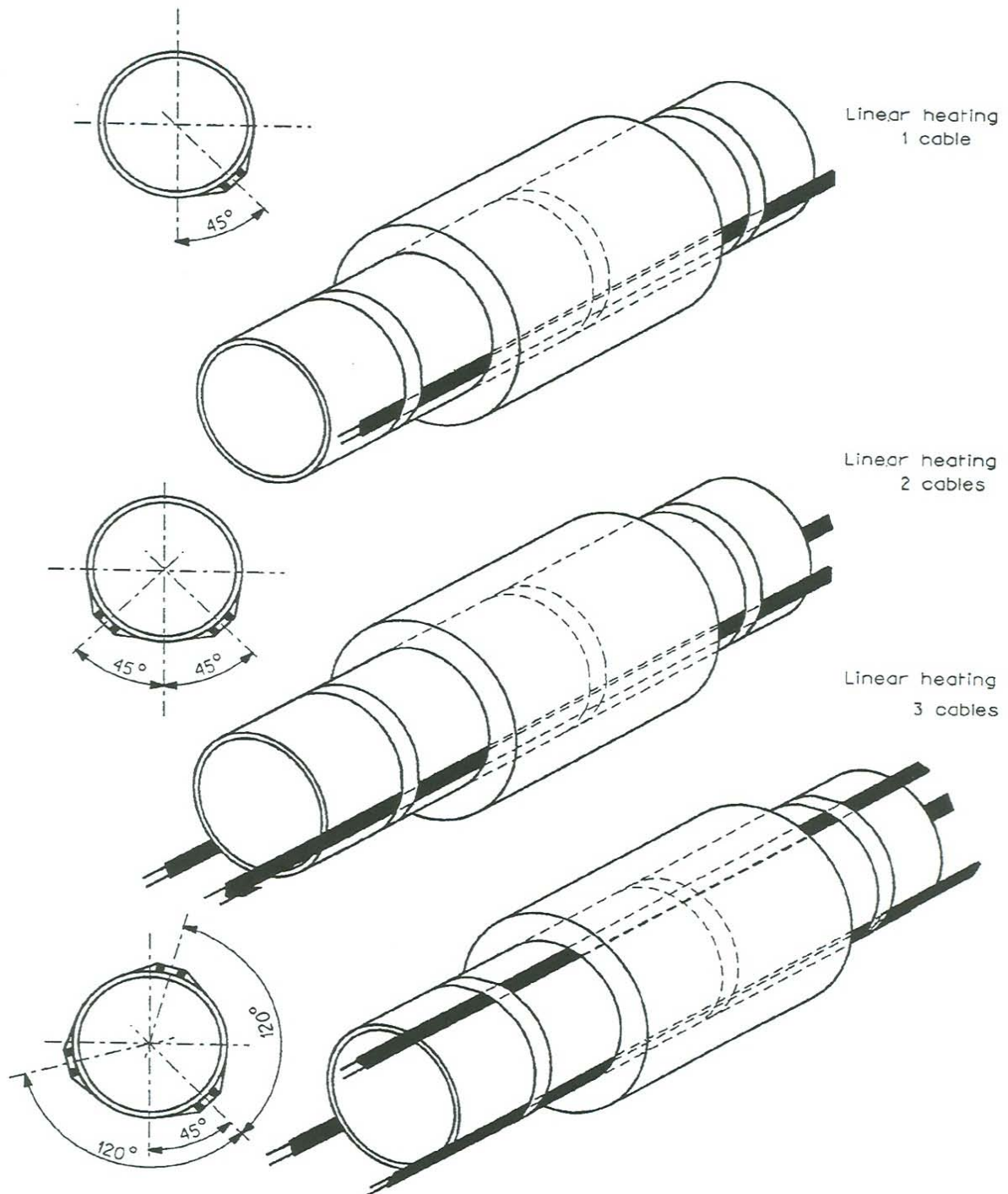
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## Appendix 2

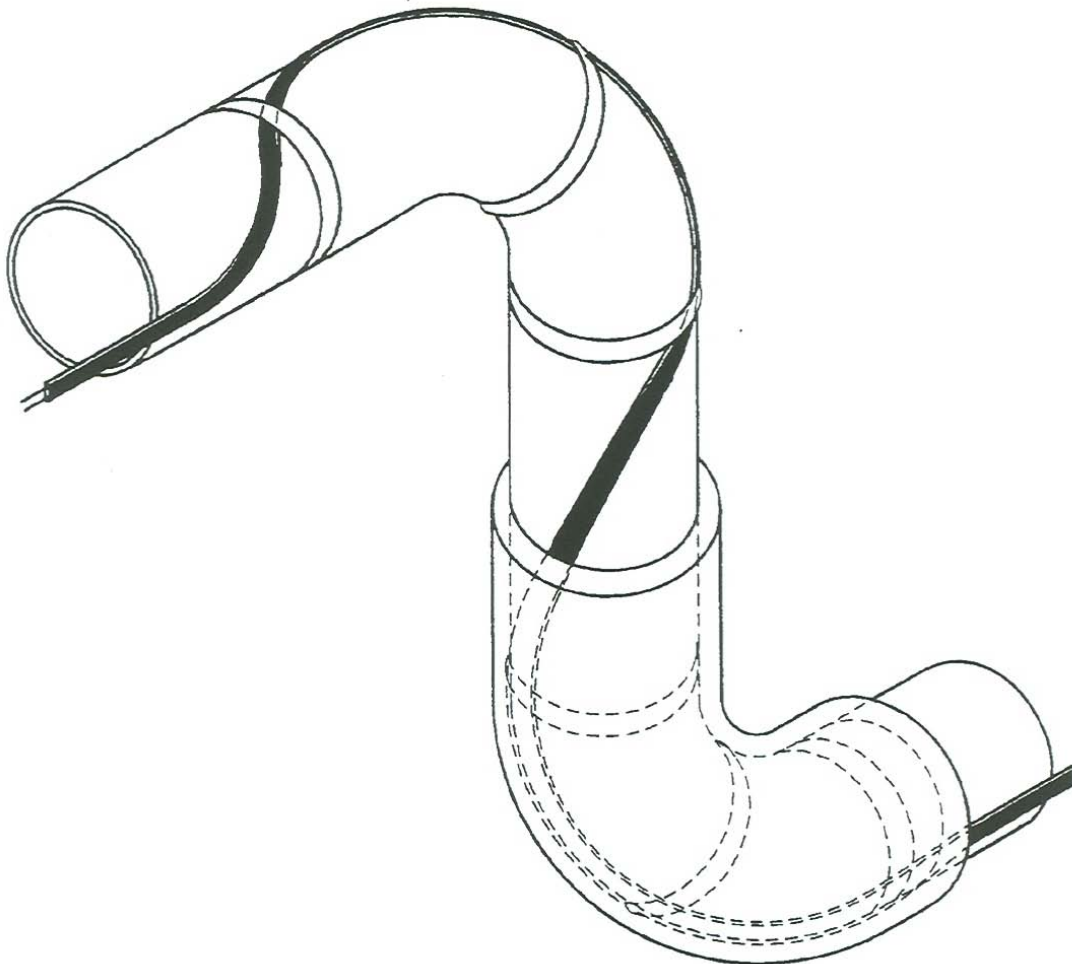
## Appendix 2 Installation of heating cable - Horizontal piping



|                       |                         |                |
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### Appendix 3

## Appendix 3 Installation of heating cable - Elbows

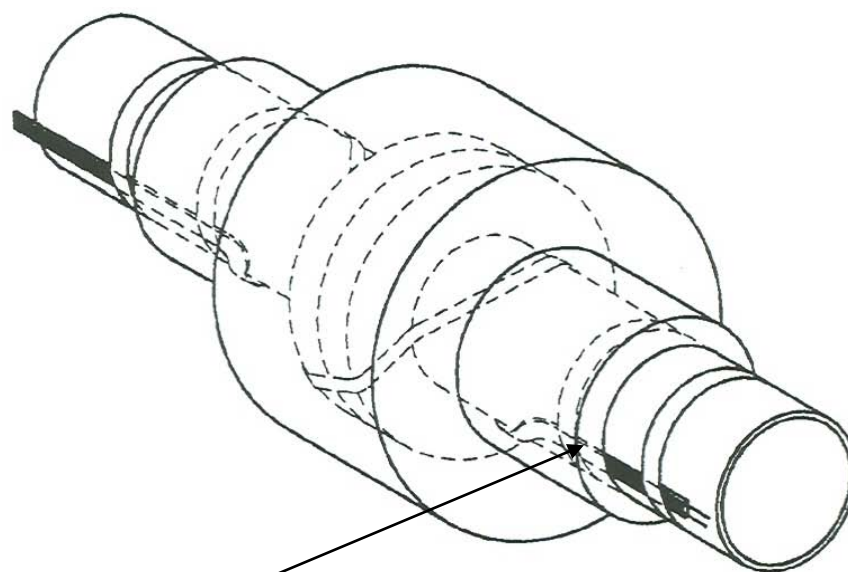
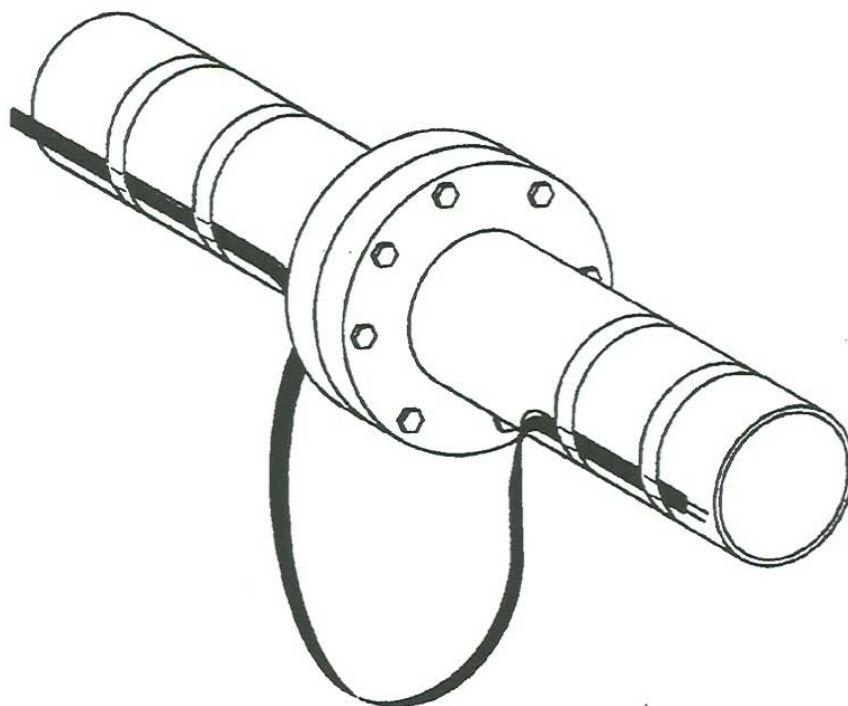


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**Appendix 4**
**Appendix 4 Installation of heating cable - Flanges**


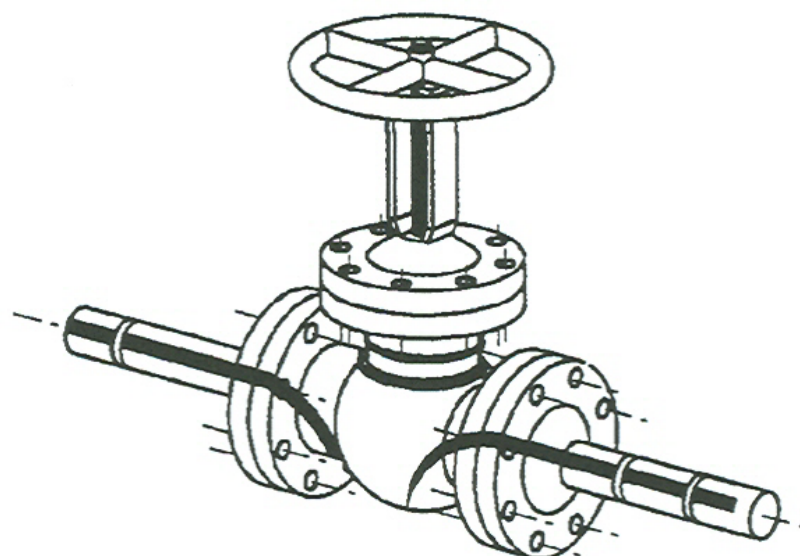
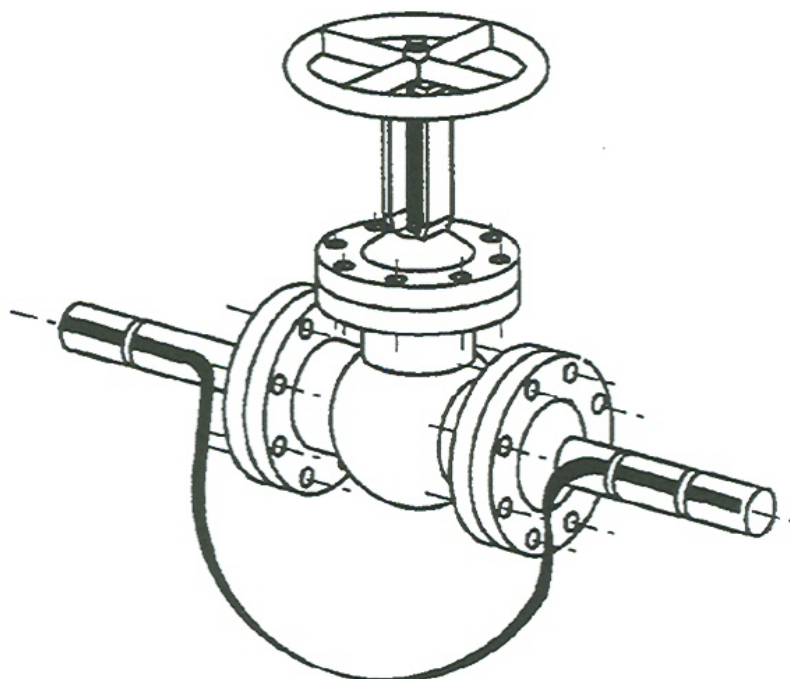
**Note:** Protection for cable transit through the insulation cover shall be provided.

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**Appendix 5**
**Appendix 5 Installation heating cable - Valves and cocks**


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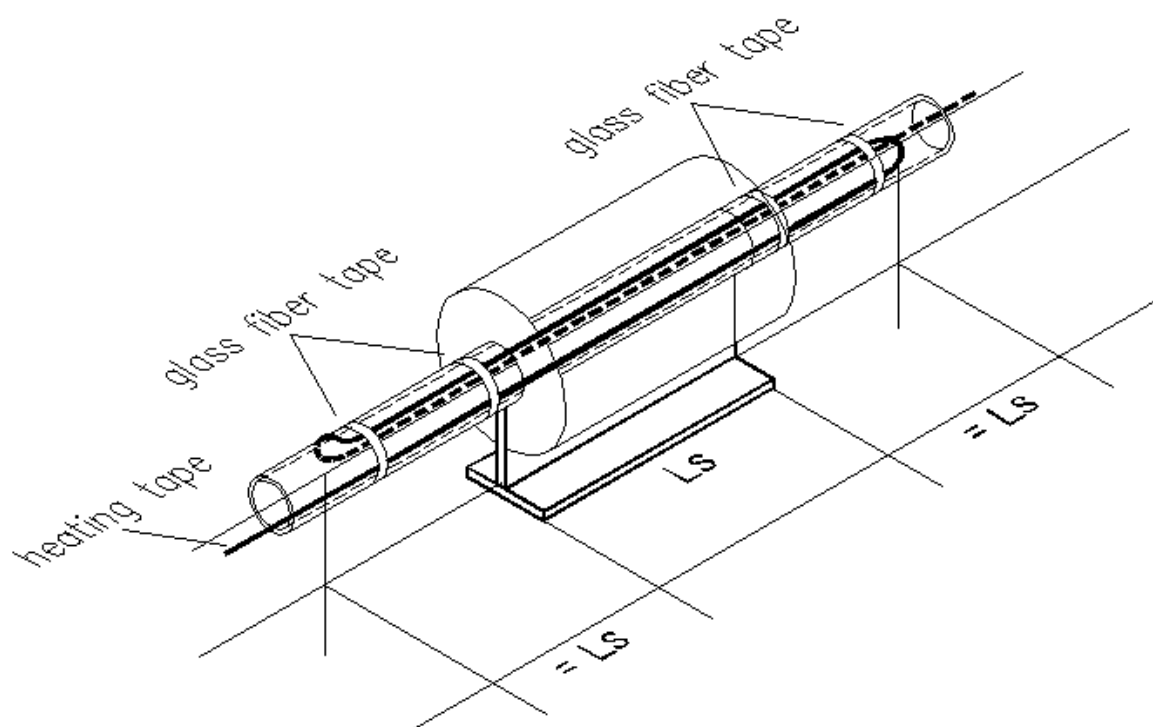
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## Appendix 6

## Appendix 6 Installation heating cable - Non insulated pipe supports



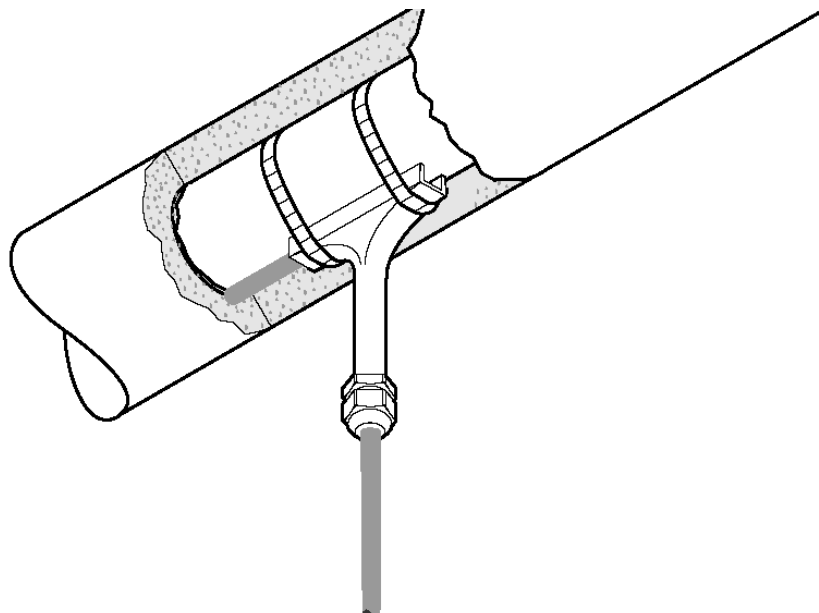
The heating tape loop length represents three times the length of the pipe support.

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**Appendix 7**
**Appendix 7 Installation heating tape - Tape insulation exit**


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Appendix 8

## Appendix 8 Installation heating cable - Junction box support/connection

