

Contents

REVISION HISTORY.....	2
DOCUMENT VERIFICATION	3
EXECUTIVE SUMMARY	4
DEFINITIONS/ABBREVIATIONS	6
1 PURPOSE	7
2 SCOPE	7
3 REFERENCES.....	7
4 ROLES AND RESPONSIBILITIES	7
5 CODES AND STANDARDS	7
6 PRECEDENCE.....	7
7 DESIGN CRITERIA	8
8 HEATING CABLE	10
9 DISTRIBUTION BOARDS	10
10 TEMPERATURE CONTROL	11
11 JUNCTION BOXES.....	12
12 CABLE GLANDS, TERMINATION KITS AND ACCESSORIES	12
APPENDIX A – CODES AND STANDARDS	12

Definitions/Abbreviations

COMPANY / OWNER

CONTRACTOR The entity which has been contracted to supply goods and/or services to the COMPANY.

SUPPLIER The party which manufactures or supplies equipment and/or services to perform the duties specified by COMPANY or CONTRACTOR.

SUB-SUPPLIER Any party which manufactures or supplies equipment and/or services to the SUPPLIER to perform the duties specified by COMPANY or CONTRACTOR

IEC International Electrotechnical Commission

IP Ingress Protection

ISO International Standards Organisation

MI Mineral Insulated

PIB Process Interface Building

SDRS Supplier Documentation Requirement Schedule

TR CU Technical Regulation Customs Union

1 PURPOSE

The purpose is to set the standard for good design and engineering practice to be applied on facilities to achieve maximum technical and economic benefit from standardisation.

2 SCOPE

This specification defines the trace heating philosophy to be applied to facilities.

The SUPPLIERS scope of supply, shall be as defined in the Contract documents.

3 REFERENCES

-00-ENG-SPC-00026	Climatic, Enviromental and Utility Data
-00-ELT-SPC-00019	Distribution Boards
-00-ELT-SPC-00028	Electrical Trace Heating

4 ROLES AND RESPONSIBILITIES

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5 CODES AND STANDARDS

Electrical trace heating equipment shall be designed, manufactured, installed and tested in accordance with the latest applicable sections of international, federal, state or local codes, regulations, ordinances and rules of Kazakhstan as detailed in Appendix A.

The word 'should' shall be replaced by 'shall' wherever it appears in the reference standards.

Kazakhstan is a member country of the Eurasian Customs Union (EAC), equipment shall meet the requirements of the technical regulations of the Customs Union. Attention should be paid to:

- Electromagnetic compatibility
- Low voltage equipment
- Machinery
- Safety
- EAC marking

Where the data sheet indicates that the equipment is for use in a hazardous area, the equipment and all its associated parts shall comply with the requirements of Technical Regulation Customs Union (TR CU) 012/2011.

6 PRECEDENCE

The order of precedence shall be as follows (unless stated otherwise in the project documentation):

- 1) National and/or Local Regulations;
- 2) Purchase Requisition;
- 3) Data sheets and drawings;
- 4) Project specifications;
- 5) This specification
- 6) Industry codes and standards referenced.

CONTRACTOR is responsible for satisfying all technical and certification requirements for

and on behalf of the COMPANY with the local Kazakh authorities.

Any apparent conflict between documents in the same level of the hierarchy shall be brought to the attention of the COMPANY for clarification. However, generally, where such conflict exists, the most onerous requirement shall govern.

CONTRACTOR shall identify and detail any deviations and/or exclusions to the documents during the Tendering phase. Unless such deviations/exclusions are specifically identified, the CONTRACTOR shall be deemed to have confirmed full compliance with all the documents listed.

7 DESIGN CRITERIA

7.1 General

Electrical trace heating shall be provided for temperature maintenance and frost protection of process pipework, instruments, impulse lines, transmitters, equipment.

7.2 Service Conditions

The trace heating system shall be safe and reliable for the conditions specified within the "Specification for Climatic, Environmental and Utility Data", Doc. No. -00-ENG-SPC- 00026. Unless other conditions are specified elsewhere, the equipment shall be rated to operate continuously in a maximum ambient temperature of 40°C and a minimum ambient of minus 5°C indoor or minus 45°C outdoor.

The trace heating system shall be capable of continuous operation under the normal operating conditions without requiring any electrical shutdown for maintenance.

The design life of the system and the heating tape shall be a minimum of 20 years.

Wherever possible, electrical equipment shall be located in non-hazardous areas.

7.3 Design Requirements

The electrical trace heating system shall provide:

- Temperature maintenance of the process fluid and associated equipment by means of pipeline thermostats or resistance temperature detectors
- Frost protection of instrument pipework and instruments by means of ambient thermostats.
- Frost protection of process and utility pipework by means of ambient thermostats.

Trace heating shall be provided for pipework, pipework fittings, pumps, valves, instruments / instrument lines and vessels as defined in the design documentation. Further items requiring trace heating and identified in the design documentation, where applicable, may include:

- Instrumentation and associated small bore pipework
- In-line instruments
- Packaged equipment items which will be provided with pre-installed trace heating circuits and require a power supply only (e.g. instrument enclosures, emergency safety showers and eye wash facilities).

The system design shall be based on the following data:

- Piping Line List including a schedule of design data for the electrically trace heated pipelines.
- Piping & Instrument Diagrams (P&ID's)

- Piping Isometric Drawings
- Plot Plans
- Instrument Layout Drawings
- Instrument Hook-Up Diagrams
- Area Classification Drawings
- Schedule of Instrumentation Requiring Trace Heating a Connection Details
- Schedule of Equipment Requiring a Power Supply for Trace Heating
- Power Supply Details

During the early part of detail design, trace heating instrument hook-up drawings shall be produced.

The trace heating system shall be designed to operate on 230V, 50Hz, single phase. The supply to each distribution board will be a 400V, 3 phase, 4 wire, 50Hz distribution system.

All main components and accessories for the heating cable shall where applicable be certified Ex"d" or Ex"e" for use within hazardous areas. The accessories shall maintain the ingress protection (IP) rating of the enclosure to which they are connected and shall be suitable for the service conditions stated in Section 7.2 with protection to IP55 (minimum).

Where an electrical fault condition in the heating cable can cause the temperature of the heating circuit to exceed the permissible temperature classification of the installation, a separate, high set, fail-safe, limiting (safety) thermostat device shall be provided in addition to the normal operating thermostat.

The design of the heating system shall include for devices to ensure that the heating cable does not exceed the limiting temperature. The limiting temperature shall not exceed:

- The withstand temperature of the device.
- The maximum acceptable surface temperature of the pipe.
- The maximum acceptable surface temperature within the classified area.

The trace heating design shall allow for heating cables to be double wrapped around pumps, valves and flanges to permit equipment dis-assembly without damaging or cutting the cables.

Large valves and other in-line equipment are potential 'cold spots'. Consideration shall be given in the design for the necessary additional heating cable and circuitry to avoid any cold spots.

The design of the heating cable to a heated pump casing shall include for adjacent junction boxes to facilitate the removal of the heating cable and pump from the pipeline.

Any electrically traced circuit shall be dedicated to one process pipework service. Different process pipework services shall not be supplied from the same circuit.

Trace heating circuit load on start-up shall not be greater than 75% of the MCB rating at – 20°C.

The trace heating system shall be designed to minimise the total number of electrical circuits required, and to locate the power connection junction boxes taking account of the need to optimise routing of power feeder cables.

7.4 Winterisation specification

For detailed design, refer to Winterisation Philosophy doc. no. -00-ENG-PHL-00006

In accordance with -00-PIP-SPC-00021, electrical tracing shall be limited to early works when the steam system is unavailable and to piping systems within process and utility areas.

8 HEATING CABLE

All trace heating cable and associated equipment shall be certified for the area in which they are installed and suitable for the specified service conditions. The following heater types shall be used in sequence of preference:

- Self-regulating heaters
- Constant wattage parallel heaters
- Mineral insulated heaters (MI cable)

Any proposal to install constant wattage parallel heaters and MI heaters requires to be approved by COMPANY (electrical authority).

The heater type applied shall be the best suited for each application.

Due to high exposure temperatures, the following types of heating cables are suitable for installation on pipes and vessels which require steam cleaning to prevent damage:

- XTV
- KTV
- VPL
- FMP
- FHT

The heating cable shall have a tinned copper braid with a cross sectional area being equal to or greater than the conductor cross sectional area. The braid shall be protected from chemical attack and mechanical abuse by a fluoropolymer outer jacket.

Note: Where individual or groups of sample and impulse lines are required to be trace heated, self-contained trace heating tube bundles shall be considered as the preferred method of trace heating.

9 DISTRIBUTION BOARDS

Trace Heating distribution boards designed and manufactured in accordance with project specification "Distribution Boards", Doc. No. -00-ELT-SPC-00019 shall be located in substations, PIBs, and at strategic locations.

Outdoor distribution boards shall be avoided as far as is practical in the plant areas. Where they are required they shall be equipped with thermostatically controlled space heaters

The distribution boards shall comprise MCB controlled outgoing final sub circuits with RCDs for the protection of trace heating circuits and shall be suitable for indoor or outdoor use and the hazardous area in which they are to be situated. There shall be suitable co-ordination between the MCC feeder and the distribution board MCBs.

Trace Heating circuits shall be supplied at 230V, 50Hz, single phase but main distribution may be by a 4 wire 400/230V system where this is appropriate. All circuits feeding fittings in

classified areas shall have both poles switched. Switch handles on distribution boards shall be padlockable in the 'off' position.

Trace Heating distribution boards shall be designed to include for 25% spare ways to account for future growth.

Each miniature circuit breaker on the distribution board shall be provided with one (1) normally open tripped alarm auxiliary contact connected to form a Common Alarm, wired to terminals. The alarms shall be cabled to the DCS.

10 TEMPERATURE CONTROL

10.1 General

All temperature control equipment shall:

- Be certified for the classified area in which they will operate.
- Comply with specified service conditions.
- Be housed within a glass reinforced plastic or stainless steel enclosure with a minimum rating of IP65.

10.2 Thermostats

Thermostats for frost protection shall be of the ambient air sensing type utilising either an integral or external sensor.

Thermostat sensors for pipeline temperature control or safety cut out shall be of the bulb/capillary or electronic type. Thermostats shall be complete with an internal, accessible adjustment and rated as follows:

Temperature Range: Refer to the Data Sheet.

Contacts: Two (2) changeover type, 230V AC, 16A, 50Hz.

All alarm signals from control panels and thermostats shall be cabled to the distributed control system (DCS). A suitable communications port shall be provided. The preferred option is to use a serial link to the DCS, if this is not possible then signals will be hard wired.

10.3 Resistance Temperature Detectors

Resistance temperature detectors for process pipeline temperature control shall be suitable for use with a suitable electronic controller and where applicable a temperature limiting device both located within a remotely located control panel.

10.4 Temperature Limitation for Safety Reasons

Where heaters are installed in a hazardous area (Zone 1 or 2) which is classified with a more stringent temperature classification than that of the heater, independent temperature limiters shall be installed to monitor the surface temperature of the heaters. Where the maximum allowable temperature has been reached, the associated heater shall be switched off automatically, and remain switched off until the temperature limiter has been reset manually.

Alternatively, automatic reset will be acceptable when the temperature limiter gives an alarm in a manned control room when the heater is switched off. The assemblies shall be suitable for the service conditions and hazardous area classification in which they are to be installed.

11 JUNCTION BOXES

As far as is practical junction boxes shall be located at close to grade or adjacent to platforms, stairs, or ladders in order to facilitate access for safe installation, inspection and maintenance.

Junction Boxes shall be suitable for the service conditions stated in Section 7.2, with protection to IP65 (minimum).

Junction boxes shall be used for:

- The connections between supply cable and heater cable
- The distribution of supply of one circuit of the distribution board to sub circuits. Only the supply of one circuit of the distribution board shall be allowed in a connection box.

12 CABLE GLANDS, TERMINATION KITS AND ACCESSORIES

All accessories for the heating cable shall, where applicable, be certified EEx'd' or EEx'e' for use within the hazardous area. The accessory shall maintain the ingress protection (IP) rating of the enclosure to which they are connected. All accessories shall be suitable for the service conditions stated in Section 7.2, with protection to IP65 (minimum).

Heating elements shall be supplied with either a termination kit or be suitable for direct entry.

Through jointing and remote end sealing devices shall be of the cold applied, heat shrinkable type. End sealing devices shall have dimensions to permit installation within the insulation without any deformation.

Proprietary insulation entry devices shall be provided to protect the heating cable within the insulated cladding. The entry device shall be manufactured from either stainless steel or plastic.

Consideration should be given to the use of externally accessible, illuminated end-of- line seal devices for the frost protected pipework only.

APPENDIX A – CODES AND STANDARDS

CODES AND STANDARDS OF THE REPUBLIC OF KAZAKHSTAN

Rules for the Arrangement of Electrical Installations RK	PUE RoK 2015
Explosive atmospheres - Part 0: Equipment - General requirements, (IDT)	ST RK IEC 60079-0-2010
Explosive atmospheres. Electrical resistance trace heating. Part 30-1. General and testing requirements	GOST IEC 60079-30-1-2011
Explosive atmospheres. Electrical resistance trace heating. Part 30-2. Application guide for design, installation and maintenance	GOST IEC 60079-30-2-2011
Degrees of protection provided by enclosures (IP code) (IDT))	ST RK IEC 60529-2012
Low-voltage electrical installations - Part 1: fundamental principles, assessment of general characteristics,	ST RK IEC 60364-1-2012

definitions (IDT)

INTERNATIONAL CODES AND STANDARDS

AMERICAN STANDARDS

Recommended practice for electrical impedance,
induction and skin effect heating of pipelines and vessels IEEE 844

EUROPEAN STANDARDS

Part 1 & 2: Electrical insulating materials – Thermal
endurance properties IEC 60216

Electrical Accessories - Circuit-breakers for overcurrent
protection for household and similar installations - Part 1:
Circuit-breakers for A.C. operation - Edition 1.2;
Consolidated with Amendments 1: 2002 and 2 2003 IEC60898-1

Explosive atmospheres IEC 60079

Explosive atmospheres – Part 30-1: Electrical resistance
trace heating – General and testing requirements IEC 60079-30-1

Explosive atmospheres – Part 30–2: Electrical resistance
trace heating – Application guide for design, installation
and maintenance IEC 60079-30-2

Degrees of protection provided by enclosures (IP Code) IEC 60529

Quality management systems – Requirements ISO 9001

Low-voltage electrical installations – Part 1: Fundamental
principles, assessment of general characteristics,
definitions. IEC 60364-1

Safety of equipment for operation in explosive
atmospheres TR CU 012/2011