

DEP SPECIFICATION

ELECTRICAL TRACE HEATING

DEP 33.68.30.32-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for electrical resistance trace heating systems for winterising and heat loss compensation of piping and equipment, in terms of design, material selection, installation and testing.

Electrical resistance trace heating within the scope of this DEP shall be designed and constructed so as to ensure electrical, thermal and mechanical durability and reliable performance so that, in normal use, it poses no danger to the user or the surroundings.

This DEP covers trace heaters that may comprise either factory-assembled or field-assembled units, and which may be series heating cables, parallel heating cables or and heating panels that have been assembled and/or terminated in accordance with the Manufacturer/Supplier's instructions.

This is a revision of the DEP of the same number dated February 2013; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Ambient temperature	Temperature surrounding the object under consideration. If an electrical heating cable is enclosed in thermal insulation, the ambient temperature is the temperature exterior to the thermal insulation.
Branch circuit	Portion of the wiring installation between the overcurrent device protecting the circuit and the trace heater unit(s).
Cable loop	Single trace heating cable doubled back along a surface in order to obtain multiple tracing or to trace a short length of pipe, without branching from the main traced pipe.
Certificate of Conformity	Certificate stating that the electrical apparatus complies with the relevant standards for use in potentially explosive atmospheres.
Certificate	Document issued by a recognised authority certifying that it has examined a certain type of apparatus and, if necessary, has tested it and concluded that the apparatus complies with the relevant standard for such apparatus
Cold lead	Electrically insulated conductor(s) used to connect a trace heater to the branch circuit and designed so that it does not produce significant heat.
Constant wattage cable	Heating cable with a constant thermal output per metre/section of cable regardless of its temperature.
Crossover	Location where the heating cable crosses, overlaps, or touches another section of the same cable.
Dead leg	Segment of the process piping that is not in the normal flow pattern.
Declaration of Compliance	Document issued by the Manufacturer declaring that the electrical apparatus complies with the requirements of IEC 60079
Electrical resistance trace heating	Utilisation of electric heating cables, other electric heating devices and support components that are externally applied and used to maintain or raise the temperature of fluids/materials in piping and associated equipment.
Heat loss compensation	Trace heating installed on piping and equipment to compensate for the heat losses through the thermal insulation and heat sinks, in order to maintain a certain product temperature under varying climatic and operational conditions.
Heat sink	Device that conducts and dissipates heat away from the pipe or equipment. Heat sinks, as related to pipe heating systems, can be pipe shoes, pipe supports and items of large mass such as valve actuators and pump bodies.
Heating pad	Trace heater comprising series- and parallel-connected elements with sufficient flexibility to conform to the general shape of the surface to be heated.

Term	Definition
Hot spot	Spot in the heater with an unacceptably high temperature, resulting from insufficient dissipation of heat and involving risk of damage to the heater.
Maintain temperature	Specified temperature of the fluid or process material that the trace heating is designed to hold at equilibrium under specified design conditions.
Maximum continuous exposure temperature	Highest temperature to which a component of the trace heating system may be continuously exposed (heater de-energized).
Parallel heating cable	Heating elements that are electrically connected in parallel, either continuously or in zones, so that watt density per unit length is maintained irrespective of any change in length for the continuous type or for any number of discrete zones.
Piping (and pipes)	Pipe used in piping systems and transmission pipelines. If a requirement is intended to apply only to transmission pipelines the term "pipeline" is used.
Power limiting heating cable	Heating cable consisting of a metal alloy heating element helically wrapped around a fibre substrate, which is electrically disposed between two copper conductors. The element has a positive temperature coefficient characteristic and reduces its output with increased temperature.
Power output	Total power or power/unit length of a heating cable or surface heating device at rated voltage, temperature and length, normally expressed as W/m or kW.
Rated voltage	Voltage to which operating and performance characteristics of heating cables are referred.
Self-regulating/self-limiting heating cable	Parallel heating cable with a semi-conductive element, which responds to temperature variation by adjusting the thermal output to reach equilibrium.
Series heating cable	Heating elements that are electrically connected in series with a single current path and have a specific resistance at a given temperature for a given length.
Stabilised design	Concept where the temperature of the trace heater will, by design and use, stabilise below the limiting temperature even under adverse conditions, without the need for a protective system to limit the temperature.
TN-S	TN power systems have one point directly earthed at the source, the exposed-conductive partsof the installation being connected to that point by protective conductors. In the TN-S system a separate protective conductor is used.

Term	Definition
TT	The TT system has only one point directly earthed and the exposed-conductive-parts of the installation are connected to earth electrodes electrically independent of the earth electrode of the supply system.
Temperature controller	Device or combination of devices incorporating a means of sensing temperature and of controlling the power to the trace heater.
Temperature sensor (sensing element)	Device designed to respond to temperature by providing an electrical signal or mechanical operation.
Test Report	Document prepared by the Manufacturer indicating in detail the tests and verifications to which the electrical apparatus has been subjected and their results
Thermal insulation	Material having air- or gas-filled pockets, void spaces or heat reflecting surfaces which, when properly applied, retard the transfer of heat.
Trace heater	Device designed for the purpose of producing heat on the principle of electrical resistance and typically composed of one or more metallic conductors or an electrically conductive material, which is suitably electrically insulated and protected.
Trace heater unit (trace heater set)	Series trace heater cable, parallel trace heater cable, heater pad or heater panel suitably terminated in conformity with the Manufacturer/Supplier's instructions.
Trace heating	Utilization of electric trace heater cables, pads, panels and support components, externally applied and used to raise or maintain the temperature of contents in piping, tanks and associated equipment.
Winterising	Trace heating installed in piping and equipment containing liquid, in order to prevent freezing or solidification due to external low ambient temperatures.

1.3.3 Abbreviations

Term	Definition
MCB	Miniature Circuit Breaker
TT	Terra terra

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (9).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2013. The following are the main, non-editorial changes.

Section/Clause	Change
All	Restructured and clarified requirements, enforced use of shall / should / may for normative statements.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL DESIGN REQUIREMENTS

2.1 CONTRACTOR'S RESPONSIBILITIES

1. The basic design of, collection of process data, and the calculations for, the trace heating system shall be the responsibility of the Contractor.
2. The design shall be based on the specific requirements stated on the process data specifications, drawings, isometrics and completed requisition, refer to DEP 33.68.30.94-Gen.
3. The Manufacturer/Supplier shall be involved in the design, or at least confirm that the design is sound; however, this does not relieve the Contractor of Contractor responsibilities.

2.2 QUALITY ASSURANCE

1. The Manufacturer and Contractor shall implement a quality assurance system in accordance with a recognised standard such as ISO 9001.

2.3 SAFETY

2.3.1 General

1. For safe and reliable application of electrical trace heating systems, the climatic, environmental and operating conditions shall be taken into consideration during design and construction.
2. Electrical trace heating equipment shall not be located in Zone 0 areas.
3. Electrical trace heating equipment should be located in non-hazardous areas.
4. For trace heating equipment requirements, refer to IEC 60079-30-1 and IEC 60079-30-2.

2.3.2 Hazardous areas

1. For installation of electrical trace heating systems in hazardous areas, refer to the construction of electrical equipment IEC 60079-30-1 and IEC 60079-30-2.
2. For installations in Zone 1 and/or Zone 2 areas, the following types of protection specified in Table 1 shall be used, and Ex certification from a Notified Body ("Nobo") provided:

Table 1 Types of protection

Equipment	Protection
Connection boxes:	Ex "e" enclosure
Local switches:	Ex "d" or Ex "m" switches, or a combination of these two, with Ex "e" terminals and enclosure
Thermostats:	Ex "d" or Ex "m", or a combination of these two, with Ex "e" terminals and enclosure
Temperature control systems:	Ex "i" for e.g., PT 100 connections

2.3.3 Non-hazardous areas

1. Material specified for Zone 1 and/or Zone 2 areas shall be used in non-hazardous areas.

The use of equipment rated for hazardous areas provides standardization.

2.4 SITE CONDITIONS

1. The parts of a heating system installed outdoors shall be suitable for use in conditions where:
 - a. relative humidity can reach 100%;
 - b. exposure to direct sunlight without protective shelter is expected;
 - c. the atmosphere is considered to be saliferous, sulphurous and dusty;
 - d. condensation, as experienced during large temperature fluctuations in a humid atmosphere, is likely;
 - e. extremely corrosive and saliferous conditions may be present (e.g., such as offshore applications).

Site information will be included in the requisition, refer to DEP-33.68.30.94-Gen.

2.5 DEGREE OF PROTECTION

1. The enclosures shall have a degree of protection of at least IP 55 (IP 56 for offshore installations) in accordance with IEC 60529.
2. For the IP rating of the main and sub-distribution boards, refer to DEP 33.67.01.31-Gen.

2.6 ELECTRICAL SUPPLY SYSTEM

2.6.1 Onshore

1. The AC supply to the trace heating system shall be either single-phase or symmetrical three-phase, + neutral, with a nominal voltage and frequency as indicated in the requisition.
2. The earthing system shall be TN-S, unless otherwise agreed with the Principal.
3. Supply variations at the distribution board under steady-state conditions shall be limited to:
 - a. Nominal system voltage: $\pm 5\%$;
 - b. Nominal system frequency: $\pm 2\%$.
4. Equipment shall be suitable for temporary, input voltage variations of +10% and -20% of the nominal voltage, caused by e.g., motor starts.

2.6.2 Offshore

For requirements relating to the AC supply to the trace heating system, refer to IEC 61892-1 article 4.7.

2.7 HEATING-UP REQUIREMENT

1. If the trace heating is required to maintain a particular operating temperature, the Manufacturer/Supplier shall advise the initial time required to reach the operating temperature.
 - a. If this time is excessive, additional heating capacity shall be installed, subject to approval by the Principal.

Acceptable heat-up time may be defined by the Principal.

2.8 START LOAD

1. The Supplier shall determine any significant start-up loads and loads that require changes in the circuit protection.