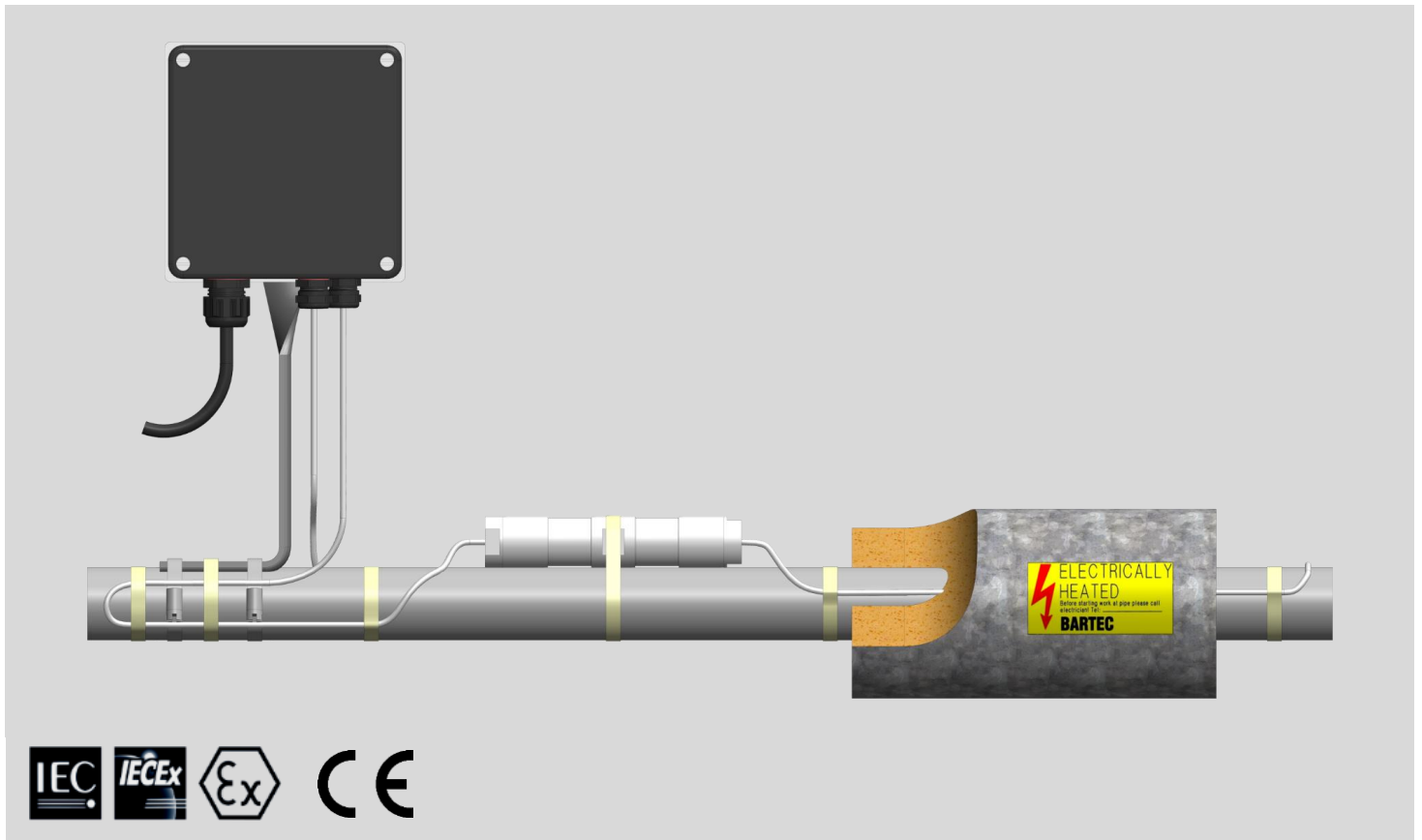


Series Resistance Heating Cable EKL

Design Guide

for pipes and vessels in hazardous industrial locations



Origin Design Guide

Sprache: EN

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1. Overview

This Design Guide covers the design and general installation of BARTEC Series Resistance Heating System EKL for use in hazardous locations using the Series Resistance Heating Cable EKL, hereinafter called Heating Cable EKL types:

EKL medium

27-582*-756G*

EKL premium

27-582*-756K*

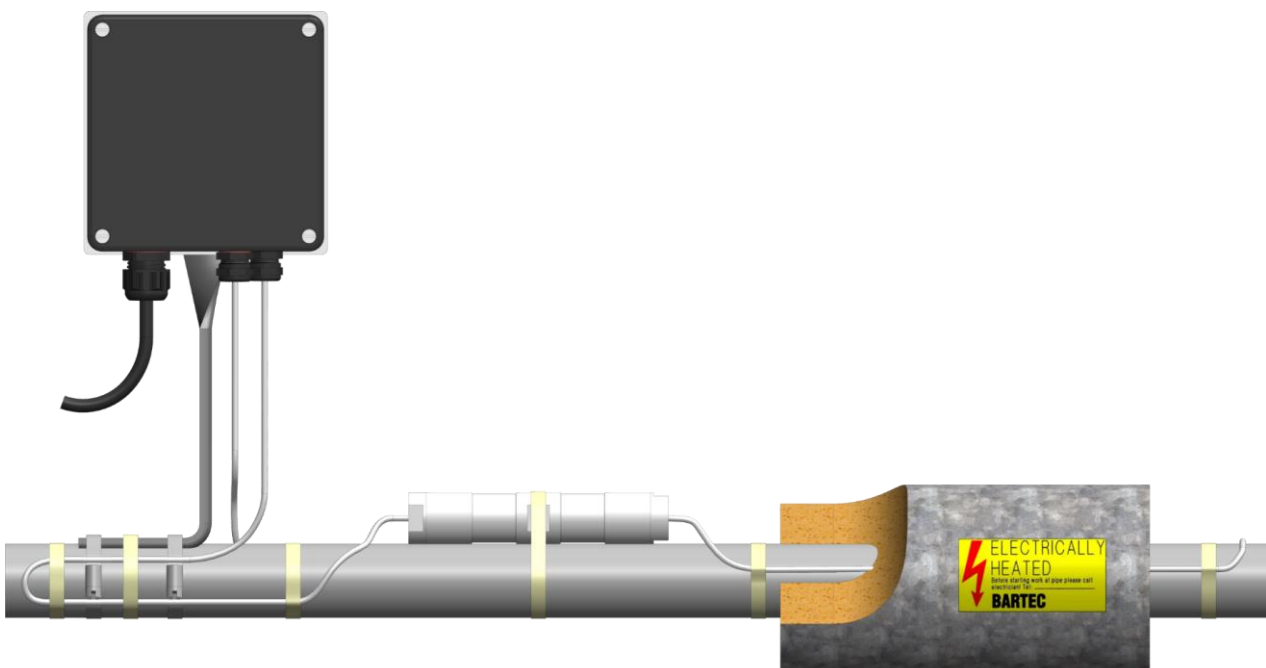
A trace heating circuit comprises the power termination, a trace heater, cold leads (Heating Cable EKL with low resistance) and cold lead connectors ECT. The trace heating circuit can be made of a single heating cable or multiple heating cables connected by a splice or a tee, which are pre-determined by BARTEC.

The trace heating system consists of one or more trace heating circuits. Each trace heating system is associated with rules for design, installation and documentation.

The trace heating system is available as

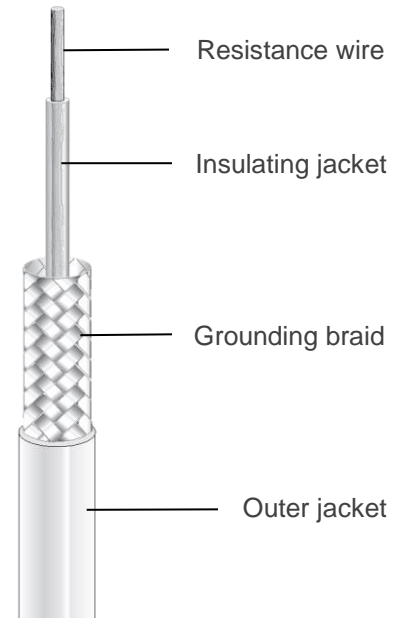
- **stabilized design** (27-1ES*-*****) and
- **controlled design** (27-1EC*-*****).

For the controlled design, otherwise optional components for temperature limitation and control in accordance with IEC 60079-0 become a necessity.



The Heating Cable EKL comprises of a resistance wire insulated by a polymer based inner jacket. For mechanical stability the inner jacket is wrapped in a metallic grounding braid, which is insulated by a polymer based outer jacket. The heat is generated by running a current through the resistance wire.

Crossing or overlapping with other trace heating cables are not permitted.



The following illustration shows a typical Series Resistance Heating System EKL.

2. Safety

For safe installation and operation of BARTEC Series Resistance Heating System EKL the technical requirements and instructions given in this Design Guide, all applicable documents and the corresponding manuals of the installed products or products to be use must be followed. Keep these instructions for future reference. If applicable, leave them with the end user. Retain the trace heating system documentation for each trace heating circuit as long as the trace heating system is in use.

All electrical systems and installations must comply with BARTEC GmbH requirements and be installed in accordance with the relevant electrical codes and any other applicable national and local codes.

Use Heating Cable EKL in accordance with the intended use and strictly comply with the operational data specified in section Technical Data. Install all components of the trace heating system carefully.

Any defective component of the trace heating system must be replaced before installation. Replace each defect component of the installed trace heating system.

Disconnect the trace heating circuit from the power supply before removing the pipe insulation or working on the enclosure. Allow the trace heating system and the Junction Box to cool down. Avoid personal injury such as burning from hot surfaces.

Use only original BARTEC accessories and spare parts.

Note that the Applicable Documents listed below shows further important information and must be observed in addition to this manual.

Applicable documents:

Operating and installation instructions EKL medium/premium	21-5820-7D0001
Operation and Installation Manual Junction Box types PBS/PBM for Heating Cables EMK/EKL	01-3T00-7D0002
Storage conditions	21-0000-7Q0001

corresponding manuals of the installed products or products to be used

2.1. Intended Use

The BARTEC Heating Cables EKL (27-582*-****-****) can be used to create Series Resistance Heating Systems EKL in combination with cold leads (heating cables EKL with low resistance) and heating cable connectors as follows:

- ECT35 and ECT45 (27-5A3*-****/****)

It is designed for industrial purposes in shown trace heating systems for freeze protection and temperature maintenance applications. It is intended for use in hazardous (potentially explosive) gas or combustible dust atmospheres ("hazardous locations").

Operation is allowed with

- one kind of heating cable in each heating circuit only
- installed earth fault equipment protection and overcurrent protection for each branch circuit

The approval and marking of the respective trace heating system, the technical data of the Heating Cable EKL and the applicable documents must be observed.

For use with electrical systems, the relevant installation and operating conditions must be observed.

Planning and installation is only permitted by observing the relevant electrical regulations and all other applicable national and local regulations.

Specific Conditions of Use

Series Resistance Heating System EKL which include Series Resistance Heating Cables EKL medium and cold leads EKL medium type 27-582*-756G/**** and type 27-7A6G/**** are only intended for use in applications with a low risk of mechanical damage.

The heating cable connectors types ECT35 and ECT45, type 27-5A3*-****/**** must be installed in such a way that the heating cable is protected against tensile forces.

The instructions and the Specific Conditions of Use of the separately certified equipment (e.g. resistance thermometers, temperature limiters) have to be observed.

The connection of the cold leads to the supply circuit using terminals in the enclosures has to be made in accordance with the applicable installation regulations (e.g. in a separately certified junction box or outside the hazardous zone).

The design of the heating circuit may only be carried out by BARTEC or a person specially trained by BARTEC.

If acceptance test is carried out by specialists or trained specialist personnel, the acceptance report must be approved by BARTEC or a person specially trained by BARTEC.

2.2. Foreseeable Misuse

The following activities are a misuse of Heating Cable EKL and are not allowed:

- Use of the Heating Cable EKL for purposes other than those described in the intended use
- Installation, commissioning, operation, maintenance or disposal by unauthorized or unqualified personnel
- Work on live parts or circuits without switching off the Heating Cable EKL, the heating circuit or the Series Resistance Heating System EKL
- Commissioning of damaged or faulty system components or incomplete installation
- Recommissioning after dismantling the cable gland without replacing the cable gland
- Recommissioning after dismantling of the ECT35/ECT45 without replacing the sealings
- Unauthorized technical modification to components or the system
- Wrong setting of limiter temperature causing the loss of explosive protection if the limiter triggers at too high temperatures


2.3. Personal Qualification


For system planning, installation, commissioning, operation and maintenance observe the requirements for personnel qualification according to IEC 60079-14, note appendix A.


2.4. Symbols and Signs

The warnings shall be intended to protect against dangerous situations, personal injury and damage to property.

In the operating instructions, the severity of the possible dangers is indicated by the following signal words.

	<p>DANGER!</p> <p>DANGER indicates an imminent danger. If not avoided, death or serious injury will result.</p>
--	--

	<p>WARNING!</p> <p>WARNING indicates a potentially imminent danger. If not avoided, it can result in death or serious injury.</p>
--	--

	<p>CAUTION!</p> <p>CAUTION indicates a potentially imminent danger. If not avoided, minor injuries may result.</p>
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ATTENTION!

ATTENTION indicates a potentially harmful situation. If not avoided, the plant or something in its vicinity may be damaged.



PLEASE NOTE!

PLEASE NOTE indicates notes and information on an effective, economical and environmentally friendly handling.

3. Applications

The Series Resistance Heating System EKL is meant for fixed installation in hazardous areas with explosive gas, vapor or dust atmosphere.

Trace heating compensates for the heat loss through the insulation to maintain the pipe and fluid at temperatures above the freezing or solidification point. Thus, trace heating is critical for pipe freeze protection systems that are expected to have stagnant fluids for prolonged durations.

Freeze protection:

Water, and fluids containing significant water, expand as they freeze. This expansion can cause the pipe to be blocked or break leading to:

- Economic losses: A frozen water pipe, e.g. in a waste water treatment plant or cooling tower, can shut down critical processes during operation causing high economic losses.
- Safety issues: A frozen pipe leading to safety showers can jeopardize personnel safety in the event of hazardous chemical exposure.



Temperature maintenance:

A process temperature maintenance system can maintain the temperature of the fluid in a pipe to the desired level over a broad range of temperatures.

Maintaining liquids within the specified temperature range allows you to cost-effectively transport the fluids from one location to another, operate your processes at maximum efficiencies, and safely start/shut down your operations.

4. Certifications / Approval / Markings

Approval for Bartec Heating Cable EKL:

BVS 17 ATEX E 103 X IECEX BVS 17.0096 X	
	II 2G Ex 60079-30-1 IIC T3, T4, T5, T6 Gb
	II 2D Ex 60079-30-1 IIIC T195 °C, T130 °C, T95 °C, T80 °C Db

5. Applicability

This document covers the design of BARTEC Heating Cable EKL in combination with the cold lead connector ECT. It includes mainly engineering procedures for certified components.

The manuals shipped together or available with the individual components will contain additional relevant content to this document.

Relevancy of individual sections of this document is highlighted at the beginning of each section.



CAUTION!

The trace heating system is only applicable if workpiece temperatures are higher than the layout ambient temperature.



WARNING!

Risk of fire or electrical shock due to Electric Trace Heating System.
Risk of lost explosion protection.
The maximum Trace heater steady-state current is to be observed!
Follow these guidelines to avoid personal injury or material damage.

6. Technical Data

Heating Cables EKL

Property	EKL medium	EKL premium
Rated Voltage	max. 750 V	max. 750 V
Rated Current	max. 129 A	max. 129 A
Rated Power	max. 30 W/m	max. 30 W/m
IP protection class	IP66	IP66
Distance between trace heaters	min. 20 mm	min. 20 mm
Minimum bending radius		
types *00R8* and *1R71*	25 mm	25 mm
all other types	15 mm	15 mm
Minimum installation temperature	-60 °C	-60 °C
Temperature range	-60 °C to +260 °C	-60 °C to +260 °C
Mechanical Strength	4 J	7 J
Storage Temperature	-60 °C to + 60 °C	-60 °C to + 60 °C
Resistance		
heating cable	10 Ω/km to 8000 Ω/km	10 Ω/km to 8000 Ω/km
cold lead	7.2 Ω/km	0.8 Ω/km to 7.2 Ω/km



WARNING!

Risk of fire or electrical shock.

Heating Cable EKL medium Types No.: 27-582*-756F****, 27-582*-756G****, 27-582*-756H**** may only be used in areas with low mechanical risk or impact.


ECT Connector


Property	ECT 35	ECT 45
Rated Voltage	max. 750 V	max. 750 V
Rated Current	32 A @ 2.5 mm ² 54 A @ 6.0 mm ²	73 A @ 10 mm ² 98 A @ 16 mm ² 129 A @ 25 mm ²
Temperature range	-60 °C to +200 °C	-60 °C to +200 °C
IP protection class	IP66 (EN/IEC 60079-0)	IP66 (EN/IEC 60079-0)
Sealing range	3.2 to 7.9 mm	4.6 to 12.4 mm
Dimensions	176 mm length 35 mm diameter	231 mm length 45 mm diameter

For individual resistance values and their corresponding type numbers, refer to the EKL operating manual or data sheet.


7. Accessories


7.1. Heating Cables


	<p>Single-core series resistance heating cable EKL</p> <p>For use with heating cable EKL.</p> <p><u>Type EKL medium</u> mechanical strength of 4 Joule heating cable resistance from 7.2 Ω/km to 8000 Ω/km (for use in areas with low mechanical risk)</p> <p><u>Type EKL premium</u> mechanical strength of 7 Joule heating cable resistance from 0.8 Ω/km to 8000 Ω/km</p>	<p>Catalog No.: EKL medium Part No.: 27-582*-756G*</p> <p>Catalog No.: EKL premium Part No.: 27-582*-756K*</p> <p>For more information and complete ordering no. refer to the EKL operating manual and data sheet.</p>
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	<p>Single-core series resistance heating cable EKL (Cold Leads)</p> <p>EKL cold lead Ex with M20x1.5 cable gland; 1.2 m length. For use with Heating Cable EKL.</p> <p>2.5 mm² for max. 32 A 6.0 mm² for max. 54 A 10 mm² for max. 73 A 16 mm² for max. 98 A 25 mm² for max. 129 A</p>	<p>Catalog No.: EKL CL 2,5 Part No.: 05-0020-0530</p> <p>Catalog No.: EKL CL 6 Part No.: 05-0020-0553</p> <p>Catalog No.: EKL CL 10 Part No.: 05-0020-0556</p> <p>Catalog No.: EKL CL 16 Part No.: 05-0020-0557</p> <p>Catalog No.: EKL CL 25 Part No.: on request</p>
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7.2. Connection Technology

	<p>Heating cable connection ECT</p> <p>For use with heating cable EKL.</p> <p>Types ECT35 for heating cable connection or splice connection of heating cables with max. 2.5 mm² (max. 32 A) or max. 6 mm² (max. 54 A)</p> <p>Types ECT45 for heating cable connection with max. 10 mm² (max. 73 A) or max. 16 mm² (max. 98 A) or max. 25 mm² (max. 129 A)</p> <p><i>For a complete list of additional configurations see data sheet.</i></p>	<p>Catalog No.: ECT35-32 Part No.: 27-5A31-1222</p> <p>Catalog No.: ECT35-54 Part No.: 27-5A32-1232</p> <p>Catalog No.: ECT45-73-FD Part No.: 27-5A33-FD00</p> <p>Catalog No.: ECT45-98-GE Part No.: 27-5A36-GE00</p> <p>Catalog No.: ECT45-129-HE Part No.: 27-5A3A-HE00</p>
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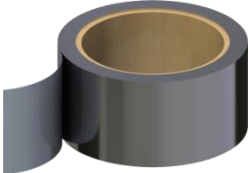
	<p>Enclosure for heating cable EKL/EMK</p> <p>For connection of heating cable types EKL/EMK and up to three heating circuits. Usage in hazardous areas.</p> <p>Cable gland for signal line: M25 / cable 6 mm² (clamping range 10 mm to 17 mm)</p> <p>Cable gland for signal line: M40 / cable 16 mm² (clamping range 17 mm to 28 mm)</p> <p>Threads for cable glands for heating circuits M20.</p>	<p>Single heating circuit, M25 cable gland: Part No.: 07-5103-9054</p> <p>Double heating circuit, M25 cable gland: Part No.: 07-5103-9055</p> <p>Triple heating circuit, M25 cable gland: Part No.: 07-5103-9056</p> <p>Single heating circuit, M40 cable gland: Part No.: 07-5103-9219</p> <p>Triple heating circuit, M40 cable gland: Part No.: 07-5103-9220</p>
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	<p>Digital temperature limiter DTL III Ex</p> <p>Digital temperature limiter for temperature limiting and monitoring of explosion-proof or media-safe heating circuits. For installation outside the hazardous area.</p> <p>More information in datasheet or manual.</p>	<p>Supply Voltage 24 V AC/DC: Catalog No.: DTL-3-Ex-24V Part No.: 17-8865-4C2222003000</p> <p>Supply Voltage 100 V to 240 V AC: Catalog No.: DTL-3-Ex-240V Part No.: 17-8865-472222003000</p>
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	<p>Resistance Temperature Device Pt100 Ex</p> <p>Electrical connection in 3-wire technology. Different measuring ranges from -200 °C to 600 °C and ambient temperature ranges from -50 °C to 70 °C available.</p> <p>More information in datasheet or manual.</p>	<p>More information and product configurations in datasheet or manual.</p>
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7.3. Mounting Parts

	<p>Electrically traced warning label</p> <p>Warning label for trace heater circuits</p> <p>Recommended: electrical warning label every 3 m on the outside of the thermal cladding on a clearly visible place.</p>	<p>German: Catalog No.: HTWL-DE Part No.: 05-2144-0046</p> <p>English: Catalog No.: HTWL-EN Part No.: 05-2144-0047</p> <p>French: Catalog No.: HTWL-FR Part No.: 05-2144-0703</p> <p>Russian: Catalog No.: HTWL-RU Part No.: 05-2144-0860</p>
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Aluminum adhesive tape

Used to fix the heating cable on pipes.

AT80: 50 mm x 50 m per roll
AT150: 50 mm x 55 m per roll
AT230: 50 mm x 50 m per roll

AT80:
Maximum withstand temperature: 80 °C
For heating cable PSB

AT150:
Maximum withstand temperature: 150 °C
For heating cable MSB, HSB and EKL Light, EKL Medium and EKL Premium

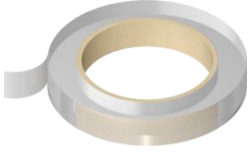
AT230:
Maximum withstand temperature: 230 °C
For heating cable HSB+ and HTSB, EKL Light, EKL Medium and EKL Premium

Gluing below 10 °C should be avoided. Observe processing instructions on datasheet.

AT80:
 Catalog No.: AT80-164
 Part No.: 02-5500-0003

AT150:
 Catalog No.: AT150-164
 Part No.: 02-5500-0014

AT230:
 Catalog No.: AT230-164
 Part No.: 02-5500-0043



Polyester adhesive tape

Used to fix the heating cable on pipes.

19 mm x 50 m per roll
Maximum withstand temperature: 100 °C


For heating cable PSB.

Gluing below 10 °C should be avoided. Observe processing instructions on datasheet.

Catalog No.: PT-164
 Part No.: 02-5500-0005


Tip: Refer to the following table to estimate the required number of tape rolls for your installation:

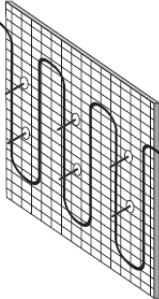
Pipe diameter in inch (DN)	1/4" (DN8)	1/2" (DN15)	3/4" (DN20)	1" (DN25)	1 1/4" (DN32)	1 1/2" (DN40)	2" (DN50)	2 1/2" (DN65)	3" (DN80)	4" (DN100)	6" (DN150)	8" (DN200)	10" (DN250)	12" (DN300)	14" (DN350)	16" (DN400)	18" (DN450)	20" (DN500)	24" (DN600)
Required no. of tape rolls per 100 ft (30 m) of piping	1	1	1	1	1	1	2	2	2	3	4	5	6	7	7	8	9	10	12

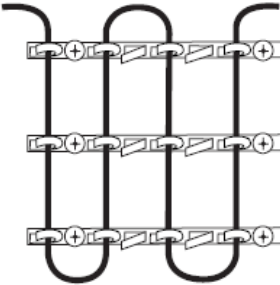
	Glass cloth tape Used to fix the heating cable on pipes. <i>11 mm x 50 m per roll</i> <i>Maximum withstand temperature: 180 °C</i> <i>(short term (1h) 250 °C)</i> <i>For heating cable PSB, MSB, HSB, HSB+, HTSB and EKL Light, EKL Medium and EKL Premium.</i> <i>Gluing below 10 °C should be avoided. Observe processing instructions on datasheet.</i>	Catalog No.: GT-164 Part No.: 02-5500-0047																																							
	<p><i>Tip: Refer to the following table to estimate the required number of tape rolls for your installation:</i></p> <table border="1"> <thead> <tr> <th>Pipe diameter in inch (DN)</th> <th>1/4" (DN8)</th> <th>1/2" (DN15)</th> <th>3/4" (DN20)</th> <th>1" (DN25)</th> <th>1 1/4" (DN32)</th> <th>1 1/2" (DN40)</th> <th>2" (DN50)</th> <th>2 1/2" (DN65)</th> <th>3" (DN80)</th> <th>4" (DN100)</th> <th>6" (DN150)</th> <th>8" (DN200)</th> <th>10" (DN250)</th> <th>12" (DN300)</th> <th>14" (DN350)</th> <th>16" (DN400)</th> <th>18" (DN450)</th> <th>20" (DN500)</th> <th>24" (DN600)</th> </tr> </thead> <tbody> <tr> <td>Required no. of tape rolls per 100 ft (30 m) of piping</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>2</td> <td>2</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> <td>12</td> </tr> </tbody> </table>		Pipe diameter in inch (DN)	1/4" (DN8)	1/2" (DN15)	3/4" (DN20)	1" (DN25)	1 1/4" (DN32)	1 1/2" (DN40)	2" (DN50)	2 1/2" (DN65)	3" (DN80)	4" (DN100)	6" (DN150)	8" (DN200)	10" (DN250)	12" (DN300)	14" (DN350)	16" (DN400)	18" (DN450)	20" (DN500)	24" (DN600)	Required no. of tape rolls per 100 ft (30 m) of piping	1	1	1	1	1	1	2	2	2	3	4	5	6	7	7	8	9	10
Pipe diameter in inch (DN)	1/4" (DN8)	1/2" (DN15)	3/4" (DN20)	1" (DN25)	1 1/4" (DN32)	1 1/2" (DN40)	2" (DN50)	2 1/2" (DN65)	3" (DN80)	4" (DN100)	6" (DN150)	8" (DN200)	10" (DN250)	12" (DN300)	14" (DN350)	16" (DN400)	18" (DN450)	20" (DN500)	24" (DN600)																						
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Tip: Refer to the following table to estimate the required number of tape rolls for your installation:

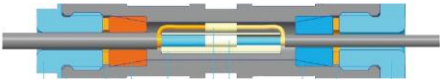
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Required no. of tape rolls per 100 ft (30 m) of piping	1	1	1	1	1	1	2	2	2	3	4	5	6	7	7	8	9	10	12


	Cable ties for trace heater installation on pipes up to 51 mm. <i>Package of 1000 pieces</i> <i>Length: 200 mm. Cable ties not UV resistant.</i> <i>Operating temperature range:</i> <i>-60 °C to 85 °C</i> <i>Min. installation temperature:</i> <i>-20 °C</i>	Catalog No.: CT-200 Part No.: 03-6500-0015

	Wire mats for heating cable EKL Galvanized steel or stainless steel <i>Size 25 m x 1 m</i>	Galvanized steel Catalog No.: WM_GS Part No.: 02-2210-002 Stainless steel Catalog No.: WM_SS Part No.: 02-2210-0003

	Spacing strip for heating cable EKL <i>20 m or 50 m reel</i>	20 m reel: Catalog No.: SS_20 Part No.: 03-6510-0219 50 m reel: Catalog No.: SS_50 Part No.: 03-6510-0200


7.4. Spare Parts

	<p>Spare parts box ECT35 / ECT45</p> <p><i>Box includes butt connectors for heating cable and protective braid, thrust washers and seals.</i></p>	<p><i>Box for ECT35:</i> Catalog No.: SP_ECT35 Part No.: 05-0091-0255</p> <p><i>Box for ECT45:</i> Catalog No.: SP_ECT45 Part No.: 05-0091-0256</p>
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	<p>Crimp set for ECT35 / ECT45 and EKL</p> <p><i>Set includes crimping clamp for butt connectors and butt connectors for heating cable EKL with 1.5 mm² to 10 mm² and 16 mm² to 25 mm²</i></p>	<p>Catalog No.: CS_EKL Part No.: 03-5545-0002</p>
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8. General Requirements


The Series Resistance Heating System EKL must be designed by BARTEC or BARTEC qualified personnel using the BARTEC software Heloc Pro.

	<p>WARNING!</p> <p>Risk of fire or electrical shock. Risk of lost explosion protection. Insulation material and thickness, length and resistance of the heating cable, current and voltage, limiter temperature and offset cannot be changed after calculation and must be observed.</p>
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8.1. Requirements for Stabilized Design

The maximum sheath temperature must be calculated by BARTEC or BARTEC qualified personnel for each individual heating circuit. The calculated design data must be followed, including heating circuit lengths, insulation material and thickness, type of heating cable, current and voltage.


The design data must be added to the heating circuit documents alongside the completely filled out Acceptance Report (see Appendix on page 27).

	<p>WARNING!</p> <p>Risk of fire or electrical shock. Risk of lost explosion protection. The design data must be observed thoroughly and correctly.</p>
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8.2. Requirements for Controlled Design

The controlled design of the Series Resistance Heating System EKL requires the usage of temperature sensors, temperature controller and limiter that are certified in accordance to IEC 60079-0.

The design data must be added to the heating circuit documents alongside the completely filled out Acceptance Report (see Appendix on page 27).

	<p>WARNING!</p> <p>Risk of fire. Risk of lost explosion protection. The temperature offset of the limiter must be set in accordance with the design data.</p>
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9. Installation of EKL on Pipes and Vessels

9.1. Preparation

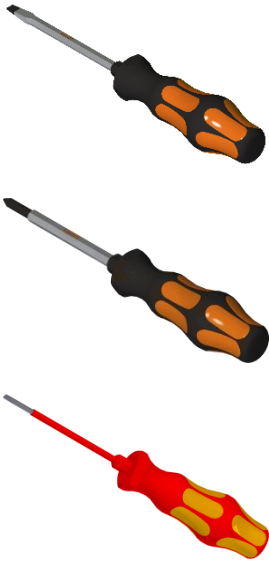
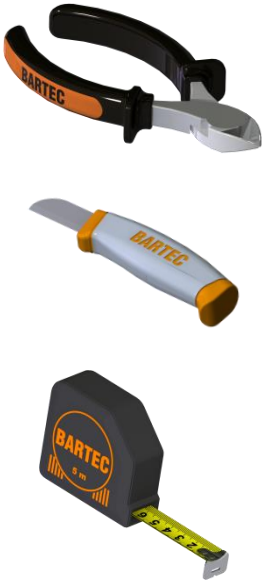

Before installing any Heating Cable EKL, the person installing must check if the Series Resistance Heating System EKL has been designed and planned correctly. It is particularly essential to verify the following points:

- complete project planning documentation, operating and installation instructions and applicable documents
- correct selection of the trace heater and accessories with respect to all Technical Data e.g.:
 - calculation of heat losses
 - max. permissible operating temperature
 - max. permissible ambient temperature
 - temperature class
 - heating circuit length

Before installing each heating circuit, make sure that all piping and equipment is properly installed and pressure tested.

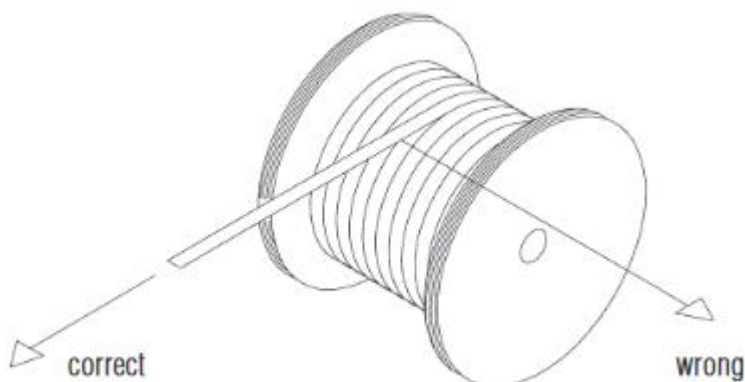
9.2. Required Tools / Equipment

The following tools are required for the installation and insulation resistance measurement of Series Resistance Heating Cable EKL:

<ul style="list-style-type: none"> ▪ Flat head screwdriver ▪ Cross-head screwdriver ▪ Electricians screwdriver 	<ul style="list-style-type: none"> ▪ Wire cutters ▪ Utility knife ▪ Tape measure 	<ul style="list-style-type: none"> ▪ Adjustable wrenches (2x) ▪ Needle nose pliers ▪ Insulation resistance meter with a test voltage of 2500 Vdc. ▪ Crimping tool 
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9.3. Unrolling the Heating Cable EKL

Unroll the Heating Cable EKL in a straight line. Avoid excessive tensile forces. Avoid torsion.



Take care to prevent damage to the insulation in the case of sharp corners and edges such as flanges or clamping systems. Use a stable mechanism that is suitable for the reel to unroll the cable. Size and weight of the reel should be taken into account.



PLEASE NOTE!

For practical and safe handling on site, it is recommended to limit the length of the heating cable per reel to a total reel weight of 25 kg to 30 kg.

9.4. Mounting the Heating Cable EKL



WARNING!

Risk of fire, injury and/or property damage.
Observe the following instructions when routing Series Resistance Heating Cable EKL.

Install the Heating Cable EKL in a straight line along the pipe or vessel. This saves time, helps to avoid installation mistakes and prevents damage to the Heating Cable EKL during the thermal insulation work.

Do not tread on the Heating Cable EKL or use it for climbing.

Do not cross or overlap the Heating Cable EKL to each other heating cable. The minimum distance between trace heaters must be observed at all times. Distance has to be min. 20 mm.

The minimum bending radius of the Heating Cable EKL must be observed at all times. Min. bending radius is 25 mm for Heating Cable EKL types 00R8 and 01R7 and 15 mm for all other types of Heating Cable EKL.

The Heating Cable EKL is a single core heating cable. Thus, to close the electrical circuit, both ends of the heating cable must be routed into a Junction Box or Terminal Box. See chapter Accessories (7.2 Connection Technology).



WARNING!

Risk of fire or electrical shock.
Risk of lost explosion protection.
The lengths of the heating circuits are to be observed in accordance with the design data. Shortening or lengthening of any circuit is not permitted.

9.5. Installation on Pipes

For the installation on pipes refer to the manual *Operating and installation instructions EKL medium/premium* that includes routing for common installations such as flanges, pumps, valves, pressure gauges and supports. See Applicable documents in chapter 2. Safety.

9.6. Installation on Vessels



WARNING!

Risk of fire or electrical shock.
Observe the minimum bending radius and minimum distance between Heating Cables.
Overlapping of the Heating Cables are not allowed.

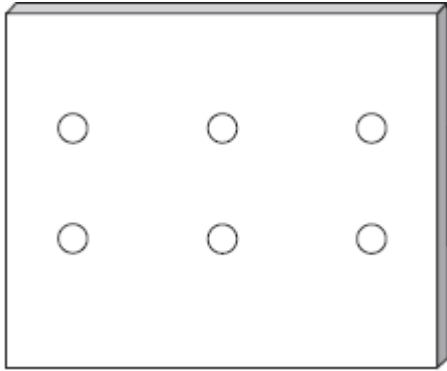
For installation of Heating Cables EKL on vessels you have to weld fixing points on the surface of the vessel. On these fixing points you can mount spacing strips or wire mats. See chapter Accessories (7.3 Mounting Parts).

You have to weld approx. 25 fixing pins per square meter by means of spot welding.

Mounting steps:

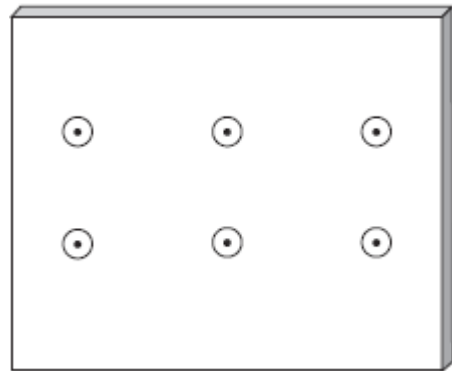
- Clean the surface in the welding area (picture 1)
- Weld the fixing pins (picture 2)
- Coat the welding pins and cleaned area with a suitable corrosion protection
- Mount spacing strips or wire mats accordingly following description

Clean the surface in the welding area



1

Weld the fixing pins by means of spot welding



2

Installation using spacing strips



WARNING!

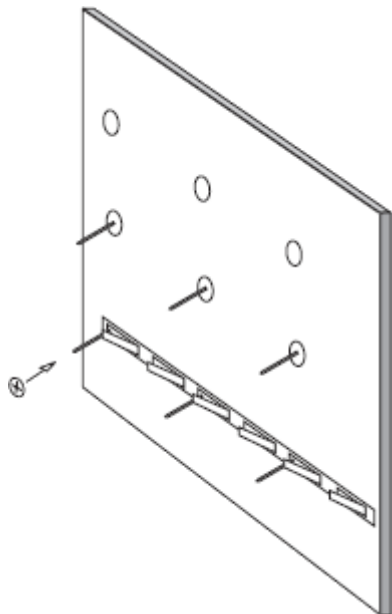
Risk of injury.
Pay attention to sharp edges when installing the spacing strips.

Mounting steps:

- Fix the spacing strips on the welded fixing pins using spring washers or weld the spacing strips onto the surface of the vessel. (picture 3)
- Route the Heating Cable EKL starting from the terminal box over the surface of the vessel and into the spacing strips in loops (picture 4)

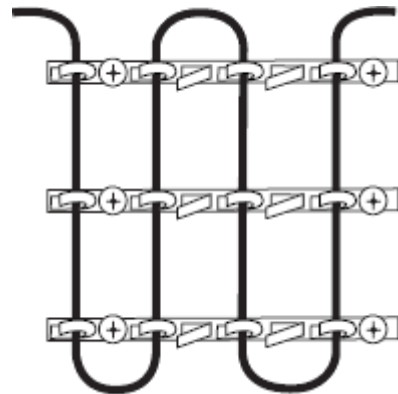
Note the bending radius and distance between the Heating Cables EKL

Fix the spacing strips on the welded fixing pins



3

Route the Heating Cable EKL into the spacing strips in loops



4

Installation using wire mats



WARNING!

Risk of injury.
Pay attention to sharp edges. If required, sharp edge cutouts should be bent to the inside.

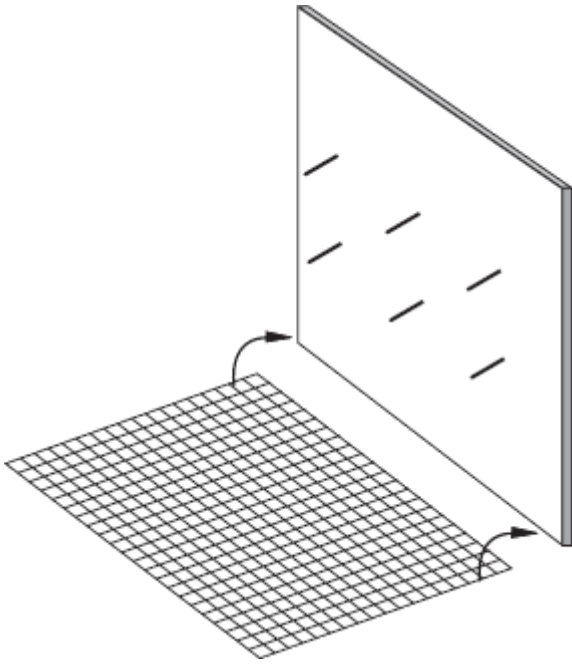
Mounting steps:

- Cut the wire mats in shape and mount it on the welded fixing pins of the vessel (picture 5) using spring washers (picture 6)
- Route the Heating Cable EKL starting from the Junction Box over the surface of the vessel and onto the wire mats in loops (picture 8)

Note the bending radius and distance between the Heating Cables EKL

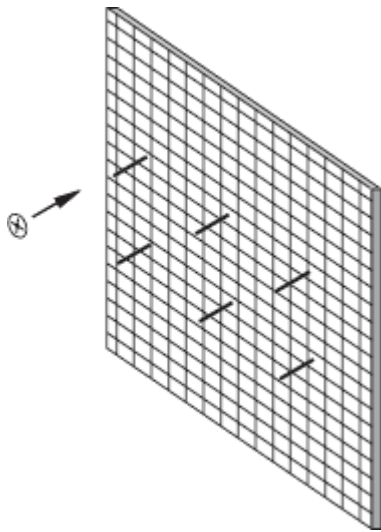
- Cover the heated surface of the vessel with aluminium foil if planned in design data (picture 9)

Mount the wire mats on the welded fixing pins

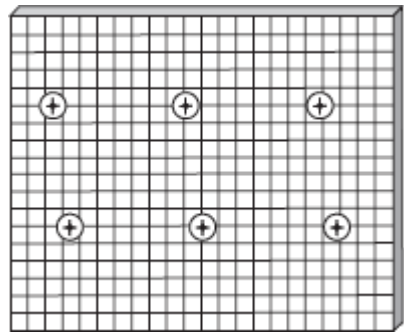


5

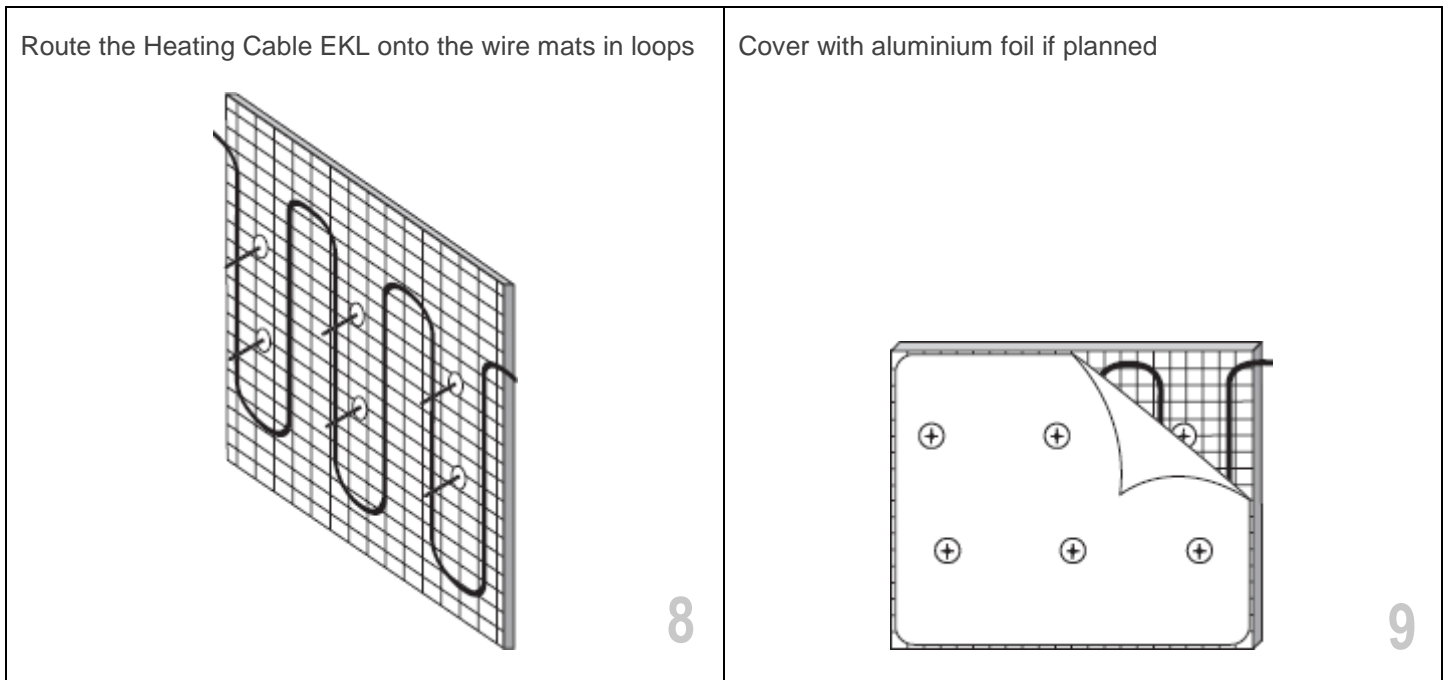
Using spring washers



6



7



9.7. Installation in Junction Box

For correct installation and connection of cold leads of Heating Cable EKL in a Junction Box, refer to the *Operation and Installation Manual Junction Box types PBS/PBM for Heating Cables EMK/EKL*. See Applicable documents in chapter 2. Safety.

BARTEC recommends using the Junction Boxes listed in chapter Accessories (7.2 Connection Technology). If a different Junction Box shall be used, it must fulfill the following criteria:

- Ex e protection
- suited terminals for the corresponding cold lead diameter
- min. IP 66 ingress protection
- suited for the expected ambient temperature
- suited terminals for the respective cold leads
- suited cable glands (IP 66) and seals to hold the trace heater securely in place

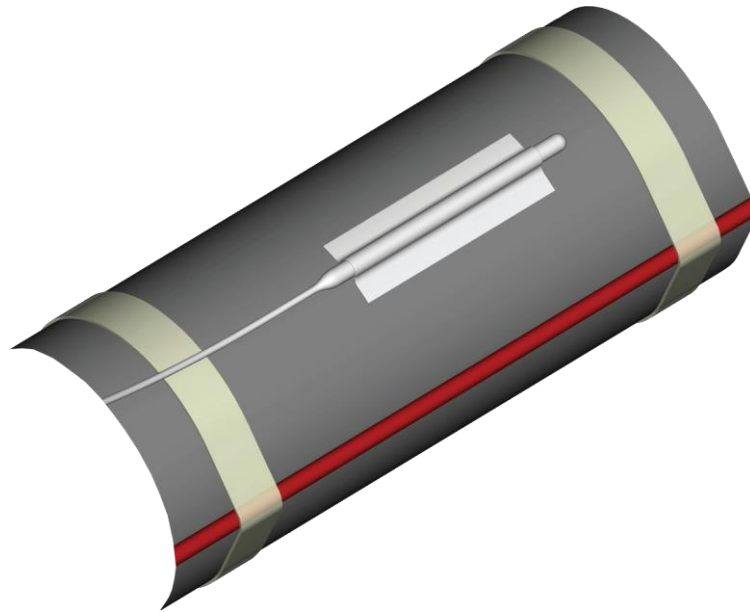
9.8. Installation of the Temperature Sensor (Controlled Design)

Following mounting situations are applicable in the case of system design is controlled design only.

The needed temperature sensor may be installed anywhere on the work piece excepting on valves, pumps, flanges, etc.

Mounting Situation 1

Sensor mounted on the workpiece

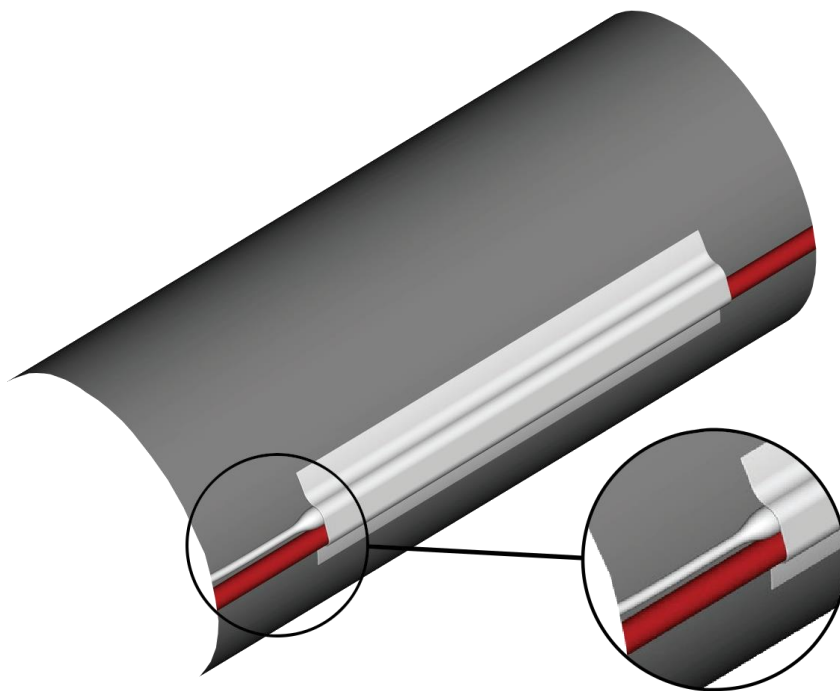


10

The temperature sensor must be fixed on the workpiece with aluminium adhesive tape. See chapter Accessories (7.3 Mounting Parts). Note the distance between heating cable and temperature sensor in the picture.

Mounting Situation 2

Sensor mounted on the Heating Cable

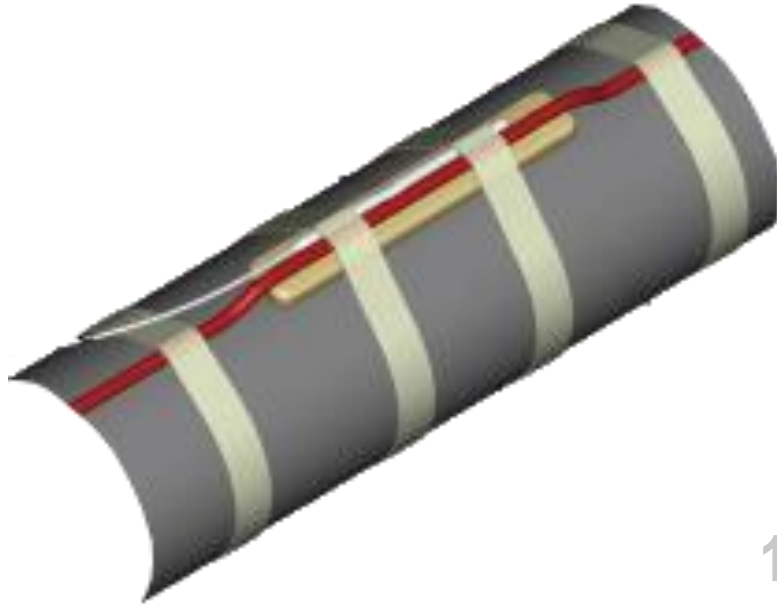


11

The temperature sensor must be fixed on the workpiece with longitude contact to the heating cable. For fixing use aluminium adhesive tape. See chapter Accessories (7.3 Mounting Parts).

Mounting Situation 3

Mounting as an Artificial Hot Spot



Mount a piece of insulating material on the workpiece. Note the technical details below. Mount the heating cable and the temperature sensor on the insulating material. Note the longitude contact between heating cable and temperature sensor. Cover the artificial hot spot with aluminium adhesive tape. See chapter Accessories (7.3 Mounting Parts).

The dimensions of the piece of insulation material must be as follows:

Length: 3x length of the temperature sensor

Broadness: 30 mm

Thickness: 10 mm

List the dimensions in the Acceptance Report. See Appendix on page 27.

The material of the insulation for the artificial hot spot must be suitable to the expected temperatures on the work piece. The thermal conductivity must be the same or lower than the values provided in the following table or the design data.

Thermal conductivity of the insulation material for artificial hot spot:

Thermal conductivity dependent on average expected temperature	T in °C	50	100	200	300
	W/mK	0,041	0,046	0,060	0,078

These mounting situations do not guarantee that the sensor will determine the temperature of the hottest point in the Series Resistance Heating System EKL. Thus, the limiter needs to be operated with a temperature offset.



WARNING!

Risk of fire.

Risk of lost explosion protection.

The temperature offset of the limiter must be set in accordance with the design data.

10. Tests and Commissioning

10.1. Measurement of the Insulation Resistance

The measurement of the insulation resistance is used to determine damage to the trace heater and possible installation faults. It must be carried out at the following times:

- Preliminary test (on the reel, before installation of the trace heater on the construction site)
- Acceptance test (after installation of the heating circuit and before installation of the thermal insulation; refer to chapter Acceptance Report in Appendix)
- Final inspection (immediately after completion of work on the thermal insulation)
- Upon commissioning
- Before switching on the installation

Preparation of the measurement:

- De-energize the heating circuit.
- Disconnect the thermostat or controller, if installed.
- Disconnect the bus wires and PE wires from the terminal block, if installed.
- For the measurement you need an Insulation Resistance Meter with test voltage of 2500 Vdc. Installation faults can be detected more reliably with a test voltage of 2500 Vdc.

Measurement:

- Set the test voltage to 0 Vdc.
- Connect the negative (-) lead to the grounding braid of the trace heater.
- Connect the positive (+) lead to one of the bus wires.
- Turn on the Insulation Resistance Meter and set the voltage to 2500 Vdc.
- Apply the voltage for 1 minute. The meter reading should stabilize. Rapid changes in the reading indicate a breakdown of the insulation.
- Record the insulation resistance value in the Inspection Record.
- Repeat the measurement between the grounding braid (-) and the grounded pipeline (+).

Results:

- Properly installed dry and clean trace heater sets should measure thousands of MΩ, regardless of the trace heater length or measuring voltage. Even if optimum conditions may not apply, all insulation resistance values should be greater than the IEC/IEEE 60079-30-2:2017 minimum recommendation of 20 MΩ. However, BARTEC strongly recommends a minimum reading of 1000 MΩ. If the reading is lower or fluctuating, refer to chapter *Troubleshooting* on page 28.

- Insulation resistance values for any particular circuit, should not vary more than 25 percent as a function of measuring voltage. Greater variances may indicate a problem with your trace heating system. Confirm proper installation and/or contact your local BARTEC representative for assistance.



WARNING!

Risk of fire or electrical shock.

If the insulation resistance is insufficient the issue must be found and resolved before putting the heating circuit into Operation.

After the measurement:

If the trace heater meets all resistance criteria:

- Reconnect the bus wires and PE wires to the terminal block.
- Reconnect any thermostat or controller.
- Reenergize the heating circuit.

10.2. Acceptance Test

After completion of the installation work (before installation of the thermal insulation) each heating circuit must be accepted, if possible in the presence of the client. All further tests must also be documented in an Acceptance Report (See Appendix on page 27).



PLEASE NOTE!

Claims under warranty will not be considered if the acceptance report is not filled in completely. The acceptance report must be released by BARTEC or BARTEC qualified personnel.

After completion of work on the thermal insulation final inspection and acceptance of each individual heating circuit is recommended. Usually, this is the task of the client or the final customer (= final inspection).

10.3. Commissioning

Each trace heating system can only be put into operation if the following conditions are fulfilled:

- The acceptance reports for each heating circuit are complete and the trace heating system has been accepted.
- All components of the heating circuit are completely installed and in properly operational order.
- It has been ensured that the heating circuit is operated in conformance with the technical data specified by BARTEC.
- It has been ensured that the trace heating system parameters such as the applied voltage, the ensuing current and the pipe temperature (as indicated in design documentation) will be verified during commissioning.



PLEASE NOTE!

Upon a cold start additional heating power is required for heating up tanks and pipes. When starting the system you should allow sufficient time for heat up. For further information on heat up calculations contact your local BARTEC representative.

11. Operation

During operation of the trace heating system you must ensure that all components of the system are operated within the operating data specified by BARTEC. This applies particularly to observation of the maximum temperature. Operation within these operating data is a precondition for possible later warranty claims.

11.1. System Documentation

Complete documentation must be carried out for each system, from the project planning stage, through installation and commissioning up to periodic maintenance of the trace heating system.

This documentation should include the following:

- Project planning documents
- Results of design calculation e.g. summarized in Print out of Heloc Pro calculation or manual calculation documented e.g. in BARTEC template 21-1000-7E0001 (www.bartec.com)

This means in detail:

- Trace heating circuit identification
- Pipe size or workpiece dimensions
- Maximum ambient temperature
- Maximum workpiece temperature
- Temperature to be maintained or the maximum process/exposure temperature
- Thermal insulation type/size and thickness
- Thermal insulation cladding if applicable
- Heat loss calculation
- Selection of heating cable type
- Operating voltage
- Temperature class or maximum sheath temperature

- Layout plans with sections of heating circuits
- Trace ratio
- Circuit graphs (e.g. Circuit diagram or single line diagram)
- Manuals of all of the components of the trace heating system
- Acceptance reports
- Reports on repair work and any operations carried out on the tank/pipe system, trace heating system and thermal insulation
- Inspection reports

12. Maintenance



CAUTION!

Danger of burning due to electric trace heating system
 Danger of burning from hot surface
 Disconnect the heating circuit from the power supply before removing the pipe insulation.
 Allow the heating system to cool down.
 Disconnect the heating circuit from the power supply before working on the Junction Box. Allow the Junction Box to cool down.

12.1. Visual and Functional Inspection

- Regularly check the thermal insulation for possible damage, missing seals, cracks, damage to the outer jacket, missing thermal insulation bushings for heating cables and cables, penetrated water or chemicals. If the thermal insulation is damaged the heating cable should be checked for possible damage.
- Damaged heating cables must be replaced.
- Parts subject to wear must be replaced (e.g. seals, locking plates etc.).
- Check Junction Boxes, splices, end terminations etc. for corrosion and possible mechanical damage. Make sure that all Junction Boxes covers are properly in place.
- If present, check the temperature controller connecting cables and sensors for damage and that their installation is protected against mechanical damage.

12.2. Electrical Inspection

Measurement of the insulation resistance should be seen as a permanent part of regular Maintenance. For instructions on how to perform the test refer to chapter 10. Tests and Commissioning on page 22.

Upon completion of maintenance, repair or modification the insulation resistance of the heating cable shall be measured and recorded after installation. It shall be value of more than 20 MΩ. Follow steps and description in chapter 10. Tests and Commissioning.

12.3. Inspection Intervals

- For frost protection installation inspections should be carried out annually before the heating period begins.
- For systems designed to maintain process temperatures, inspections should be carried out at regular intervals, but at least twice a year.



WARNING!

Risk of serious injury due to electrostatic charging. For plastic type label electrostatic charging hazard exist. Only wet cleaning is allowed.

12.4. Personnel Training Courses

Regular maintenance should be carried out by trained, experienced maintenance personnel. It is recommended that maintenance personnel is updated on new developments in application technology and maintenance.

12.5. Repair Work on Piping or Thermal Insulation



CAUTION!

Consult the trace heating system documentation prior to maintenance/repair/modification.

- Ensure that all safety procedures and precautions in the area for repairs are followed.
- Take care that the trace heating system is not damaged during repair work on the pipes or insulation.
- Make sure that any repaired heating circuit are properly installed and tested according to the project planning documentation after completion of the repair work.

**WARNING!**

Risk of fire or electrical shock due to damaged components.

- Carry out a visual, functional and electrical test (refer to section 10. Tests and Commissioning on page 22).
- Test the operation of the earth-fault device of each affected circuit or equivalent.

In the event of an earth fault or over current interruption, the device shall not be reset until the cause of the trip has been investigated by qualified personnel or equivalent.

13. Disposal and Recycling

Each product of the trace heating system must be disposed of properly in accordance with legal regulations. The main components are plastic, metal and electrical components. Each product must be disassembled into its components and fed into the recycling system in accordance with its components.

**Disposal**

For disposal the appliance must be disposed of in accordance with local laws and regulations according to its components.

14. Appendix

14.1. Acceptance Report

Abnahmeprotokoll / Acceptance Report

BARTEC

vor Erstinbetriebnahme und für Stückprüfung / before initial operation and for routine test

Elektrische Rohrbegleitheizung Electric Trace Heating Pipe <input type="checkbox"/>		Blatt Sheet <input type="checkbox"/> von <input type="checkbox"/> of <input type="checkbox"/> Bemerkung/Anlage Comments/Appendix <input type="checkbox"/>	
Behälterbeheizung Electric Trace Heating Tank/Vessel <input type="checkbox"/>		Datum Date	
Auftraggeber Customer		Best.-Nr./Komm.-Nr. Order Comm. No.	
		Projekt Project	
		BARTEC Auftrags-Nr. BARTEC Order No.	
Ex-Bereich ja <input type="checkbox"/> yes <input type="checkbox"/> nein <input type="checkbox"/> no <input type="checkbox"/>	Zone Zone <input type="checkbox"/>	Temperaturklasse Temperature class T <input type="checkbox"/>	Explosionsgruppe Group <input type="checkbox"/>
Seriennummer (Heizkreis-Nr.) Serial number (Heating circuit No.)		Prüfung vor Montage der Wärmedämmung Check before installation of insulation	
Rohr-/Behälter Größe Pipe / Vessel size		Min. Verlegeabstand eingehalten Min. distance observed	<input type="checkbox"/>
Heizkabel / Typ Heating cable type		Min. Biegeradius eingehalten Min. bending radius observed	<input type="checkbox"/>
Charge-Nr. Heizkabel Batch No. Heating cable		Aluminiumfolie oder -klebeband verwendet Aluminium foil or tape used	ja <input type="checkbox"/> yes <input type="checkbox"/> nein <input type="checkbox"/> no <input type="checkbox"/>
Anschluss / Verbinder Typ Connection / Splice type		Wärmedämmung Thermal insulation	
Anschluss / Verbinder Seriennummer Connection / Splice type serial number		Material Material	
Heizkabellänge Heating cable length _____ m		Isolierstärke Insulation thickness	_____ mm
Heizkabelwiderstand Resistance heating cable _____ Ω		Keine Wärmedämmung zwischen Heizleitung und Rohr/Behälter No thermal insulation between heating cable and workpiece	<input type="checkbox"/>
Spannung Voltage _____ V		Typenschild Type label	
Strom (Einsch./Betrieb) Current (Switch-on / Operation) _____ / _____ A		Kennzeichnung entspricht Auslegedokumentation Marking equivalent to design data <input type="checkbox"/>	
Leistung Heizkabel Output Power heating cable _____ W/m			
Isolationswiderstand bei Insul. resistance at _____ V		_____ MΩ	
Temperatursensor Begrenzer (nur Überwachte Bauart) Temperature sensor limiter (only Controlled Design)			
Montage Temperatursensor Mounting Temperature sensor	Sensor auf Rohr Sensor on pipe <input type="checkbox"/>	Sensor an Heizleitg. Sensor on cable <input type="checkbox"/>	Künstlicher Hot.Spot Artificial hot-spot <input type="checkbox"/>
Temperatureinstellung Begrenzer Temperature setting limiter	_____ °C	Off-Set Off-set	_____ K
		Wärmeleitfähigkeit Thermal conductivity	_____ W/mK
		Länge Length	_____ mm
		Höhe Height	_____ mm
		Breite Width	_____ mm
	Monteur nach IEC/EN 60079-14 Installer according to IEC/EN 60079-14	Auftraggeber Customer	
	Name Name	Name Name	
	Datum / Unterschrift Date / Signature	Datum / Unterschrift Date / Signature	
Bemerkung Comments			
Freigabe BARTEC oder BARTEC qualifizierte Person* Release BARTEC or BARTEC qualified person*			
Ort/Datum City/Date	Name Name	Unterschrift Signature	
*Inbetriebnahme nur mit Freigabe / *operation only with release			
BARTEC GmbH, Max-Eyth-Straße 16, 97980 Bad Mergentheim, Germany Deutschland Tel.:+49 7931 597-0 www.bartec.de			

14.2. Troubleshooting

Problem	Possible cause	Remedy
Trace heater remains cold	No power supply	Check the power wiring for continuity to circuit breaker.
	Trace heater bus wires or power wiring not properly connected	Connect the trace heater and power wiring according to the installation instructions.
	Control unit adjusted incorrectly	Adjust the control unit according to the installation instructions.
Automatic circuit breaker tripped	Automatic circuit breaker defective	Replace the automatic circuit breaker.
	Automatic circuit breaker has wrong tripping characteristics, e.g. "B" instead of "C"	Install an automatic circuit breaker with Type-C tripping characteristics or contact the factory for Type-B tripping characteristics.
	Nominal circuit breaker size is insufficient	Install an automatic circuit breaker with higher capacity. Observe the maximum current of all components of the trace heating circuit!
	Short circuit Humidity inside the connection system	Identify the cause and remedy the fault Dry the components. For junction boxes, be sure that the cable gland is correctly installed and sealing properly.
Ground fault protection is disengaged	Trace heater damaged	Replace the trace heater at the point where it is damaged.
	Moisture in the components	Dry the components. For junction boxes, be sure that the cable gland is correctly installed and sealing properly.
	Ground fault protection defective	Replace the ground fault protection device(s).
Low or inconsistent insulation resistance	Trace heater damaged	Replace the trace heater at the point where it is damaged.
	Moisture in the components	Dry the components. For junction boxes, be sure that the cable gland is correctly installed and sealing properly.
	Arcing due to damaged trace heater insulation	Replace the trace heater at the point where it is damaged.
	Arcing due to inadequate stripping distance between heating element and grounding braid	Check the stripping distance between bus wires and grounding braid at all connections to ensure adequate separation.
	Short-circuit between the grounding braid and the heating element or the grounding braid and the pipe	Check for cut or damaged cable or inadequate stripping length
	Test leads touching the junction box	Relocate test leads and retest.

14.3. Limited Product Warranty

Worldwide, excepting North America:

Scope

BARTEC warrants that all BARTEC products and accessories that are the subject of this manual will be free from defects in materials and workmanship from and after its date of purchase for a period of 12 (twelve) months.

For the avoidance of doubt, this limited product warranty will **not** cover any damage caused by:

- accidents,
- misuse, improper installation, operation, maintenance or repairs,
- neglect, or
- alteration.

Furthermore, BARTEC cannot be held liable under this warranty for:

- installation or removal costs,
- loss or damage to property,
- indirect, special, incidental or consequential damages (including, without limitation, loss of revenue or anticipated profits), or
- any other damages or costs directly or indirectly related to the warranty issue.

If all warranty conditions are met (as set forth below), BARTEC will, at its sole discretion:

- repair the product,
- replace the product, or
- refund the purchase price paid for the product.

This warranty gives you specific legal rights, and you may also have other rights which vary by country, state or province. Except as specifically provided otherwise in this limited product warranty, the BARTEC Group General Terms and Conditions shall apply.

General terms and conditions

BARTEC Global Terms and conditions are available at: <https://www.bartec.de/en/terms/>

Conditions

The limited product warranty is subject to the following conditions:

- proper installation, operation and maintenance in compliance with the state of the technology and the product documentation, and
- presence of completely filled in acceptance reports for all installation, maintenance and repairwork operations.

How to claim the warranty

To file a claim under the limited product warranty:

- Notify BARTEC or your local BARTEC representative by written correspondence or email within 30 days after identification of a possible warranty issue.
- If requested, you must provide any warranty-related information and documentation to BARTEC, including, without limitation:
 - project planning documents, and
 - acceptance reports for installation, operation, maintenance or repairwork.

Contact

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Fax: +49 7931 591-499

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