TraceCalc Net, software design in three easy steps:

1. Select your heat-tracing design

2. Enter the design data

3. Get a bill of materials and request a quotation
Follow this design guide
to get to the right solution for your application. This paper guide offers the benefit that it is fast and easy to use at any location where you may need it. First select the correct heating cable, then take care of the electrical design and select the components and accessories to complete your heat-tracing system.

Or use our software design tools
TraceCalc Net or TraceCalc Pro to generate a complete bill of materials, design summary and line list for your heat-tracing system. Both offer the possibility to do designs for use in hazardous or non-hazardous areas and for frost protection or temperature maintenance. With TraceCalc Net selecting the appropriate industrial pipe heat-tracing products is easy.
The simple 3-step design process consists of:
1. Select your heat-tracing design
2. Enter the design data
3. Get a bill of materials and request a quotation
Register for this online design tool at:
www.tycothermal.com/TraceCalc/
For heat-tracing in industrial applications, TraceCalc Pro provides design calculations such as pipe heat loss, number of circuits, electrical loads and maximum temperatures, automated heating cable and component selection, recommendations for control and monitoring selection, and much more.
It provides easy-to-use standard reports and last but not least, its powerful features help you obtain the best heat-tracing solution for your particular project.
With TraceCalc Pro, Tyco Thermal Controls provides you with an unprecedented design tool giving you an optimal heat-tracing solution. Please contact your Tyco Thermal Controls representative for more information.

Or let us do the design for you
Simply complete the project information sheet provided at the end of this guide and email or fax it back to your Tyco Thermal Controls representative who will quickly provide you with a most appropriate design, a bill of materials and pricing.

We manage the heat you need...
Our Raychem self-regulating heat-tracing system is ...

... Super Safe

- Raychem self-regulating heat-tracing cables are certified for unconditional T-rating in accordance with European Standard EN 60079-30-1. The surface temperature of the heating cable will never exceed its T-class temperature.

- The self-regulating principle ensures that the cable senses overlaps. It regulates its heat accordingly and prevents any heat build-up or burn out. Furthermore, complex shapes like valves, flanges or pipe supports are easily traced with this system.

... Cost Saving

- The cable is easy to tee, splice, install and repair. No special skills are required, resulting in reduced installation time.

- Due to its self-regulating principle, this system saves energy and thus operational costs.

- The system requires a minimum of maintenance and is fully resistant to all pipe maintenance procedures.

- To easily accommodate design changes on site, the cable can be cut-to-length when being installed.
... Reliable

- Toughness is a major attribute of self-regulating heat-tracing cables. An outer jacket of fluoropolymer offers mechanical strength as well as chemical resistance. Both XTV and KTV type heating cables have a unique fiber construction and are manufactured using high performance polymers.

- The cable compensates for variations in heat loss and voltage. It can be fine-tuned to control your pipe temperature to a tolerance of 3°C by installing a pipe sensor and feeding the input to a control unit.

- Even variations in ambient temperature are automatically compensated for by the self-regulating heating cable.

- Our company can build on more than 30 years of experience in the heat-tracing business.

- With Tyco Thermal Controls, customers can rely on a company that has shipped over a billion feet (> 300,000 km) of self-regulating heat-tracing cables.
How to select and design the heat-tracing system for pipes

This Design Guide outlines a simple procedure for designing and selecting a complete heat-tracing system using BTV, QTVR, XTV or KTV heating cables.

By following the design steps in the 3 sections, a bill of materials can be easily produced which includes the heating cable type, length, components and accessories needed to install the heat-tracing system correctly.

<table>
<thead>
<tr>
<th>1.0</th>
<th>Heating cable selection</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>Electrical design</td>
<td>11</td>
</tr>
<tr>
<td>3.0</td>
<td>Components and accessories selection</td>
<td>13</td>
</tr>
</tbody>
</table>

Installation
Tyco Thermal Controls heat-tracing systems must be installed following Tyco Thermal Controls guidelines. Contact your Tyco Thermal Controls representative for a copy of the installation manual. All components are supplied with easy-to-follow instructions.

Additional information
Full technical information on components and heating cables can be found in our Technical Databook. Combined with the installation instructions this supplements the information in this guide. These documents are available from your local Tyco Thermal Controls representative and from the Tyco Thermal Controls website (www.tycothermal.com).

1.0 Heating cable selection

To select the correct heating cable determine
- Pipe or tubing diameter
- Thermal insulation thickness
- $T_m$: Maintain Temperature (desired fluid temperature)

Example:
Fluid: Process liquid, steam-cleaned
Line size: NB 50 mm
Insulation thickness: 50 mm
$T_m$: 50°C
### Step 1.1 Determine heat loss

<table>
<thead>
<tr>
<th>DN=Ø pipe (NB)</th>
<th>Insulation thickness (mm)</th>
<th>5</th>
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<th>20</th>
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<td>19.8</td>
<td>23.5</td>
<td>27.3</td>
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</tbody>
</table>

The table is based on the following parameters:
- Mineral wool insulation
- Minimum expected ambient temperature: -20°C
- Pipes located outdoors
- Steel pipes
- Safety factor 10%

For other configurations (dimensions, temperatures, etc.), please use TraceCalc Pro or TraceCalc Net software or consult your Tyco Thermal Controls representative.

1. Select the pipe diameter and insulation thickness Example: NB 50 mm, 50 mm insulation thickness
2. Select the desired maintain temperature
3. Note the heat loss result

Example: NB 50 mm, 50 mm insulation thickness T_m: 50°C 18.8 W/m
Step 1.2 Select heating cable family

- Verify that maximum exposure temperatures of heating cable are sufficient
- Select correct heating cable according to temperature classification

Example:
Steam-cleaned: System is cleaned for 6 hours per year using 20 bar saturated steam (215°C)
Normal operating temperature is 50°C
Temperature classification is T3
Correct family is XTV2-CT-T3

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Temperature classification</th>
<th>Continuous Max. exposure temperatures intermittent (1000 hours cumulated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTV2-CT</td>
<td>T6</td>
<td>65°C 85°C</td>
</tr>
<tr>
<td>QTVR2-CT</td>
<td>T4</td>
<td>110°C 110°C</td>
</tr>
<tr>
<td>XTV2-CT-T3</td>
<td>T3</td>
<td>120°C 215°C</td>
</tr>
<tr>
<td>20XTV2-CT-T2</td>
<td>T2</td>
<td>120°C 215°C</td>
</tr>
<tr>
<td>KTV2-CT</td>
<td>T2</td>
<td>150°C 215°C</td>
</tr>
</tbody>
</table>

Step 1.3 Select heating cable

- Select graph below based on the heating cable family
- Draw a vertical line at the maintain temperature
- Draw a horizontal line for the heat loss
- Select nearest cable above crossover of these two lines

**BTV2-CT**
A 10BTV2-CT
B 8BTV2-CT
C 5BTV2-CT
D 3BTV2-CT

**QTVR2-CT**
A 20QTVR2-CT
B 15QTVR2-CT
C 10QTVR2-CT
**XTV2-CT-T**\(^*\) (*=3 or 2)

A  20XTV2-CT-T2
B  15XTV2-CT-T3
C  12XTV2-CT-T3
D  8XTV2-CT-T3
E  4XTV2-CT-T3

**KTV2-CT**

A  20KTV2-CT
B  15KTV2-CT
C  8KTV2-CT
D  5KTV2-CT

---

**Example:**

XTV graph

Maintain temperature = 50°C

Heat loss = 18.8 W/m

Nearest cable above crossover is D = 8XTV2-CT-T3
### Step 1.4 Determine heating cable length

Determine the total length of the heating cable by combining lengths from each component in the piping system.

#### For the piping
Calculate the amount of heating cable required for the pipe length. In the case of a straight heating cable run, this quantity is equal to the total length of the piping. Add at least one metre to allow for the entry into a junction box and the end seal. Add a heating cable length of 5-10% for bends, flanges, elbows etc.

#### For each valve
Add the following heating cable lengths:

<table>
<thead>
<tr>
<th>Valve type</th>
<th>Heating cable length (m) per valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate</td>
<td>1.0</td>
</tr>
<tr>
<td>Butterfly</td>
<td>0.4</td>
</tr>
<tr>
<td>Ball</td>
<td>0.5</td>
</tr>
<tr>
<td>Globe</td>
<td>0.9</td>
</tr>
</tbody>
</table>

#### Pipe supports
Add the following heating cable lengths:

<table>
<thead>
<tr>
<th>Pipe size (mm)</th>
<th>Support Type</th>
<th>Heating cable length (m) per support</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 - 25</td>
<td>Pipe hangers</td>
<td>0</td>
</tr>
<tr>
<td>32 - 60</td>
<td>Small shoe (100 mm x 5 mm)</td>
<td>1.0</td>
</tr>
<tr>
<td>65 - 150</td>
<td>Medium shoe (150 mm x 8 mm)</td>
<td>2.0</td>
</tr>
</tbody>
</table>

#### Other fittings and fixtures
Consult your local Tyco Thermal Controls representative.

**Example:**

Heating cable length =

Pipe: 30 m = 30.0 m
Junction Box entry + end seal = 1.0 m
Flanges: 5% = 1.5 m
Valves: 3 ball valves x 0.5 = 1.5 m
Supports: 5 small shoes x 1 = 5.0 m
Total length of 8XTV2-CT-T3 = 39.0 m
2.0 Electrical Design

All Raychem heating cables must be installed with electrical protection in accordance with local codes and practices.

Circuit definition
For ease of system design and use, only one type of heating cable should be connected in each circuit. Each heat-tracing circuit should have its own electrical protection. A circuit may be composed of several branches (see figure below) but the sum of all heating cable lengths should not exceed the maximum circuit length determined in section 2.2.

Electrical protection sizing
Raychem heating cables are self-regulating: power output and current draw decrease as temperature increases. This current draw must be co-ordinated with the electrical protection. Table 2 on page 12 shows maximum circuit lengths for use with commonly available protection devices (Type C to EN 60898 circuit breaker) and applies for Raychem heating cables installed on thermally insulated surfaces without the use of heat transfer aids. The table was generated in accordance with European practices for heating cables powered at 230 Vac.

For other supply voltages, applications, protection devices, start-up temperatures or products, consult your Tyco Thermal Controls representative.

Earth leakage protection
Tyco Thermal Controls requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.

To select the circuit breaker sizing, determine:
- minimum start-up temperature
- total length of heating cable

Step 2.1 Determine minimum pipe start-up temperature (°C)

The power output and current draw of a Raychem heating cable depend on its temperature. Electrical protection sizing must be based on the minimum pipe start-up temperature.

Example: 0°C

Step 2.2 Select protection rating

From table 2 on page 12, match the heating cable catalogue number (see step 1-3) at the expected minimum start-up temperature with the total heating cable length (see step 1.4). Select protection rating (A) for which the length of the heating cable is less or equal than the maximum recommended heating cable length (L ≤ L max.).

Power cable sizing
Power supply cables from the electrical protection to the Raychem connection system should be sized to meet appropriate codes of practice, protection rating and voltage drop considerations.
## Table 2

1. Select heating cable
2. Select min. start-up temperature
3. Match the total heating cable length

**Example:** 8XTV2-CT-T3

<table>
<thead>
<tr>
<th>Start-up temperature</th>
<th>Circuit breaker size (type C)</th>
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<tbody>
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<td></td>
<td>6BTV2-CT</td>
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<td></td>
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<td>26BTV2-CT</td>
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### L max (m) - Maximum recommended heating cable length

<table>
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<th>Start-up temperature</th>
<th>Circuit breaker size (type C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3BTV2-CT</td>
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<td>29BTV2-CT</td>
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* NA: Not allowed
3.0 Components and accessories selection

A complete range of cold applied components and accessories is available for all BTV, QTVR, XTV and KTV heating cable types. All of the components work together to provide a safe and reliable heat-tracing system that is easy to install and maintain. Raychem components must be used to ensure proper functioning of the product and compliance with relevant standards and regulations. A heat-tracing system consists of at least one power connection and one end seal. Additional components such as splices and tees are used as required.
Power connections

Power connections may be mounted on or off the pipe. For pipe mounted applications, select one of the integrated components below. For mounting off the pipe, select a separate junction box and the necessary connection kits and insulation entry kits from the modular components table on the next page. The kits can be used with Raychem industrial heating cables: BTV, QTVR, XTV and KTV. The power connections JBS, JBM and JBU can also be ordered with a green light for simple indication if power is on.

Integrated components

Integrated components combine the functions of the junction box, connection, insulation entry, and support bracket. These components provide full protection of the heating cable for safe operation. The cold-applied core sealing and innovative WAGO cage clamp terminals ensure reliable connections and significantly reduce installation time. The integrated components are designed for industrial applications and are approved for use in hazardous areas.

Threads are metric (M25).

Above the insulation

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Part Number</th>
<th>Order Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>JBS-100-E</td>
<td>Integrated power connection for 1 heating cable. Cold applied.</td>
<td>P/N 829939-000</td>
<td>JBS-100-L-E</td>
</tr>
<tr>
<td></td>
<td>One power cable gland included.</td>
<td></td>
<td>(P/N 054363-000)</td>
</tr>
<tr>
<td></td>
<td>Requires 1 pipe strap, to be ordered separately.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JBS-100-EP</td>
<td>Integrated power connection for 1 heating cable. Includes earth plate and</td>
<td>P/N 158251-000</td>
<td>JBS-100-L-EP</td>
</tr>
<tr>
<td></td>
<td>earth stud for use with armoured cables.</td>
<td></td>
<td>(P/N 075249-000)</td>
</tr>
<tr>
<td></td>
<td>Cold applied. Requires 1 pipe strap and 1 metal power cable gland to be</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ordered separately.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JBM-100-E</td>
<td>Integrated power connection for up to 3 heating cables. May also be used</td>
<td>P/N 831519-000</td>
<td>JBM-100-L-E</td>
</tr>
<tr>
<td></td>
<td>for tee and splice connections. Cold applied.</td>
<td></td>
<td>(P/N 395855-000)</td>
</tr>
<tr>
<td></td>
<td>One power cable gland included.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Requires 2 pipe straps, to be ordered separately.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JBM-100-EP</td>
<td>Integrated power connection for up to 3 heating cables. Includes earth</td>
<td>P/N 986415-000</td>
<td>JBM-100-L-EP</td>
</tr>
<tr>
<td></td>
<td>plate and earth stud for use with armoured cables.</td>
<td></td>
<td>(P/N 300273-000)</td>
</tr>
<tr>
<td></td>
<td>May also be used for tee and splice connections.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cold applied. Requires 2 pipe straps and 1 metal power cable gland to be</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ordered separately.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Under the insulation

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Part Number</th>
<th>Order Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-150-E</td>
<td>Low profile power connection for 1 heating cable. Maximum load of 25A</td>
<td>P/N 073704-000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cold applied. Suitable for non-armoured power cables up to 2.5 mm² with</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>stranded copper conductors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C-150-E is used as a connector:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• where connection to a junction box is difficult e.g. because of space</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>limitations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• on instrument lines or loading arms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• where installation of insulation components is preferred</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• as a cost effective alternative for JBS-100-E on short lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Part number P/N: 073704-000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Modular components

Modular components are used for making power connections for up to 3 heating cables. The junction boxes are designed for surface mounting, and versions for both hazardous and non-hazardous areas are available. The JBU-100 includes the innovative cage clamp terminals from WAGO. The connection kits and insulation entry kits are cold applied and have to be ordered separately. Select one junction box for each circuit. Select one connection kit and one insulation entry kit for each heating cable terminated in the junction box. Optionally a conduit system for mechanical protection of the heating cable where it transitions from the junction box to the pipe can be selected.

Metric system (M25)

<table>
<thead>
<tr>
<th></th>
<th>Hazardous</th>
<th>Non-Hazardous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A Junction boxes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For non-armoured power cable</td>
<td>JBU-100-E(1)</td>
<td>JB-82</td>
</tr>
<tr>
<td>For armoured power cable</td>
<td>JBU-100-EP(1)(2)</td>
<td>–</td>
</tr>
<tr>
<td><strong>B Connection kits</strong></td>
<td>C25-100</td>
<td>C25-100</td>
</tr>
<tr>
<td><strong>C Insulation entry kit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For pipes, vessels, pumps and instruments</td>
<td>IEK-25-04</td>
<td>IEK-25-04</td>
</tr>
<tr>
<td>For pipes</td>
<td>IEK-25-PIPE(3)</td>
<td>IEK-25-PIPE(3)</td>
</tr>
<tr>
<td><strong>D Conduit system</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For medium temperature applications</td>
<td>CCON25-100 + CCON-CMT-2M</td>
<td>CCON25-100 + CCON-CMT-2M</td>
</tr>
<tr>
<td>For high temperature applications</td>
<td>CCON25-100 + CCON-CHT-2M</td>
<td>CCON25-100 + CCON-CHT-2M</td>
</tr>
</tbody>
</table>

(1) with green light, order reference: JBU-100-L-E or JBU-100-L-EP
(2) includes internal earth plate and earth stud; requires metal power cable gland, to be ordered separately.
(3) requires 2 pipe straps, to be ordered separately

Splices and Tees

For in-line joining or making T-connections of the heating cables. Approved for use in hazardous areas (Ex e).

Above the insulation

JBM-100-E
For making splice or tee connections with terminals above the insulation.
Cold applied.
Requires 2 pipe straps, to be ordered separately.
Part number P/N: 831519-000
With internal earth plate and earth stud, order reference: JBM-100-EP (P/N 988415-000)
End seals are used for terminating the heating cable. Approved for use in hazardous areas. Select 1 end seal for each remote heating cable end.

### Above the insulation

E-100-E  
Mechanical end seal (Ex e).  
Cold applied.  
Requires 1 pipe strap, to be ordered separately.  
Part number: 101255-000

E-100-L2-E  
Mechanical end seal with green LED light module (Ex em).  
Cold applied.  
Requires 1 pipe strap, to be ordered separately.  
Part number: 726985-000

### Under the insulation

S-150  
For making splice connections with terminals under the insulation.  
Cold applied.  
Part number: 497537-000

E-150-E  
Low profile end seal (Ex e).  
Cold applied.  
Part number: 979099-000
Thermostats may be required for process temperature maintenance (surface sensing) or freeze protection (ambient sensing) applications. Use the table below to select the appropriate thermostat. For surface sensing, select one thermostat per circuit. For ambient sensing, select one thermostat per site.

For significant reductions in energy consumption in freeze protection applications, select the RAYSTAT-ECO-10. This electronic thermostat continuously matches the heat-tracing output to the pipe heat loss based on the ambient temperature.

<table>
<thead>
<tr>
<th>Area</th>
<th>Type</th>
<th>Catalogue number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-hazardous</td>
<td>Ambient sensing</td>
<td>AT-TS-13</td>
</tr>
<tr>
<td></td>
<td>Proportional Ambient sensing</td>
<td>RAYSTAT-ECO-10</td>
</tr>
<tr>
<td></td>
<td>Surface sensing</td>
<td>AT-TS-14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RAYSTAT-CONTROL-10</td>
</tr>
<tr>
<td>Hazardous</td>
<td>Ambient sensing</td>
<td>RAYSTAT-EX-04 (electronic)</td>
</tr>
<tr>
<td></td>
<td>Surface sensing</td>
<td>RAYSTAT-EX-02 (mechanical)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RAYSTAT-EX-03 (electronic)</td>
</tr>
<tr>
<td>Model</td>
<td>Description</td>
<td>Sensor Type</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>RAYSTAT-ECO-10</td>
<td>Proportional ambient sensing controller for use in non-hazardous areas</td>
<td>3-wire RTD (Pt 100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-CONTROL-10</td>
<td>Electronic surface sensing thermostat for use in non-hazardous areas</td>
<td>3-wire RTD (Pt 100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT-TS-13</td>
<td>Electronic ambient sensing thermostat for use in non-hazardous areas</td>
<td>PTC KTY 83-110</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT-TS-14</td>
<td>Electronic surface sensing thermostat for use in non-hazardous areas</td>
<td>PTC KTY 83-110</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-EX-02</td>
<td>Mechanical surface sensing thermostat for use in hazardous areas</td>
<td>Bulb and capillary</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-EX-03</td>
<td>Electronic surface sensing thermostat for use in hazardous areas</td>
<td>2 wire RTD (Pt 100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-EX-04</td>
<td>Electronic ambient sensing thermostat for use in hazardous areas</td>
<td>PTC KTY 83-110</td>
</tr>
</tbody>
</table>
Control and Monitoring products

In addition to products in this document, Tyco Thermal Controls also offers control & monitoring units ranging from single up to hundreds of circuits. For further information, refer to the Product Catalogue for Industrial Heat-Tracing Systems, visit our website (www.tycothermal.com) or contact your Tyco Thermal Controls representative.

Stainless steel support brackets

Support brackets are used to fix equipment such as thermostats or junction boxes on pipes. Support brackets require additional pipe straps which are to be ordered separately. They include a set of M6 and/or M4 fixing screws, nuts, washers and spring lock washers for the fixation of one junction box or thermostat. The table below outlines the typical compatibility of each bracket with relevant equipment, for other equipment please contact your Tyco Thermal Controls representative.

<table>
<thead>
<tr>
<th>SB-100</th>
<th>SB-101</th>
<th>SB-110</th>
<th>SB-111</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT-TS-13</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>AT-TS-14</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>JBU-100-E</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>JBU-100-EP</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-CONTROL-10</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-ECO-10</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-EX-02</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>RAYSTAT-EX-03</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>RAYSTAT-EX-04</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Technical data

- **plate size (mm)** X x Y: 160 x 230 160 x 160 130 x 130 130 x 130
- **distance pipe-plate (mm)**: 100 160 100 100
- **number of pipe straps required**: 2 2 1 2
- **Part number**: 192932-000 990944-000 707366-0000 579796-000
Pipe straps

Are used for fixing components. Select the appropriate pipe strap (stainless steel) according to the pipe diameter. For JBS-100, JBM-100, E-100, E-100-L, T-100 and IEK-25-PIPE, add 25 mm to the pipe diameter.

<table>
<thead>
<tr>
<th>Pipe outer diameter in mm (inches)</th>
<th>Pipe strap</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-47 (1/2” - 1 1/4”)</td>
<td>PSE-047</td>
<td>700333-000</td>
</tr>
<tr>
<td>40-90 (1 1/4” - 3”)</td>
<td>PSE-090</td>
<td>976935-000</td>
</tr>
<tr>
<td>60-288 (2” - 10”)</td>
<td>PSE-280</td>
<td>664475-000</td>
</tr>
<tr>
<td>60-540 (2” - 20”)</td>
<td>PSE-540</td>
<td>364489-000</td>
</tr>
</tbody>
</table>

Warning labels

Warning labels indicate the presence of electrical heat-tracing under the insulation of the pipe or other equipment. (min. of 1 label per 5 m of heat-tracing line).

<table>
<thead>
<tr>
<th>Language</th>
<th>Label reference</th>
<th>PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatian</td>
<td>LAB-ETL-HR</td>
<td>938764-000</td>
</tr>
<tr>
<td>Czech</td>
<td>LAB-ETL-CZ</td>
<td>731605-000</td>
</tr>
<tr>
<td>Danish</td>
<td>LAB-ETL-DK</td>
<td>C97690-000</td>
</tr>
<tr>
<td>Dutch</td>
<td>LAB-I-23</td>
<td>749153-000</td>
</tr>
<tr>
<td>English</td>
<td>LAB-I-01</td>
<td>938-947-000</td>
</tr>
<tr>
<td>Finnish</td>
<td>LAB-ETL-SF</td>
<td>756479-000</td>
</tr>
<tr>
<td>French</td>
<td>LAB-ETL-F</td>
<td>883061-000</td>
</tr>
<tr>
<td>German / French / Italian</td>
<td>LAB-ETL-CH</td>
<td>148648-000</td>
</tr>
<tr>
<td>German</td>
<td>LAB-ETL-G</td>
<td>597779-000</td>
</tr>
<tr>
<td>Hungarian</td>
<td>LAB-ETL-H</td>
<td>623725-000</td>
</tr>
<tr>
<td>Italian</td>
<td>LAB-ETL-I</td>
<td>C97688-000</td>
</tr>
<tr>
<td>Latvian</td>
<td>LAB-I-32</td>
<td>841822-000</td>
</tr>
<tr>
<td>Lithuanian</td>
<td>LAB-ETL-LIT</td>
<td>105300-000</td>
</tr>
<tr>
<td>Norwegian</td>
<td>LAB-ETL-N</td>
<td>C97689-000</td>
</tr>
<tr>
<td>Norwegian / English</td>
<td>LAB-ETL-NE</td>
<td>165899-000</td>
</tr>
<tr>
<td>Polish</td>
<td>LAB-ETL-PL</td>
<td>258203-000</td>
</tr>
<tr>
<td>Portuguese</td>
<td>LAB-ETL-POR</td>
<td>945960-000</td>
</tr>
<tr>
<td>Romanian</td>
<td>LAB-ETL-RO</td>
<td>902104-000</td>
</tr>
<tr>
<td>Russian</td>
<td>LAB-ETL-R</td>
<td>574738-000</td>
</tr>
<tr>
<td>Slovenian</td>
<td>LAB-ETL-SLO</td>
<td>538156-000</td>
</tr>
<tr>
<td>Spanish</td>
<td>LAB-ETL-SPANISH</td>
<td>C97686-000</td>
</tr>
<tr>
<td>Swedish</td>
<td>LAB-ETL-S</td>
<td>691703-000</td>
</tr>
</tbody>
</table>

Thermostat kit

HWA-WAGO-TSTAT-KIT

Kit with supplementary terminals to connect thermostat type RAYSTAT-EX-02 to the junction boxes JBS, JBM and JBU.

The kit includes 2 terminals WAGO 284 series (1 x L, 1 x PE) and 1 power cable gland GL-36-M25.

Part number: 966659-000
Fixing tape

Select the tape according to the pipe material. Applied in 3 turns every 300 mm across heating cable. Determine the quantity from the table below.

\[
\text{Number of rolls} = \frac{\text{Total pipe length}}{\text{m of pipe per roll}}
\]

Add another 20% to allow for fixing the heating cable on valves, flanges, etc. if appropriate.

GT-66  
Standard glass cloth tape.  
For carbon steel pipes.  
20 m per roll.  
Part number: C77220-000

GS-54  
Glass cloth tape with low halogen content.  
For carbon and stainless steel pipes.  
16 m per roll.  
Part number: C77221-000

For the use of aluminium tape as heat transfer aid, use TraceCalc Pro or TraceCalc Net or consult your Tyco Thermal Controls representative.

<table>
<thead>
<tr>
<th>Pipe size mm</th>
<th>Ø inches</th>
<th>GT-66 m of pipe per roll</th>
<th>GS-54 m of pipe per roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1/4&quot;</td>
<td>46.5</td>
<td>37.2</td>
</tr>
<tr>
<td>15</td>
<td>1/2&quot;</td>
<td>29.9</td>
<td>23.9</td>
</tr>
<tr>
<td>20</td>
<td>3/4&quot;</td>
<td>23.8</td>
<td>19.1</td>
</tr>
<tr>
<td>25</td>
<td>1&quot;</td>
<td>19.1</td>
<td>15.2</td>
</tr>
<tr>
<td>32</td>
<td>1 1/4&quot;</td>
<td>15.1</td>
<td>12.1</td>
</tr>
<tr>
<td>40</td>
<td>1 1/2&quot;</td>
<td>13.2</td>
<td>10.5</td>
</tr>
<tr>
<td>50</td>
<td>2&quot;</td>
<td>10.6</td>
<td>8.4</td>
</tr>
<tr>
<td>65</td>
<td>2 1/2&quot;</td>
<td>8.7</td>
<td>7.0</td>
</tr>
<tr>
<td>80</td>
<td>3&quot;</td>
<td>7.2</td>
<td>5.7</td>
</tr>
<tr>
<td>100</td>
<td>4&quot;</td>
<td>5.6</td>
<td>4.5</td>
</tr>
<tr>
<td>150</td>
<td>6&quot;</td>
<td>3.8</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Protective grommet

G-02  
Protective grommet to protect the heating cable from mechanical damage (e.g. at a sharp edge). Supplied in 1 m sections, to be cut to length.  
Part number: 412549-000
## Glands

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Material</th>
<th>Use</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>GL-33</td>
<td>3/4” NPT cable gland (Ex d II C) for RAYSTAT-EX-02.</td>
<td>Nickel plated brass</td>
<td>For use with armoured power cables.</td>
<td>493217-000</td>
</tr>
<tr>
<td>GL-34</td>
<td>3/4” NPT cable gland (Ex d II C) for RAYSTAT-EX-02.</td>
<td>Nickel plated brass</td>
<td>For use with non-armoured power cables.</td>
<td>931945-000</td>
</tr>
<tr>
<td>GL-36-M25</td>
<td>M25 power cable gland (Ex e).</td>
<td>Polyamide</td>
<td>For use with non-armoured power cables with outer diameter range 8–17 mm.</td>
<td>774424-000</td>
</tr>
<tr>
<td></td>
<td>Spare part for JBS-100, JBM-100 and JBU-100.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GL-38-M25-METAL</td>
<td>M25 cable gland (Ex e II and Exd II C) for boxes with earth plate (EP).</td>
<td>Nickel plated brass</td>
<td>For use with armoured power cables.</td>
<td>056622-000</td>
</tr>
</tbody>
</table>

### Example

**Area classification:** Hazardous  
**Power cables, non-armoured**  
Pipe Ø: 50 mm  
Heating cable type: 8XTV2-CT-T3  
Heating cable length: 39 m

**Bill of materials**  
1 x JBS-100-E integrated power connection  
1 x T-100 T-connection  
2 x E-100 end seal kit  
8 x LAB-I-01 warning label  
5 x PSE-090 pipe strap  
4 x GT-56 fixing tape
<table>
<thead>
<tr>
<th>Ref. No</th>
<th>Diameter (mm)</th>
<th>Insulation thickness (mm)</th>
<th>Pipe length (m)</th>
<th>Pipe supports</th>
<th>Valves /Pumps etc...</th>
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