

## Design Guide Parallel Constant Wattage System BPL-AL for hazardous / industrial applications



### Design Guide

Parallel Constant Wattage System BPL-AL  
for pipes and vessels in hazardous locations  
with BARTEC Parallel Constant Wattage Cable BPL-AL

Origin Design Guide



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## Overview

This Design Guide covers the design and general installation of BARTEC Parallel Constant Wattage System BPL-AL for use in hazardous locations using the Parallel Constant Wattage Cable BPL-AL, hereinafter called trace heater:

- BARTEC BPL-AL (27-5875-\*)

A trace heater unit comprises the power termination, a trace heater and an end termination. The trace heater unit can be made of a single trace heater or multiple trace heaters connected by a splice or for a tee which are pre-determined by BARTEC.

The trace heating system consists of one or more trace heater units grouped by a common power termination; the junction box is pre-determined by BARTEC as Installation Enclosure for trace heating. Each trace heating system is associated with design and installation documentation.

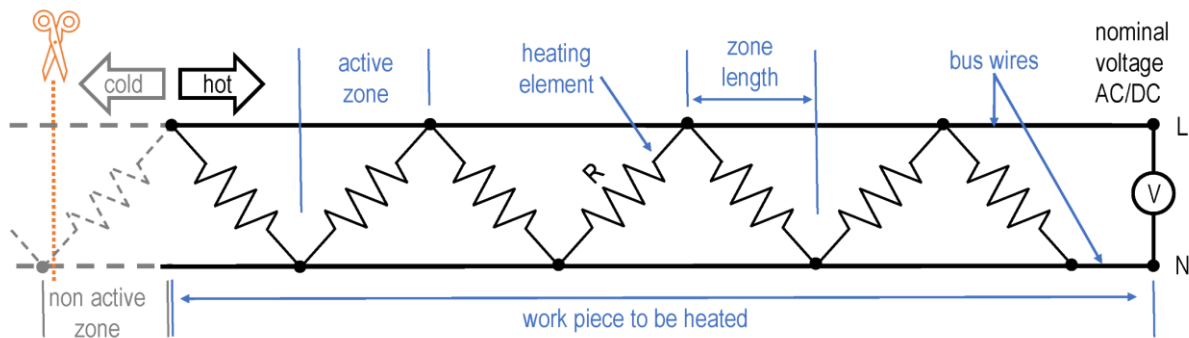
One or more trace heating systems can be merged by a common branch circuit to a heating circuit group with a joint over current device.

Optional components for temperature control or limitation and for annunciation can be included in the trace heating system.

Besides the components the system consists of rules for design and installation and its documentation.

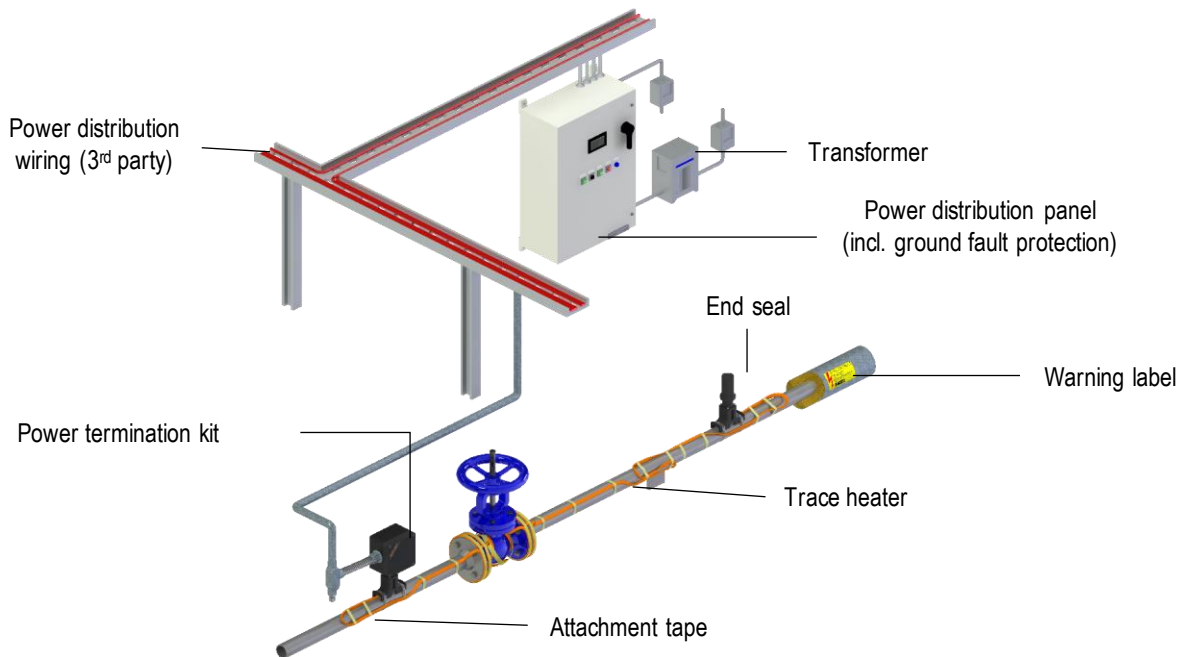
The trace heating system is available as **Stabilized design** (27-1P1S-\*\*\*\*\*) and **Controlled design** (27-1P1C-\*\*\*\*\*). For the Controlled design, otherwise optional components for temperature limitation and control in accordance with IEC 60079-0 become a necessity.

The Parallel Constant Wattage Cable BPL-AL comprises of two insulated parallel bus wires wrapped in a layer of mica and glass insulation tape. A heating wire is spirally wrapped around the insulation, which is notched at set intervals so that the heating wire connects with the bus wire underneath. Another layer of mica and glass tape insulation is wrapped over the heating wire. The insulation is coated with an aluminum outer jacket. Crossing or overlapping with other trace heaters are not possible.



The trace heaters are fixed equipment heating systems for pipes in ordinary and hazardous areas. Thanks to the parallel design the trace heater can be cut and installed to any required length, up to the Maximum heating circuit length as shown in this manual on page 6).

Multiple options for connection, splicing and end termination of the heating circuit are available to meet the individual requirements on site. A large variety of accessories allows for easy customization and extensibility. The following illustration shows a typical electric trace heating system. For better understanding the Parallel Constant Wattage Cable BPL-AL is shown in orange color.



## Applications

The Parallel Constant Wattage System BPL-AL is meant for fixed installation in hazardous areas with explosive gas, vapour 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.

## Certifications / Approvals / Marking



IECEX CSAE 24.0015X  
CSANe 24ATEX1086X

### BARTEC Parallel Constant Wattage System BPL-AL

IECEX CSAE 24.0015X  
CSANe 24ATEX1086X

Ex 60079-30-1 eb IIC T6...T1 Gb  
Ex 60079-30-1 tb IIIC T85°C...T450°C Db

## Safety

### ⚠ WARNING

Risk of fire or electrical shock due to electric trace heating system. Follow these guidelines to avoid personal injury or material damage.

### ⚠ CAUTION

Danger of burning due to electric 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 enclosure. Allow the enclosure to cool down.

### ⚠ WARNING

Risk of fire or electrical shock due to electric trace heating system.  
Risk of lost explosion protection.  
After opening the enclosure, check that the enclosure sealing is in good condition. Ensure that the enclosure sealing is elastic and free of cracks. If the enclosure sealing is damaged, contact BARTEC GmbH.

### ⚠ CAUTION

The trace heating system is only applicable in case of workpiece temperature is higher than the layout ambient temperature.

For safe installation and operation of BARTEC Parallel Constant Wattage System BPL-AL 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 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 BARTEC Parallel Constant Wattage Cable BPL-AL 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 trace heating system.

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 Design Guide.

### Applicable Documents

Storage conditions 21-0000-7Q0001

corresponding manuals of the installed products or products to be used

## Intended use

BARTEC Parallel Constant Wattage Cable type

- BARTEC BPL-AL (27-5875-\*)

can be used to create Parallel Constant Wattage System BPL-AL in combination with BARTEC splice kits and junction boxes as follows:

- Installation Enclosures types PBS-310-\* and PBM-310-\*
- Cold applied connection kits types CAK-PLH-\*

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
- respect to the maximum heating circuit length
- installed earth fault equipment protection and overcurrent protection for each branch circuit

The approval and marking of the respective heating system, the technical data of the Parallel Constant Wattage Cable BPL-AL 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.

Supply cables and power cable entry glands shall be selected per manufacturer's installation instructions for appropriate conductor size and temperature range (see chapter "Checklist customized entry port").

In case of the workpiece temperature does exceed 350°C, the Heating System must be de-energized by end user's apparatus.

## Specific Conditions of Use

- When the trace heating cable is installed on a workpiece that has a temperature above 190°C, the termination devices shall be positioned outside the insulation, and the user/installer shall ensure that they are not exposed to UV radiation.

- The end user shall ensure that a Suitably Certified Ex Equipment Cable Gland is used as part of the supply cable installation.
- The equipment shall be installed with the trace heating cables positioned vertically (downwards).
- Supply cables and power cable entry glands shall be selected per manufacturer's installation instructions for appropriate conductor size and temperature range.
- The end user shall ensure that the workpiece temperature does not exceed 350°C (energized) and 500°C (de-energized).
- The Temperature Limiter required for Controlled Design must be Ex Certified against the requirements of EN 60079-30-1:2017 Clause 4.5.3. The limiter shall be suitably rated based on the temperature requirements of the BPL-System, which can be found in this document.

## Foreseeable Misuse

The following activities are a misuse of the product and are not allowed:

- Use of the Parallel Constant Wattage Cable BPL-AL 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 Parallel Constant Wattage Cable BPL-AL or the Parallel Constant Wattage System BPL-AL
- Commissioning of damaged or faulty system components or incomplete installation.
- Recommissioning after dismantling the heating grommet without replacing the heating grommet.
- Use of heating cable glands other than those delivered with the product or listed in chapter "Spare parts"
- 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.

## Personal Qualification

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

## Technical data

### Trace heater

#### BPL-AL

<b>Max. continuous operating temperature, energized</b>	+350 °C
<b>Max. continuous exposure temperature, de-energized</b>	+500 °C
<b>Min. start-up temperature</b>	-40 °C
<b>Min. installation temperature</b>	-40 °C
<b>Power Output<sup>1</sup></b>	10, 15, 30, 50, 70, 100, 150, 200 W/m
<b>Nominal voltage</b>	110 V to 120 Vac / 208 V to 277 Vac
<b>Min. bending radius</b>	50 mm (Do not bend on the narrow axis.)
<b>Cable weight</b>	16.5 kg/100 m
<b>Heater dimensions</b>	10.7 x 7.7 mm
<b>Temperature classes</b>	T1, T2, T3, T4, T5, T6
<b>Protection classification IECEx</b>	Ex 60079-30-1 IIC T6...T1 Gb Ex 60079-30-1 IIIC T85°C...T450°C Db

### Maximum pipe / workpiece temperature<sup>2</sup>

The following table shows the maximum workpiece temperature in °C in order to maintain a set temperature class by Stabilized design for every type of Parallel Constant Wattage Cable BPL-AL.

Table 1:

	Power output W/m	Max. surface temperature at heating cable					
		T6 85 °C	T5 100 °C	T4 135 °C	T3 200 °C	T2 300 °C	T1 450 °C
maximum workpiece temperature in °C							
<b>3BPL*-AL</b>	10	34 °C	50 °C	100 °C	188 °C	290 °C	340 °C
<b>5BPL*-AL</b>	15	-	36 °C	71 °C	160 °C	289 °C	350 °C
<b>10BPL*-AL</b>	30	-	11 °C	28 °C	100 °C	246 °C	323 °C
<b>15BPL*-AL</b>	50	-	-	-	39 °C	178 °C	276 °C
<b>20BPL*-AL</b>	70	-	-	-	-	48 °C	140 °C
<b>30BPL*-AL</b>	100	-	-	-	-	48 °C	140 °C
<b>45BPL*-AL</b>	150	-	-	-	-	-	36 °C
<b>60BPL*-AL</b>	200	-	-	-	-	-	7 °C
max. operating current		16 A	16 A	19 A	19 A	19 A	19 A

Note for Controlled design:

For controlled design, a limiter must be used that is certified according to EN 60079-0. The limiter must be installed as described in section *Installation of the Limiter, Temperature Sensor (Controlled Design)* on page 17. The Offset of the Limiter is 0 K to the values listed in this table.

<sup>1</sup> nominal heat output at 10 °C

<sup>2</sup> Applies for 230 V, for 277 V applications contact your local BARTEC representative for assistance. Surface temperature limits in accordance with IEC 60079-0.

## Maximum heating circuit length

The following table shows the maximum circuit lengths in Meter (m) for the different types of Parallel Constant Wattage Cable BPL-AL with standard circuit breaker amperages. For breaker sizing see respective manual PBS or PBM depending on the product you use. Observe the applicable local electrical code. The values apply for a volt drop variation of max. 10 %.

Table 2:

	Power output W/m	Circuit length m	
		115 V	230 V
3BPL*-AL	10	120	240
5BPL*-AL	15	88	175
10BPL*-AL	30	55	115
15BPL*-AL	50	37	75
20BPL*-AL	70	31	54
30BPL*-AL	100	22	44
45BPL*-AL	150	14	29
60BPL*-AL	200	11	22

## Temperature class and specific min. service temperature

Temperature class and specific minimum service temperature are valid for supply cables and supply cable glands accordingly to the following table.

Table 3:

BPL	Minimum service temperature for supply cables and supply cable glands					
	T6	T5	T4	T3	T2	T1
T-class, Maximum surface temperature	85 °C	100 °C	135 °C	200 °C	300 °C	450 °C
Power supply cable	60 °C	75 °C	90 °C	95 °C	95 °C	95 °C
Power supply cable gland	50 °C	70 °C	75 °C	80 °C	80 °C	80 °C

## CAUTION

The trace heating system is only applicable in case of workpiece temperature is higher than the layout ambient temperature.

## WARNING

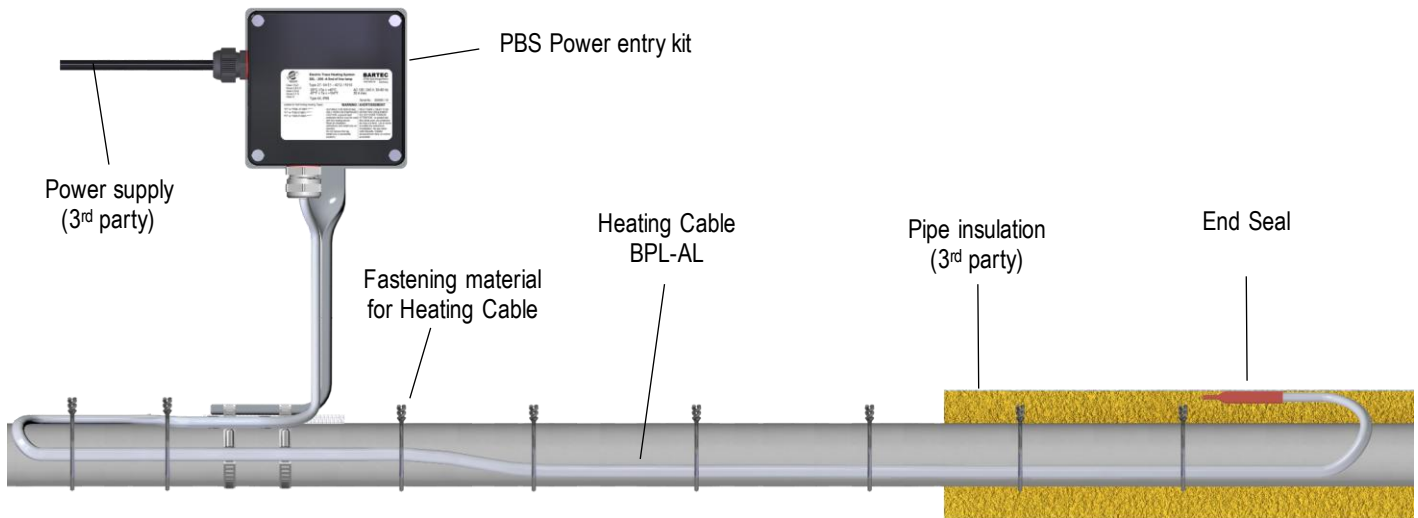
Risk of fire or electrical shock.

Risk of lost explosion protection.

The maximum Trace heater steady-state current is to be observed!


Protecting of all components of the Trace heater Installation Enclosure against over-heat is controlled by maximum Heating circuit length, depending on design parameters.

The following figure shows a sample heating circuit of PBS-310-E including typical components:



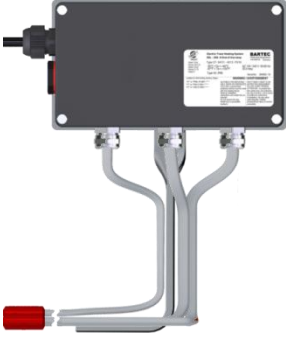
The following pages list compatible components for BARTEC Parallel Constant Wattage Cable BPL-AL in hazardous / industrial locations. The respective installation instructions are included in the scope of delivery of each product.

## Kind of Trace heaters

	<b>BPL-AL trace heater</b>	115 Vac				
		10 W/m	Catalog No.:	Order No.:	Part No.:	
 <p>Parallel Constant Wattage Cable for installation on pipes, tanks etc.</p> <p>Aluminium outer jacket</p> <p>Approved for Zone 1/21 and Zone 2/22 areas.</p> <p>See data sheet for full details.</p>	15 W/m	3BPL1-AL	-	27-5875-10107000		
	30 W/m	5BPL1-AL	432859	27-5875-10157000		
	50 W/m	10BPL1-AL	432860	27-5875-10307000		
	70 W/m	15BPL1-AL	432861	27-5875-10507000		
	100 W/m	20BPL1-AL	432862	27-5875-10707000		
	150 W/m	30BPL1-AL	-	27-5875-11007000		
	200 W/m	45BPL1-AL	-	27-5875-11507000		
		60BPL1-AL	-	27-5875-12007000		
			230 Vac			
		10 W/m	3BPL2-AL	-	27-5875-20107000	
		15 W/m	5BPL2-AL	432855	27-5875-20157000	
		30 W/m	10BPL2-AL	432856	27-5875-20307000	
		50 W/m	15BPL2-AL	432857	27-5875-20507000	
		70 W/m	20BPL2-AL	432858	27-5875-20707000	
		100 W/m	30BPL2-AL	-	27-5875-21007000	
		150 W/m	45BPL2-AL	-	27-5875-21507000	
		200 W/m	60BPL2-AL	-	27-5875-22007000	


## Power connection, splice and junction components


	<p><b>PBS-310-E/E10 Single power entry junction box</b></p> <p>For connection of a trace heater inside a junction box. Includes a mounting stand for off-pipe installation and a silicone end seal. The kit is approved for Zone 1/21 and Zone 2/22 areas.</p> <p><i>Maximum power conductor size:</i>                      PBS-310-E 6 mm<sup>2</sup>                      PBS-310-E10 10 mm<sup>2</sup></p> <p>2 pipe straps per stand required.                      For a complete list of kit contents and approvals see data sheet.</p>	<p><b>PBS-310-E:</b></p> <p>Catalog No.: PBS-310-E                      Part No.: 27-54P3-42111210</p> <p><b>PBS-310-E10:</b></p> <p>Catalog No.: PBS-310-E10                      Part No.: 27-54P3-43213B10</p>
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	<p><b>PBM-310-E/E10 Multiple power entry junction box</b></p> <p>For connection of up to 3 trace heaters inside a junction box. Includes a mounting stand for off-pipe installation and 3 silicone end seals. The kit is approved for Zone 1/21 and Zone 2/22 areas.</p> <p><i>Maximum power conductor size:</i>                      PBM-310-E 10 AWG (6 mm<sup>2</sup>)                      PBM-310-E10 6 AWG (10 mm<sup>2</sup>)</p> <p>2 pipe straps per stand required.                      For a complete list of kit contents and approvals see data sheet.</p>	<p><b>PBM-310-E:</b></p> <p>Catalog No.: PBM-310-E                      Part No.: 27-54P3-44311B10</p> <p><b>PBM-310-E10:</b></p> <p>Catalog No.: PBM-310-E10                      Part No.: 27-54P3-45313B10</p>
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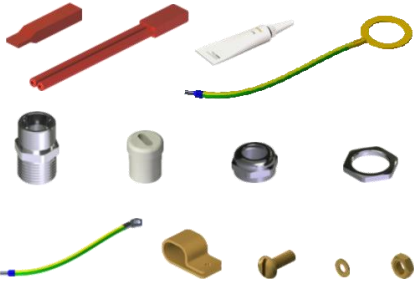
For Controlled design a suitable certified limiter is mandatory.

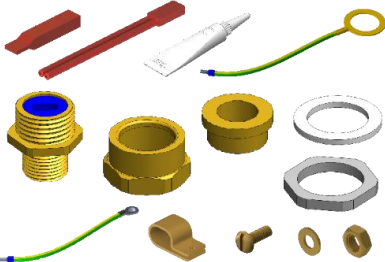
Recommended BARTEC type:

	<p><b>Digital temperature limiter DTL III Ex</b></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><i>More information in datasheet or manual.</i></p>	<p><i>Supply Voltage 24 V AC/DC:</i>            Catalog No.: DTL-3-Ex-24V            Part No.: 17-8865-4C2222003000</p> <p><i>Supply Voltage 100 V to 240 V AC:</i>            Catalog No.: DTL-3-Ex-240V            Part No.: 17-8865-472222003000</p>
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	<p><b>Resistance Temperature Device Pt100 Ex</b></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><i>More information in datasheet or manual.</i></p>	<p><i>More information and product configurations in datasheet or manual.</i></p>
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**Spare parts**

	<p><b>BPL cable gland kit and end seal</b></p> <p>spare parts kit for replacement of damaged or lost parts</p>	<p>Catalog No.: CAK-PLH            Part No.: 27-59CX-E3010001</p>
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	<p><b>BPL cable gland kit and end seal</b></p> <p>alternative spare parts kit with a different cable gland</p>	<p>Catalog No.: CAK-PLH-B            Part No.: 27-59CX-E7010001</p>
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**General Requirements**

The Parallel Constant Wattage System BPL-AL must be designed by BARTEC or BARTEC qualified personnel using the BARTEC software Heloc Pro.

**⚠ WARNING**

**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.**

**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 / Record of inspection (see page 32).

**⚠ WARNING**

**Risk of fire or electrical shock. Risk of lost explosion protection.**  
**The design data must be observed thoroughly and correctly.**

**Requirements for Controlled Design**

The controlled design of the Parallel Constant Wattage System BPL-AL 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 / Record of inspection (see page 32).

**⚠ WARNING**

**Risk of fire. Risk of lost explosion protection.**  
**The temperature offset of the limiter must be set in accordance with the design data.**

## Installation of Heating Cables on pipes and vessels

### Preparation

Before installing any Parallel Constant Wattage Cable BPL-AL, the person installing must check if the trace heating has been designed and planned correctly. It is particularly essential to verify the following points:

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

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

### Required tools / equipment

The following tools are required for the resistance measurement of the BARTEC Parallel Constant Wattage Cable BPL-AL described on the following pages:

- Wire cutters
- Insulation resistance meter with a minimum test voltage of 500 Vdc. BARTEC strongly recommends a test device with a test voltage of 1000 Vdc and 2500 Vdc.



The tools required for the installation and assembly of the heating cable and enclosures are listed in the respective installation instructions.

1

### Node location

Parallel Constant Wattage Cable BPL-AL use a heating element that is wound around the inner insulation. To ensure power supply, it alternately touches the bus wires at fixed intervals. These contact points are called nodes. They represent the limits of a heating zone.

The position of the nodes is marked by asterisks at the beginning of the product identification string: i.e. \*\*\*\* BARTEC © 5BPL1-AL ...



When the trace heater is cut within a heating zone, this zone will remain cold.



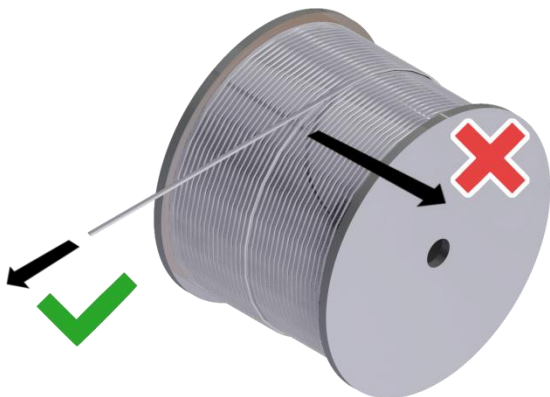
2

Unrolling the trace heater

**⚠ WARNING**

Risk of short circuit and/or material damage. Keep the trace heater ends dry before and during installation.

- Unroll the required trace heater in a straight line. Do not cut the trace heater yet.
- Do not bend or pinch the trace heater, or pull it over sharp edges.



3

- Before cutting the trace heater, measure the distance from the trace heater end to the first node marker.
- Note the measured distance.



If you cannot find the node markers, refer to section Alternate method for node location on page 21.

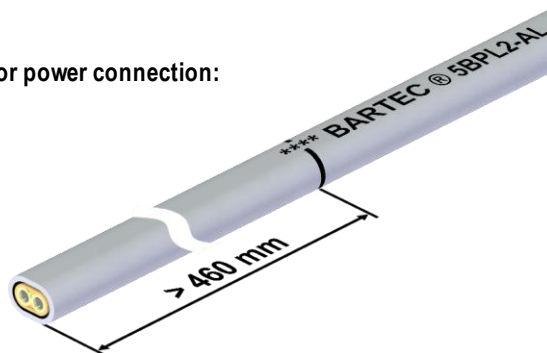
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- Make sure that the distance to the first node is:
  - at least 460 mm for the trace heater end facing towards the power connection equipment
  - at least 300 mm for the trace heater end facing towards the end seal

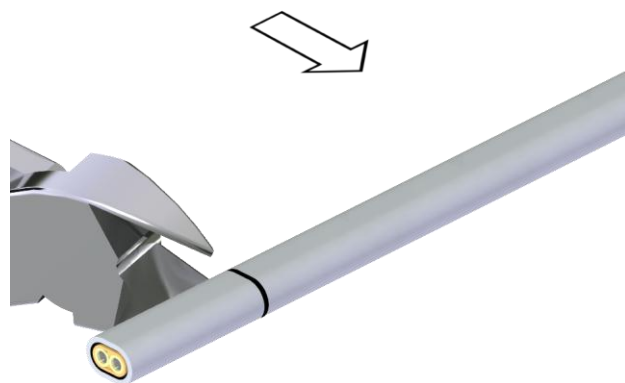
This ensures that the connection equipment will be protected from excessive heat.

- Cut off the trace heater ensuring a straight cut.

for power connection:



for end seal:



5

## Trace heater routing

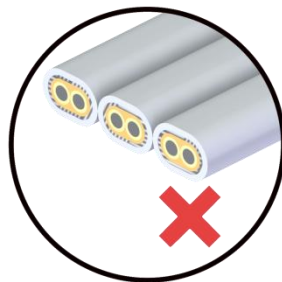
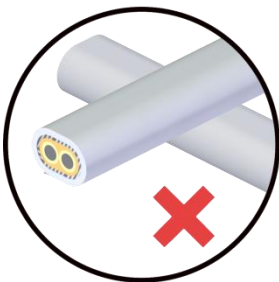
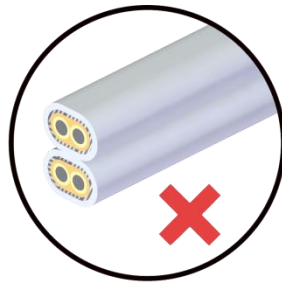
### WARNING

Risk of fire, injury and/or property damage. Observe the following instructions when routing BPL trace heaters.

- Install the trace heater in a straight line along the pipe. This saves time, helps to avoid installation mistakes and prevents damage to the trace heater during the thermal insulation work.

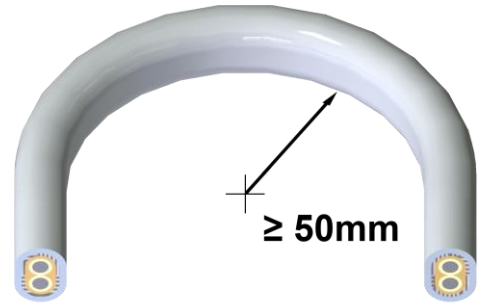


- Never step on or drive over the trace heater. Do not use it as a loop for stepping on.
- When installing allow for an additional length of trace heater for assembling splice connections, tee branches, end seals etc. (approx. 0.5 m for each).
- Do not cross, overlap, or group the trace heaters.



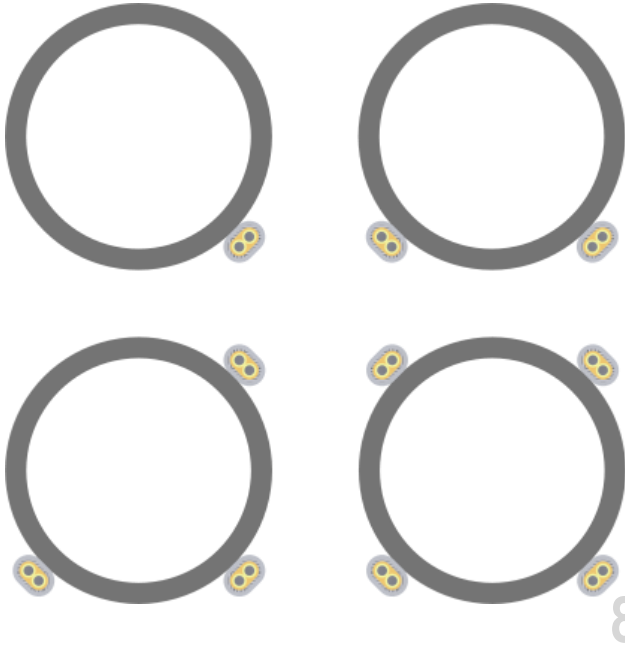
6

- When routing trace heaters on bends, observe the minimum bending radius of 50 mm.
- Do not bend the trace heater on the narrow axis.

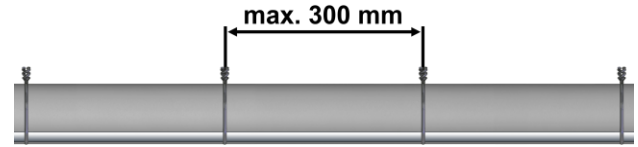


7

- Preferably install the trace heater in the lower half of the pipe. **but not on the lowest point.** This prevents mechanical damage and allows for better heat distribution.
- If you use multiple trace heaters, position them with an offset of 90°.
- Mount the mounting stand and junction box preferably on top of the workpiece, e.g. the pipe. If a different orientation of the junction box and mounting stand is necessary, there is a risk of water collecting in the mounting stand. Avoid water accumulation in the mounting stand!  
BARTEC recommends applying the pipe insulation immediately after installing the junction box and the mounting stand.



- Fasten the trace heater on the pipe at intervals of a maximum of 300 mm.
- Tighten the cable tie this way, so that the heating cable is fixed and no longer moves. Only tighten the cable tie so that the heating cable is not damaged.
- Visually inspect the cable for any damage such as sharp bends or cuts that may have occurred due to overtightening of the straps.



### NOTICE

In order to ensure good heat transfer the trace heater should have a flat, flush fit over the whole length. If necessary, reduce the distances between the fixing points.

#### Fastening

Select the correct fastening material:

- Always use fastener that suits the expected temperatures.
- Preferably use soft stainless tie wire or stainless steel bands.

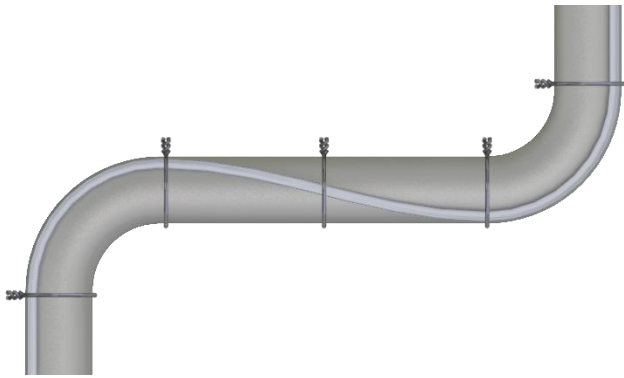


9

10

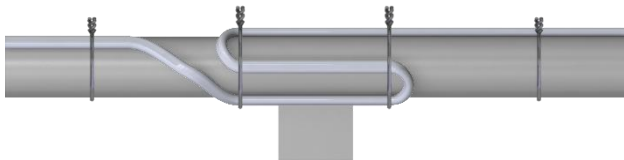
## Typical installation details

- Installation on bends:



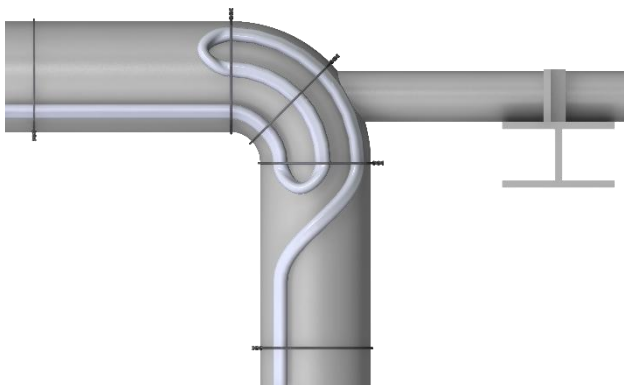
11

- Installation on pipe supports:



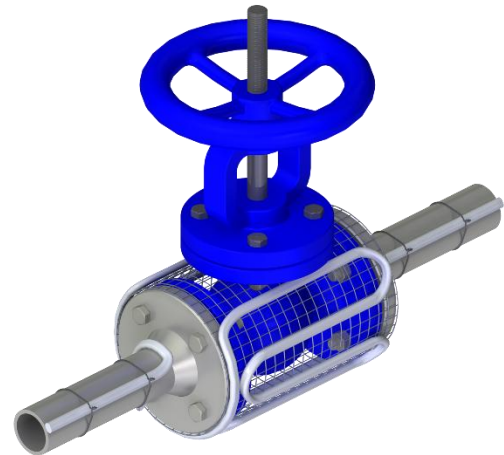
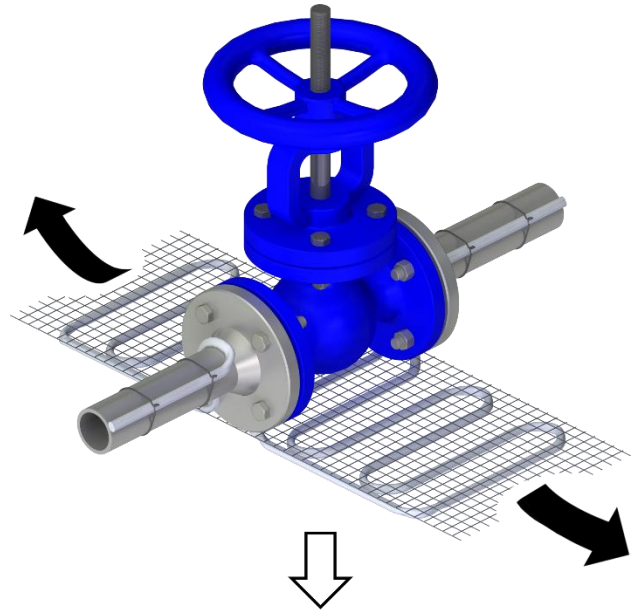
12

- Installation on dummy legs:



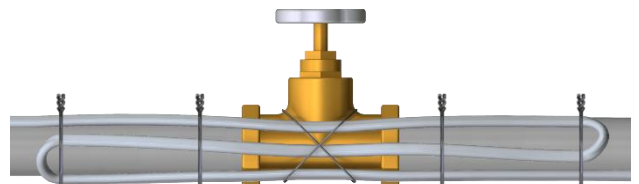
13

- Installation on flanged valves, mesh method (if DN > 100):



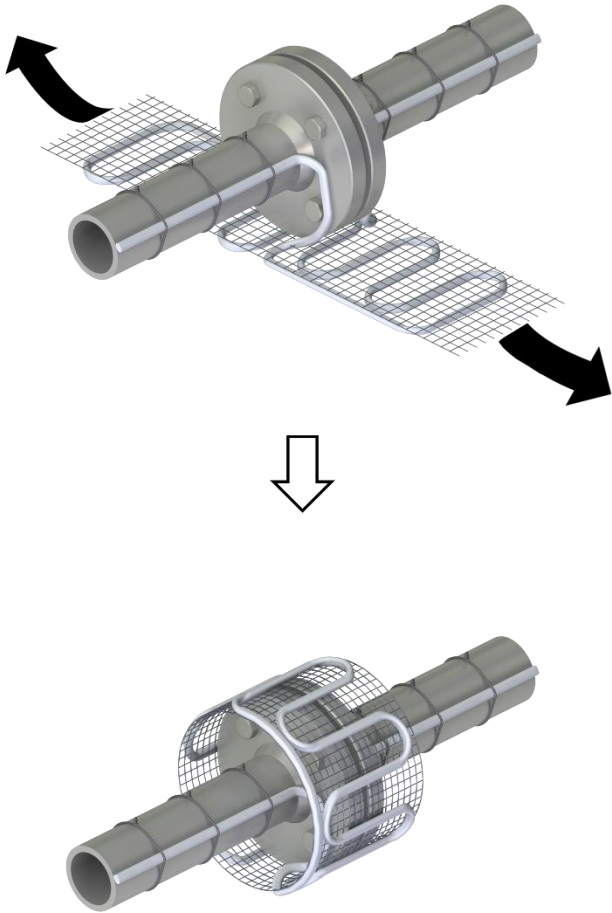
14

- Installation on welded valves, without mesh (if DN < 100):



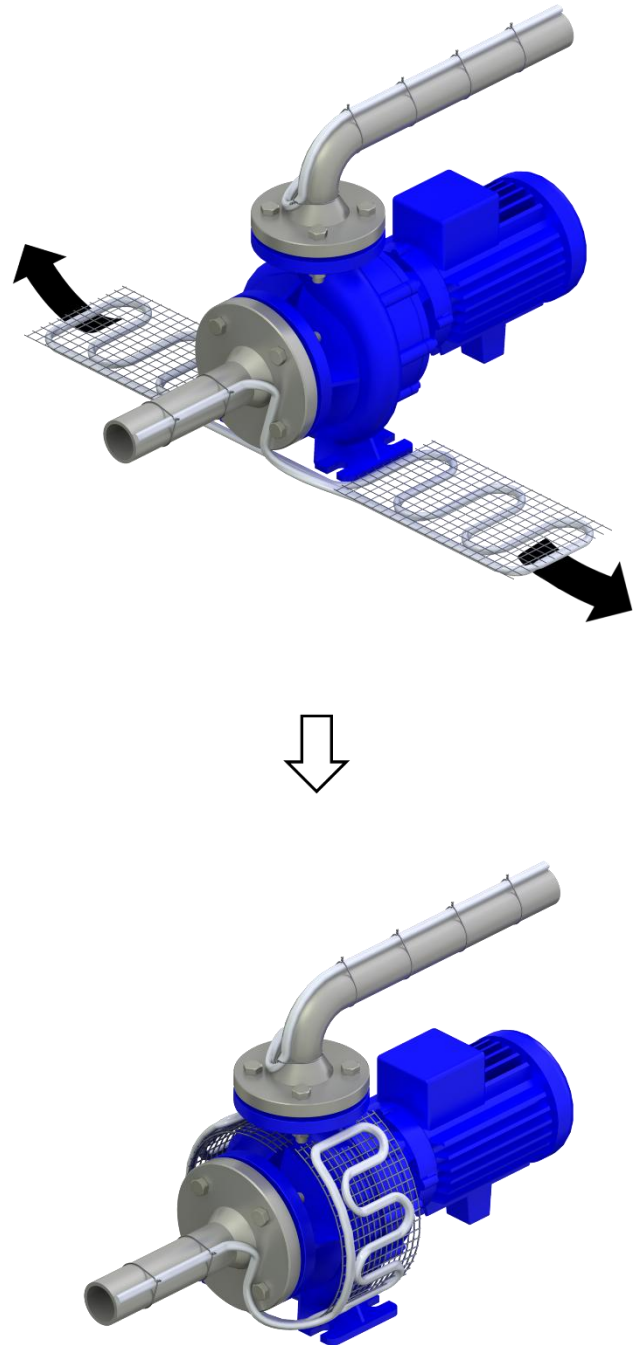
15

- Installation on flanges, mesh method (if DN > 150):



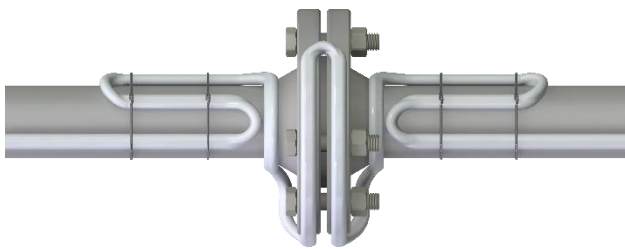
16

- Installation on pumps, mesh method:



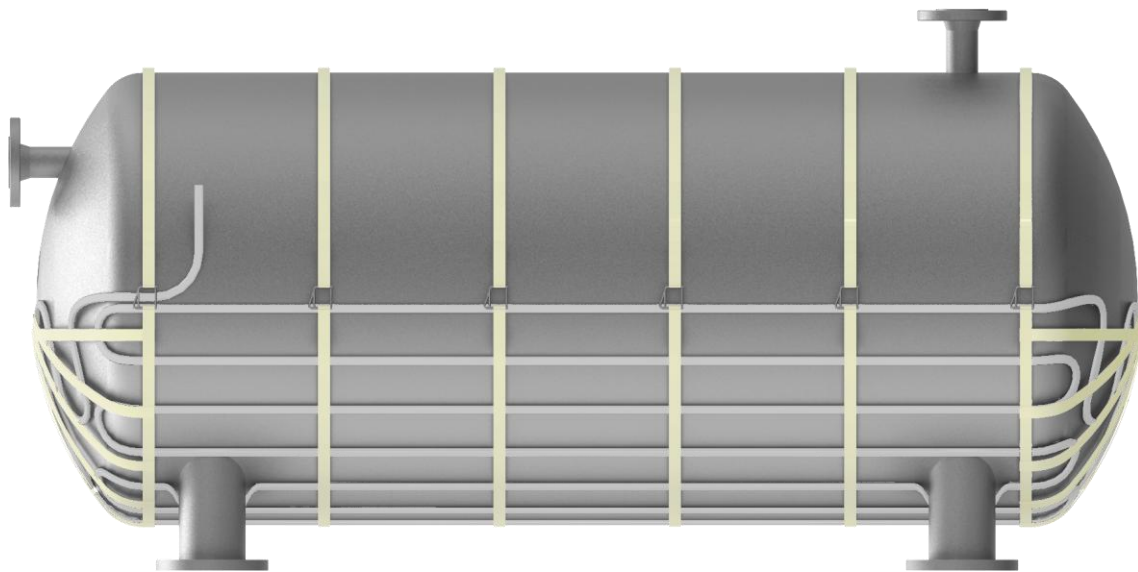
18

- Installation on flanges without mesh (DN ≤ 150):



17

The named installation instructions are also valid for the installation of BARTEC Parallel Constant Wattage Cable BPL-AL on vessels.



**Please note:**

- Use fastening materials suitable to the expected temperature range.
- Tighten the fastening material this way, so that the heating cable is fixed and no longer moves. Be sure not to damage the heating cable.
- Observe the shown bending radius. Do not bend on the narrow axis.

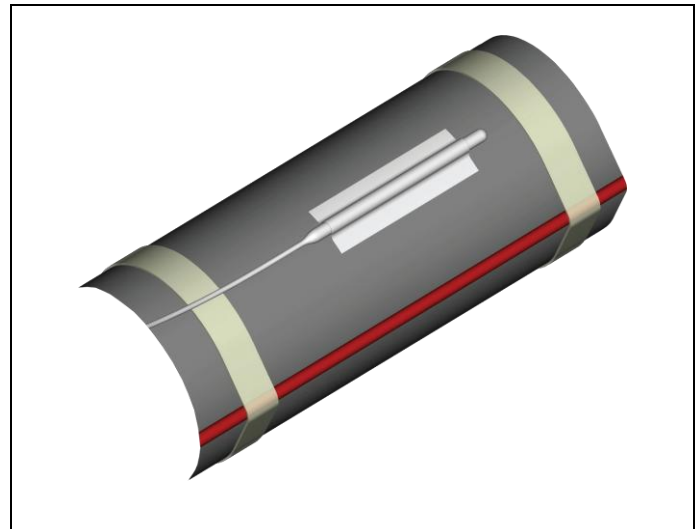
19

### Installation of the Limiter, Temperature Sensor (Controlled Design)

- Following mounting situation is 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.

▪ **Sensor mounted on the workpiece**

- The temperature sensor must be fixed on the workpiece with aluminium adhesive tape. See chapter Accessories in the manual of the product. Note the distance between heating cable and temperature sensor in the picture.
- BARTEC recommends a minimum distance of 20 mm between the heating cable and the temperature sensor to avoid interferences of the temperature sensor.
- The limiter offset for this mounting situation is 0 K to the workpiece temperature listed in table 1 in chapter *Maximum pipe / workpiece temperature* on page 5.



## WARNING

Risk of fire.  
 Risk of lost explosion protection.  
 The temperature offset of the limiter must be set in accordance with the design data.

## Tests and commissioning

### 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:

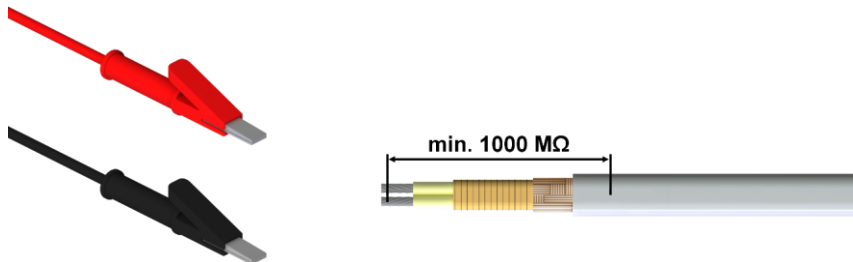
- Preliminary test (on the reel, before installation of the trace heater on the construction site; refer to chapter Acceptance report / Record of inspection)
- Acceptance test (after installation of the heating circuit and before installation of the thermal insulation; refer to chapter Acceptance report / Record of inspection)
- 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 minimum test voltage 500 Vdc. BARTEC strongly recommend a higher test voltage of 1000 Vdc and 2500 Vdc. Installation faults can be detected more reliably with a test voltage of 1000 Vdc and 2500 Vdc.

#### Measurement:

- Set the test voltage to 0 Vdc.
- Connect the negative (-) lead to the aluminum jacket of the trace heater.
- Connect the positive (+) lead to both trace heater bus wires simultaneously.
- Turn on the megohmmeter and set the voltage to 500 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 at 1000 Vdc and 2500 Vdc strongly recommended.



#### Results:

- Properly installed dry and clean trace heater sets should measure thousands of megohms, regardless of the trace heater length or measuring voltage (500 Vdc - 2500 Vdc). 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 MOhm. However, BARTEC strongly recommends a minimum reading of 1000 MOhm. If the reading is lower or fluctuating, refer to section Troubleshooting on page 33.
- 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 you must fix the heating circuit before putting it into operation.**

#### After the measurement:

If trace heater meets all resistance criteria:

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

## Acceptance test and acceptance test report

- 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 test report (refer to section *Acceptance report / Record of inspection* on page 32).

## NOTICE

**Claims under warranty will not be considered if the acceptance report is not filled in completely.**

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

## Commissioning

Each heat tracing system can only be put into operation if the following conditions are fulfilled:

- The acceptance test 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 are in working 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 (as indicated in design documentation) will be verified during commissioning.

## NOTICE

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

## Operation

During operation of the electric 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.

## 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](http://www.bartec.com)) 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 trace heater 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 heating system
- Acceptance reports
- Reports on repairwork and any operations carried out on the pipe- or vessel-system, trace heating system and thermal insulation
- Inspection reports

## Maintenance

### 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 trace heaters and cables, penetrated water or chemicals. If the thermal insulation is damaged the trace heater should be checked for possible damage.
- Damaged trace heaters 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 enclosure 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.

### 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 section Measurement of the insulation resistance on page 18.  
Upon completion of maintenance/repair/modification, the insulation resistance of the trace heater shall be measured and recorded after installation and shall not be less than 20 MOhm.

### Inspection intervals

- For frost protection installations 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.

### 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.

### Repairwork 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 heat tracing system is not damaged during repairwork on the pipes or insulation.
- After completion of the repairwork:
  - Make sure that any repaired heating circuits are properly installed and tested according to the project planning documentation.

## WARNING

Risk of fire or electrical shock due to damaged components. Remember that Parallel Constant Wattage Cable BPL-AL are designed to be installed only once.

- Carry out a visual, functional and electrical test (refer to section Tests and commissioning on page 18).
- 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.

### Disposal and Recycling

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

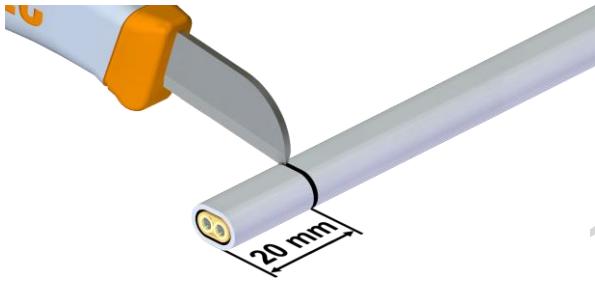


#### Disposal

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

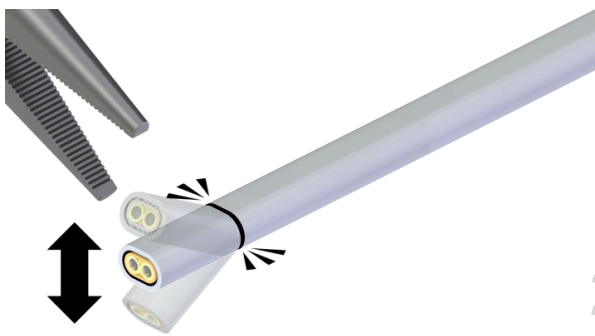
## Alternate method for node location

- Score around the aluminium jacket at 20 mm from the end of the trace heater.



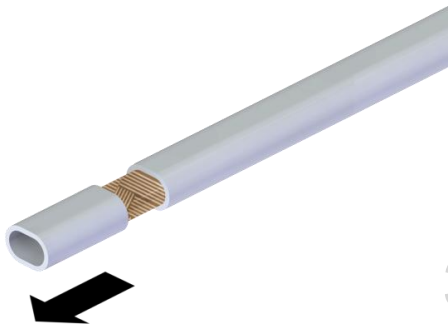
1

- Gently bend the aluminium jacket up and down at the scoring line using needle nose pliers until the aluminium jacket separates.



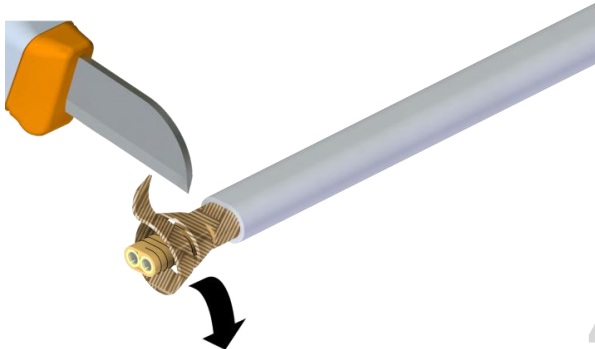
2

- Slide the aluminium jacket from the trace heater.



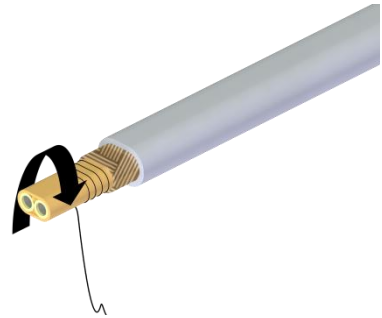
3

- Unwrap and cut off the outer insulation layer to expose the heating element.



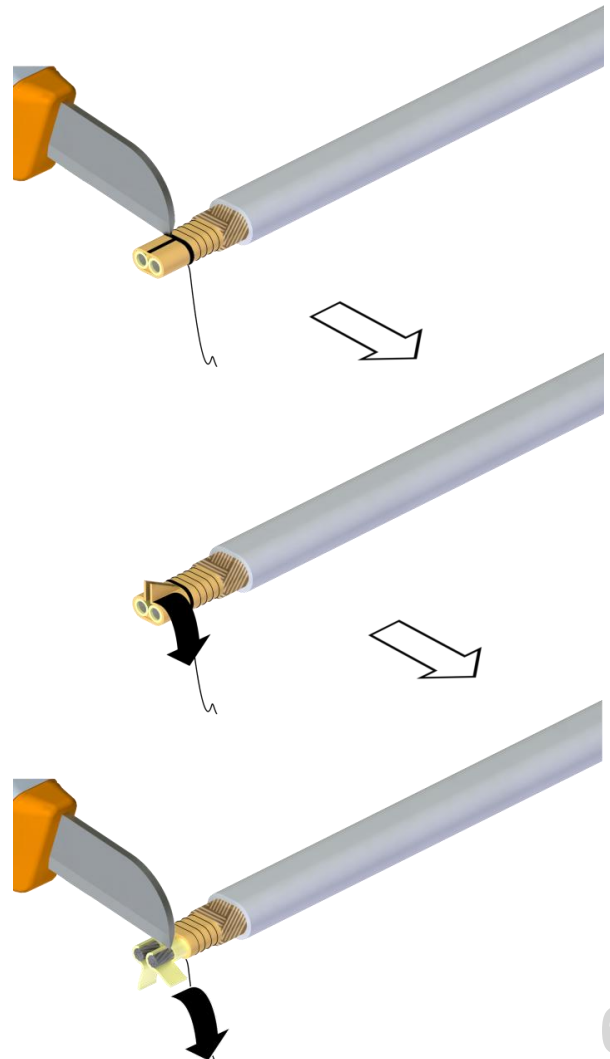
4

- Unravel 4-5 spirals of the heating element from around the inner insulation layer.



5

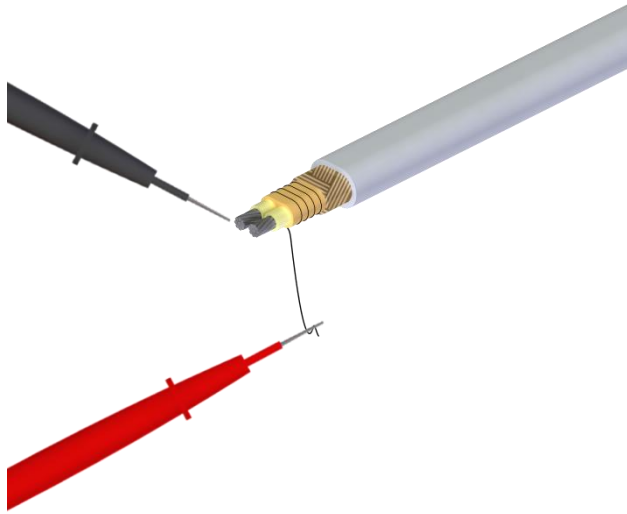
- Score around and along the middle of the bared inner insulation layer.
- Unwrap the inner insulation layer and bus wire insulation and cut it off to expose both bus wires.



6

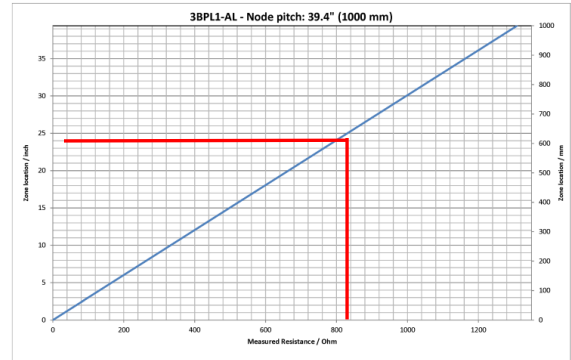
Alternate method for node location – only required if you cannot identify the node marker asterisks (\*\*\*\*) on the trace heater

- Using a standard multimeter, subsequently measure the resistance of each of the bus wires against the heating element.
- One of the 2 bus wires will display a much lower resistance.
- Note this lower reading.



7

- You can now determine the distance between the trace heater end and the next node by referring to the respective product chart.
- For the product charts see section Product charts for node location beginning on page 23.



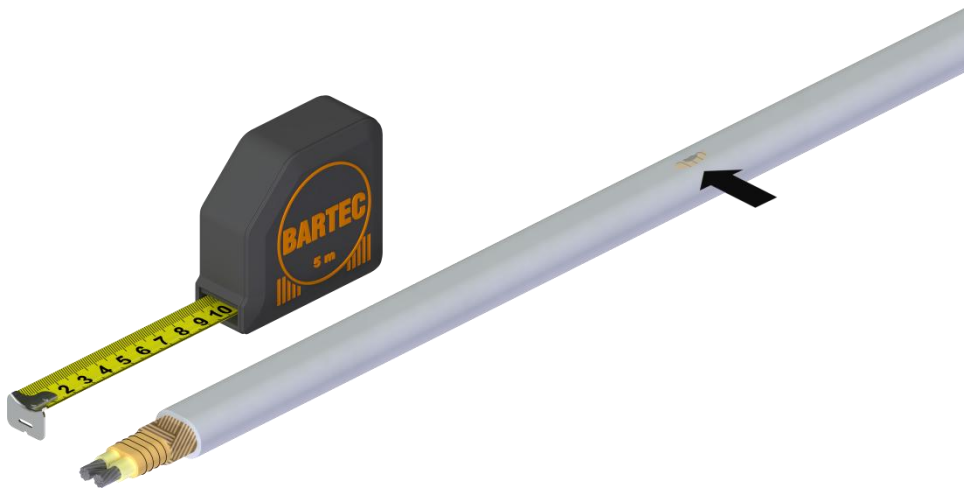
→ **Example**

- Measured resistance: **800 Ω**
- Trace heater type: **3BPL1-AL**
- Full node resistance: **1309 Ω**
- Node pitch: **1000 mm**

Distance to the next node:  $800 \Omega / 1309 \Omega \times 1000 \text{ mm} = 611 \text{ mm}$

8

- Using a tape measure, you can now locate the next node from the end of the trace heater.
- The distance between further nodes is the node pitch that you can also obtain in the product chart.

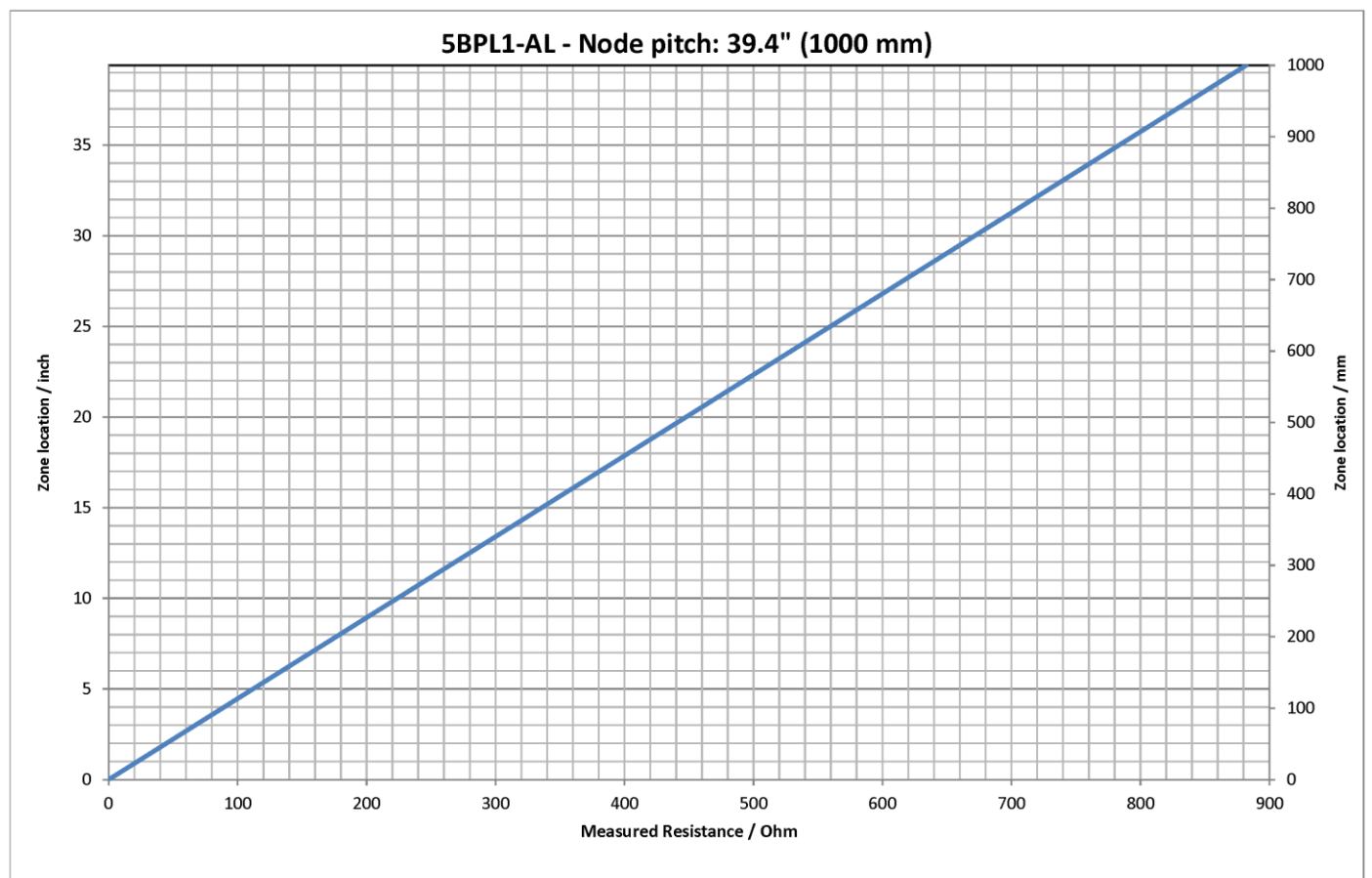
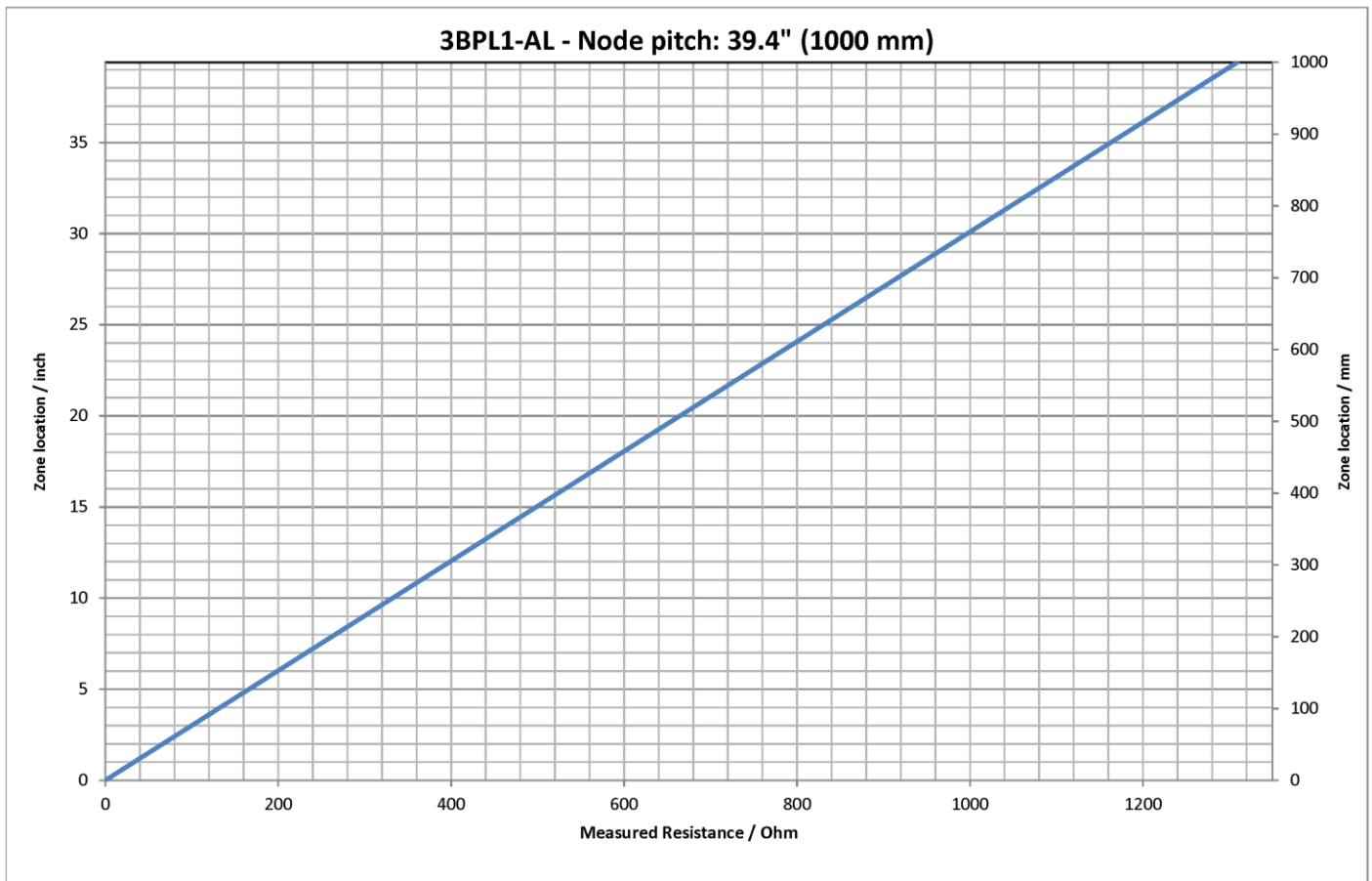


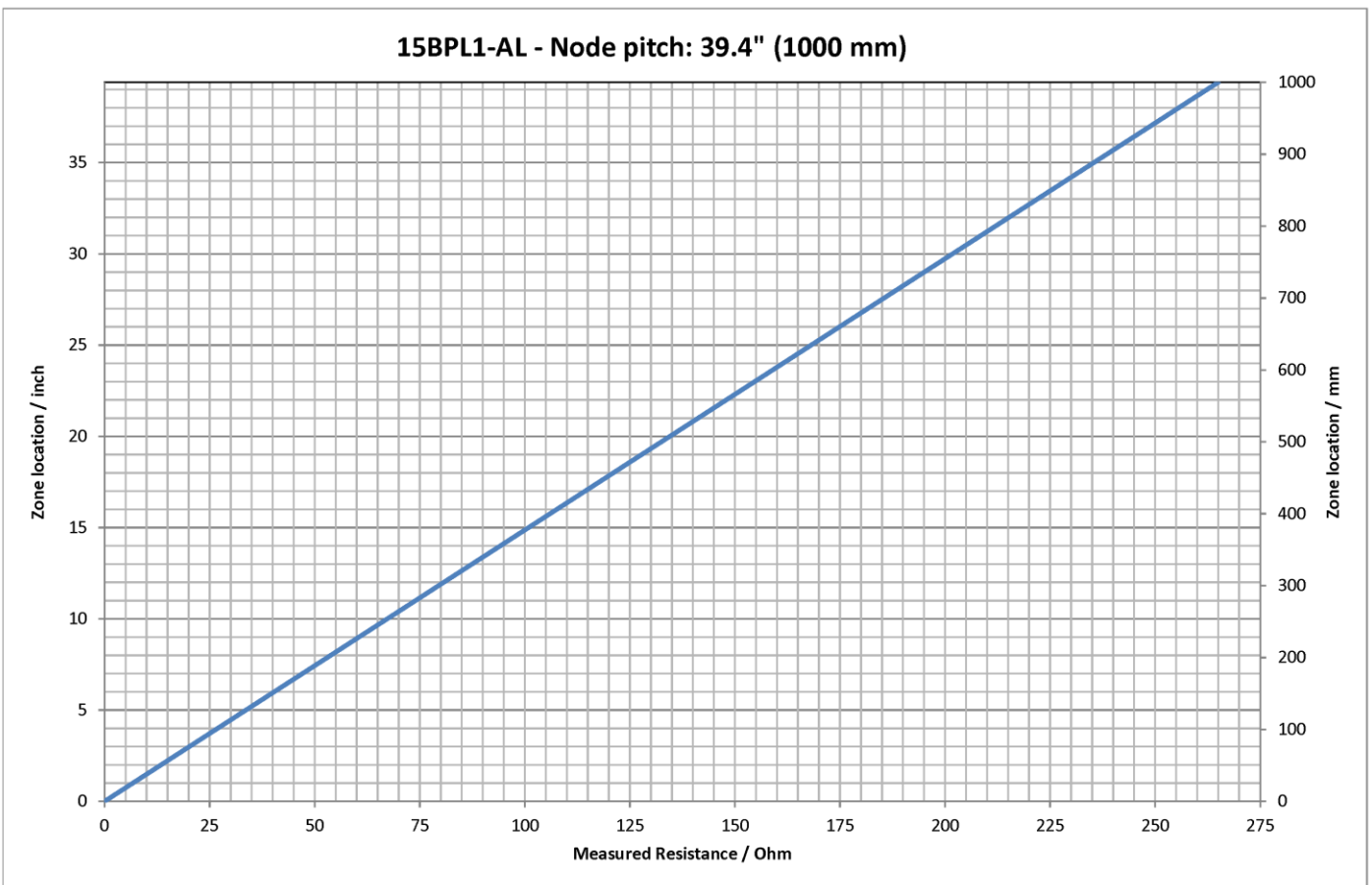
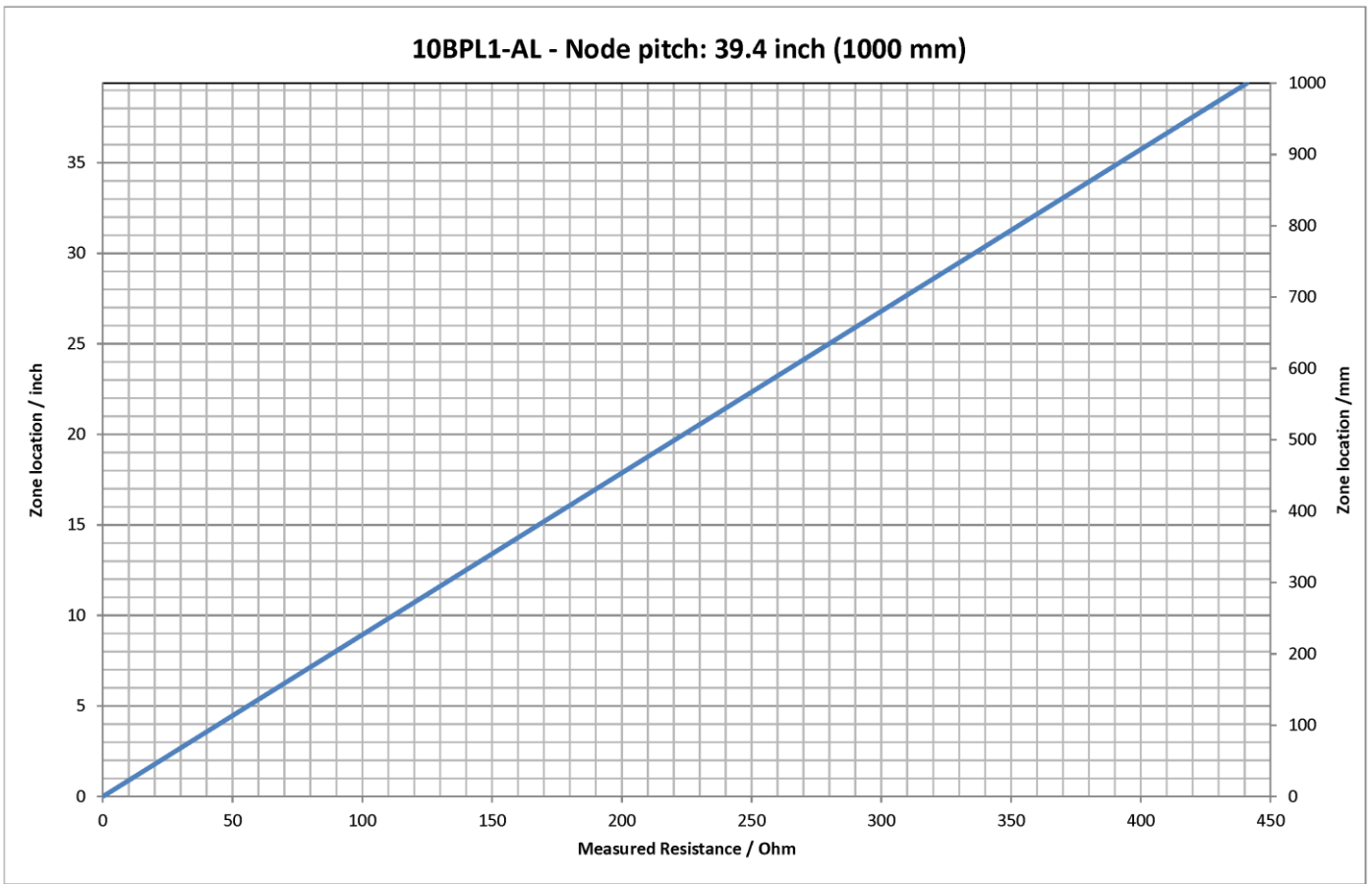
Once you have located the node position, you can refer to step 5 on page 12.

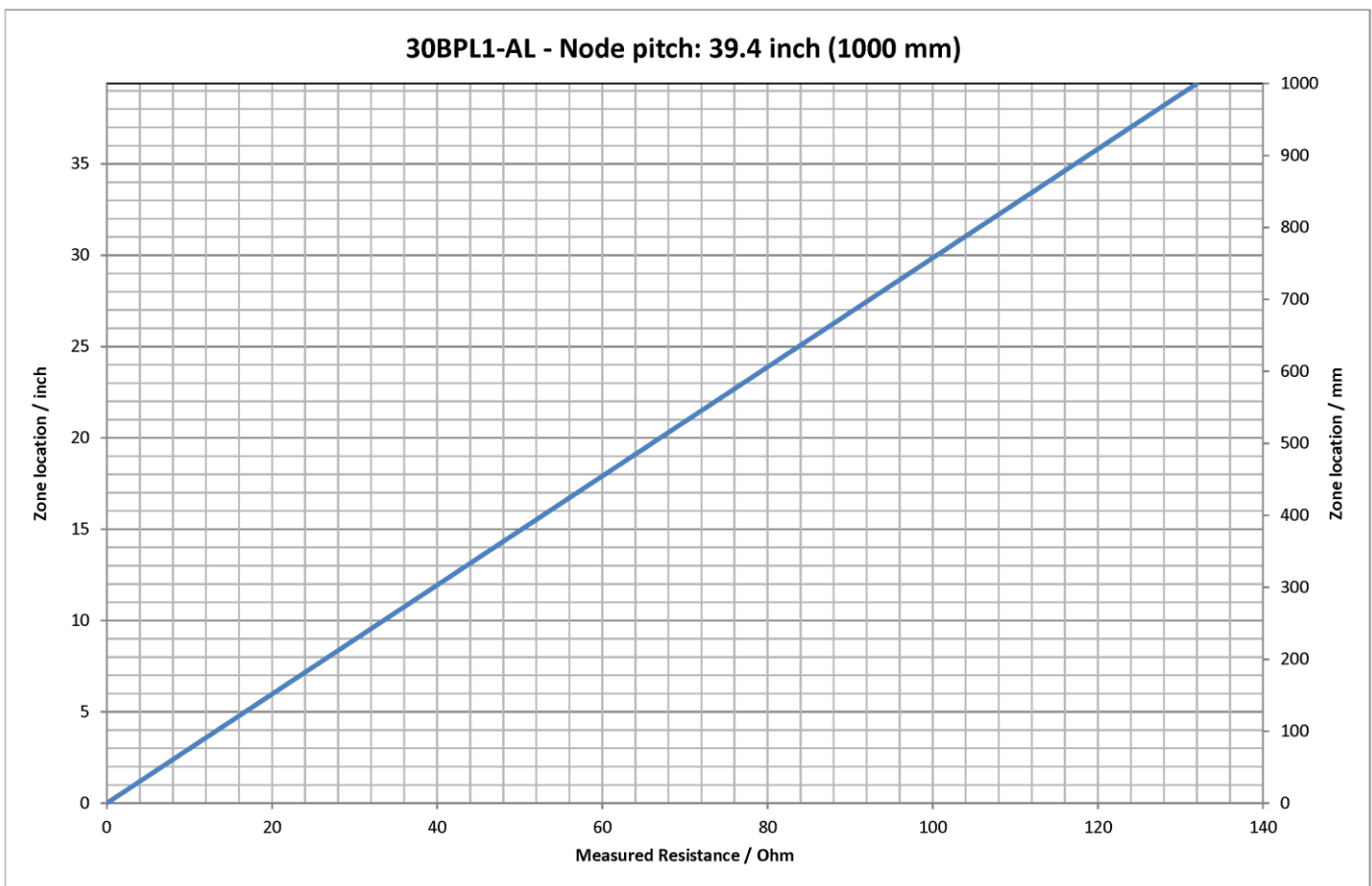
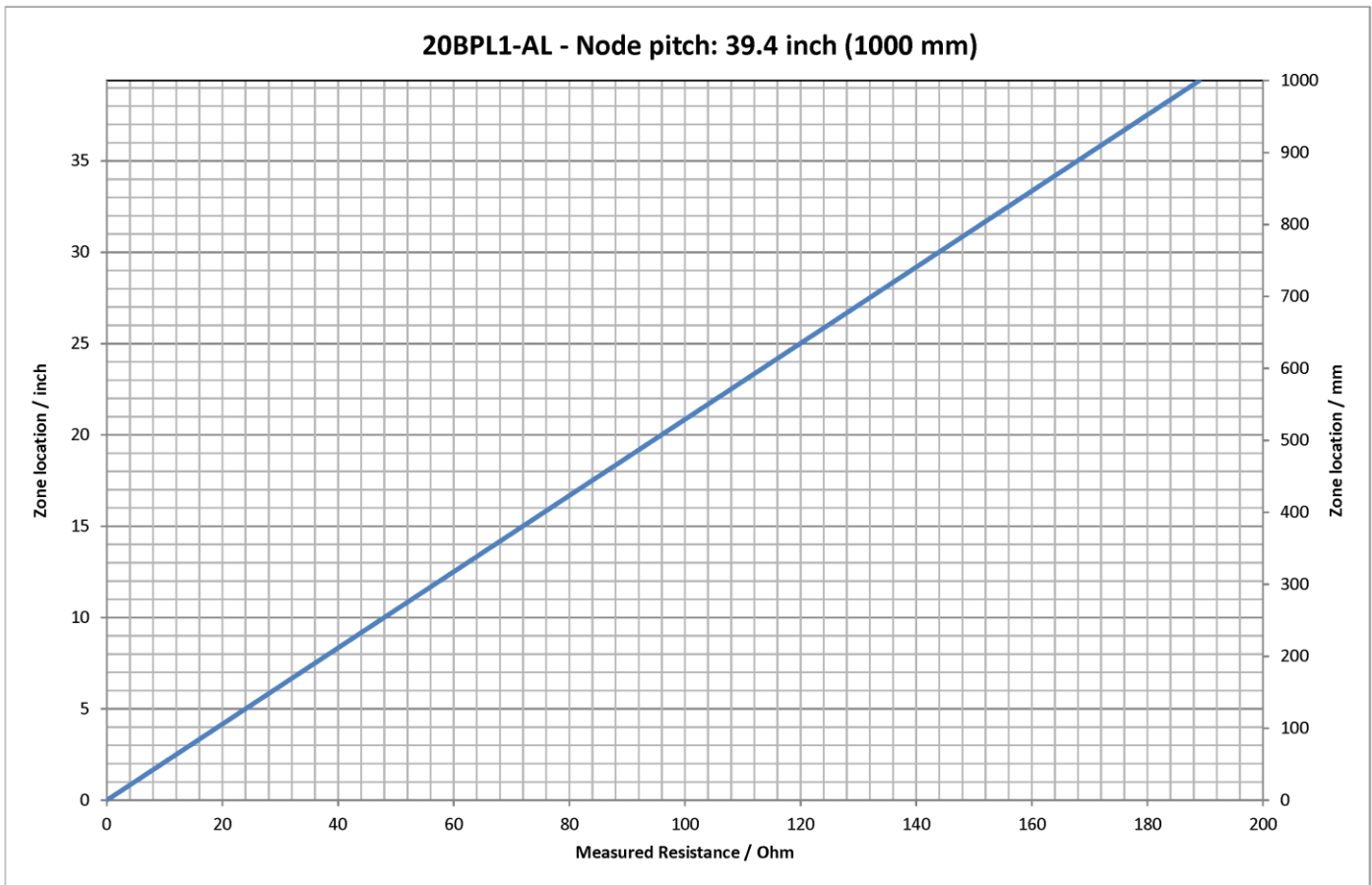
9

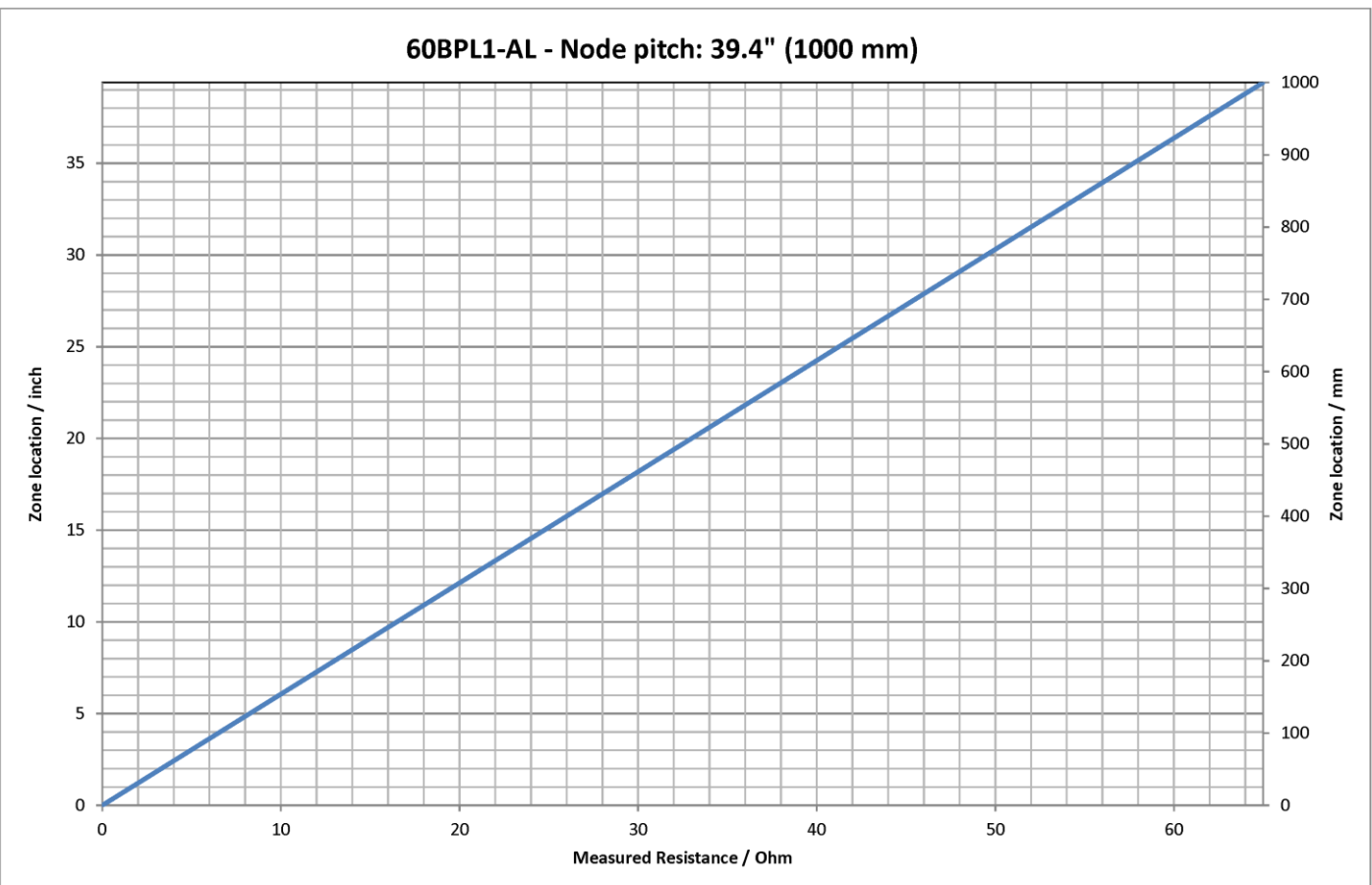
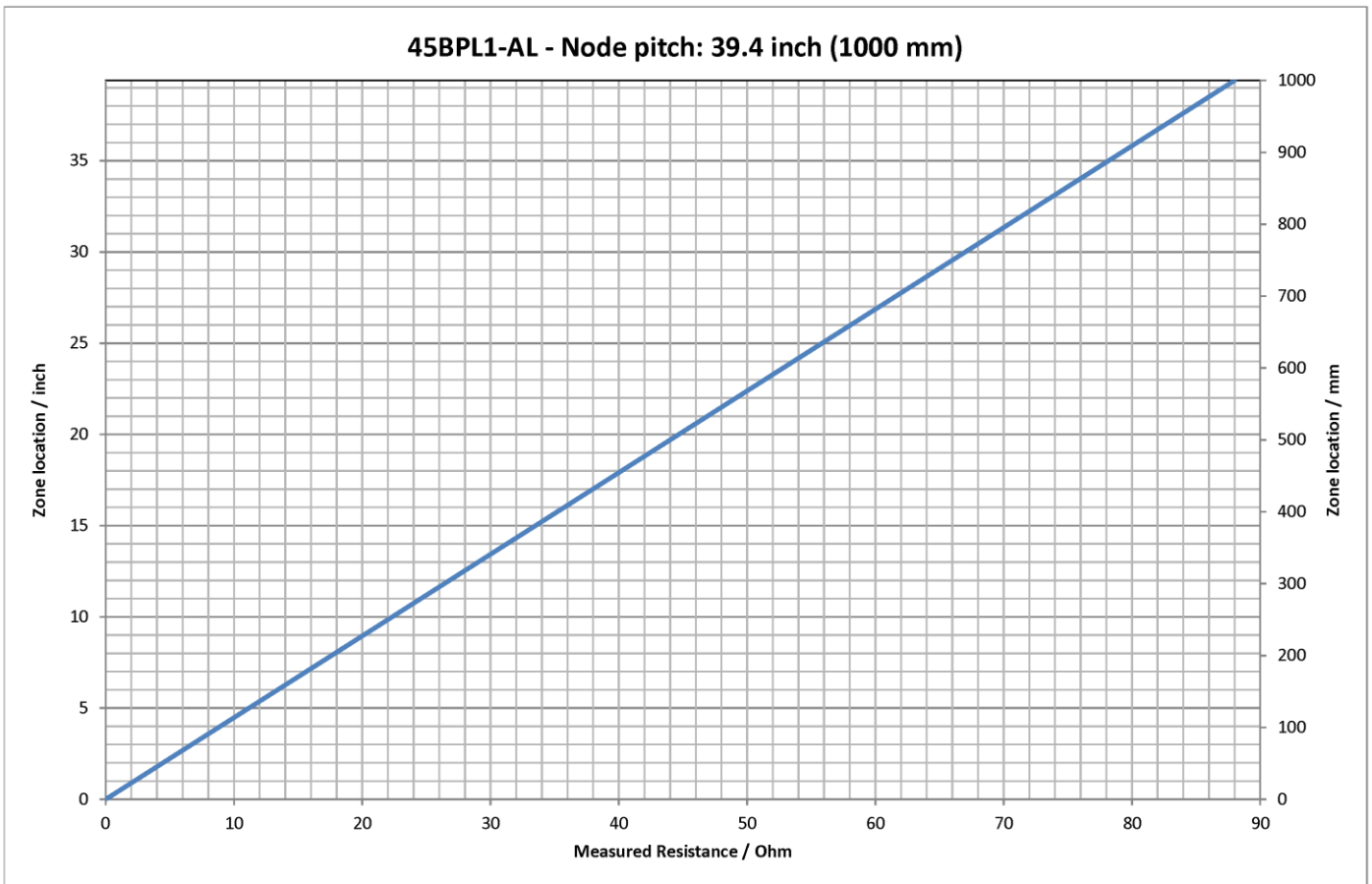
Alternative method for node location – only required if you cannot identify the node marker asterisks ( ) on the trace heater

**Product charts for node location**

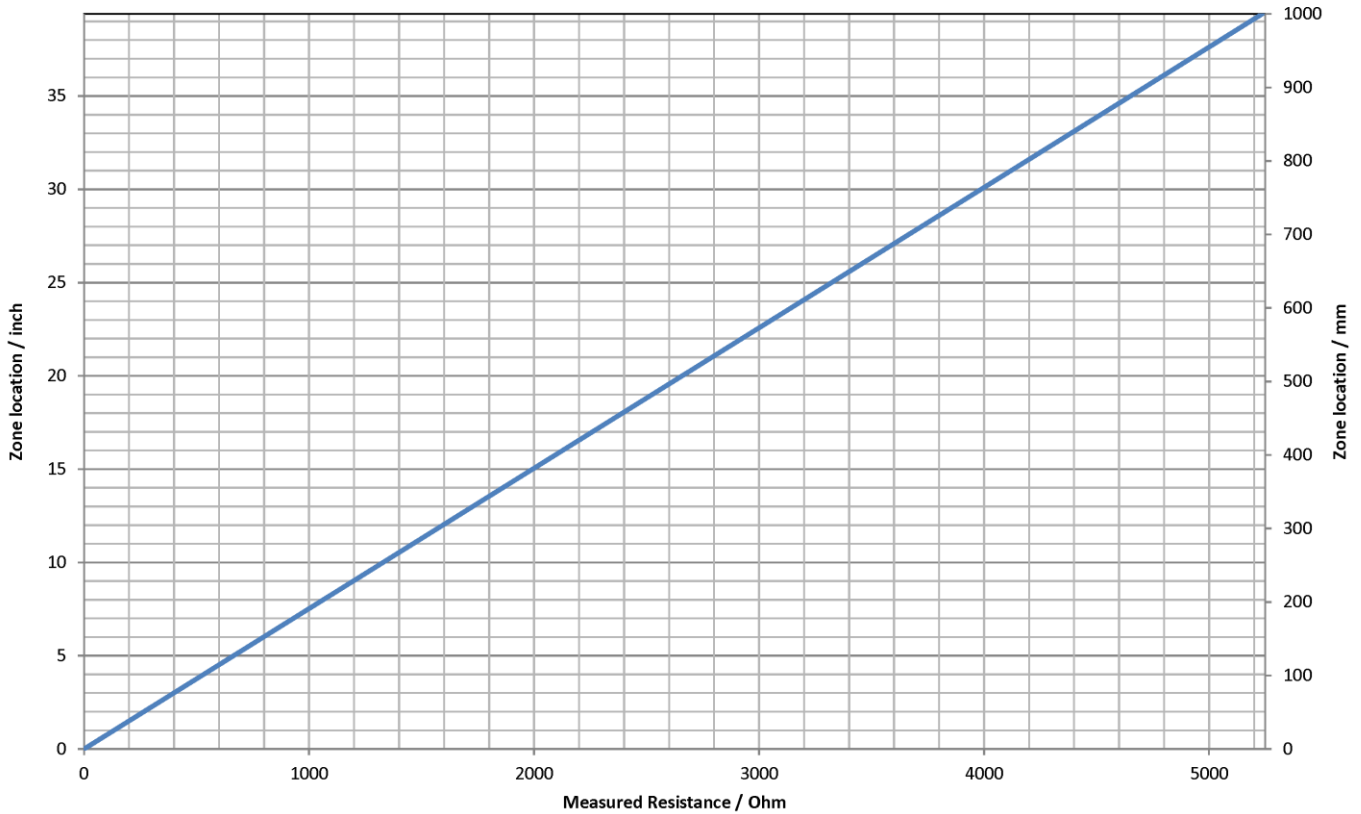




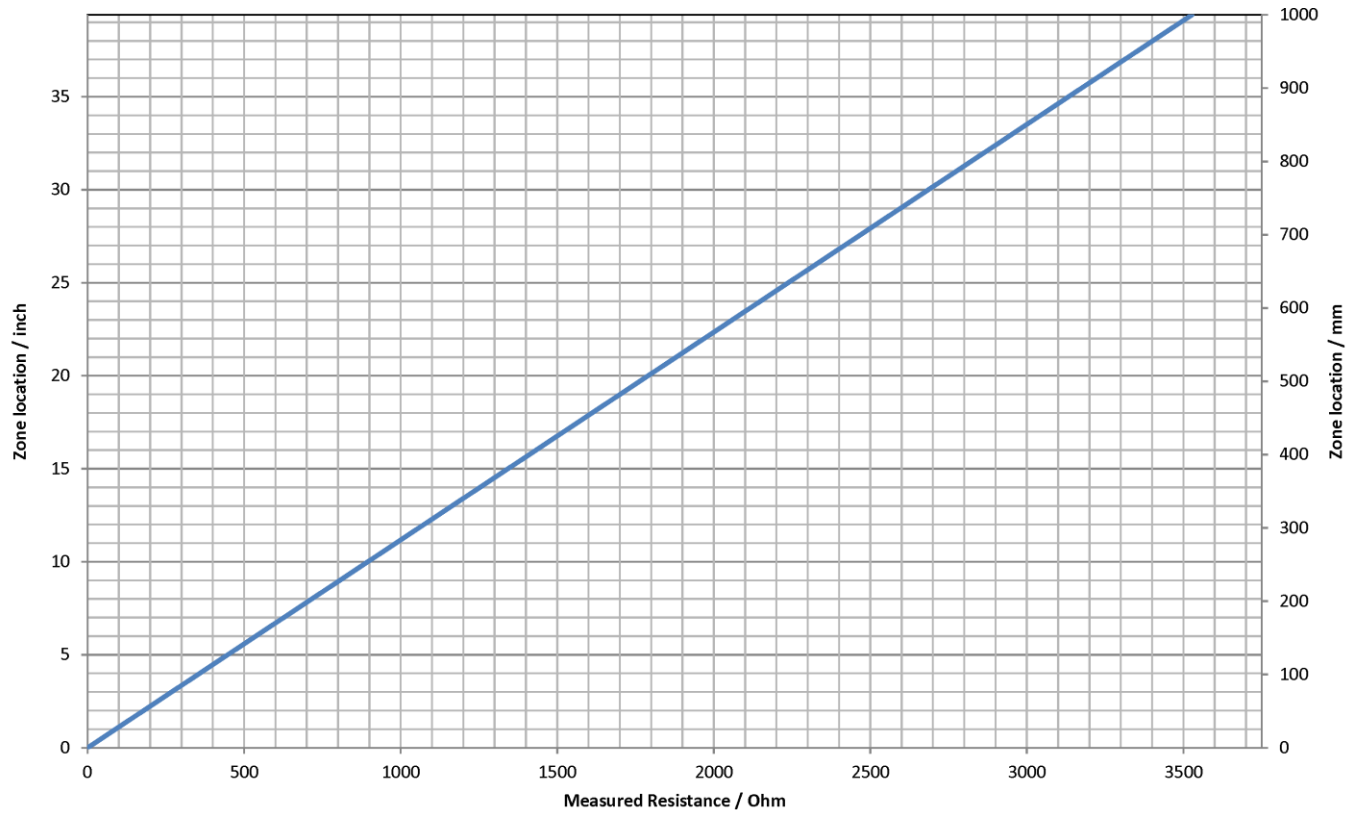


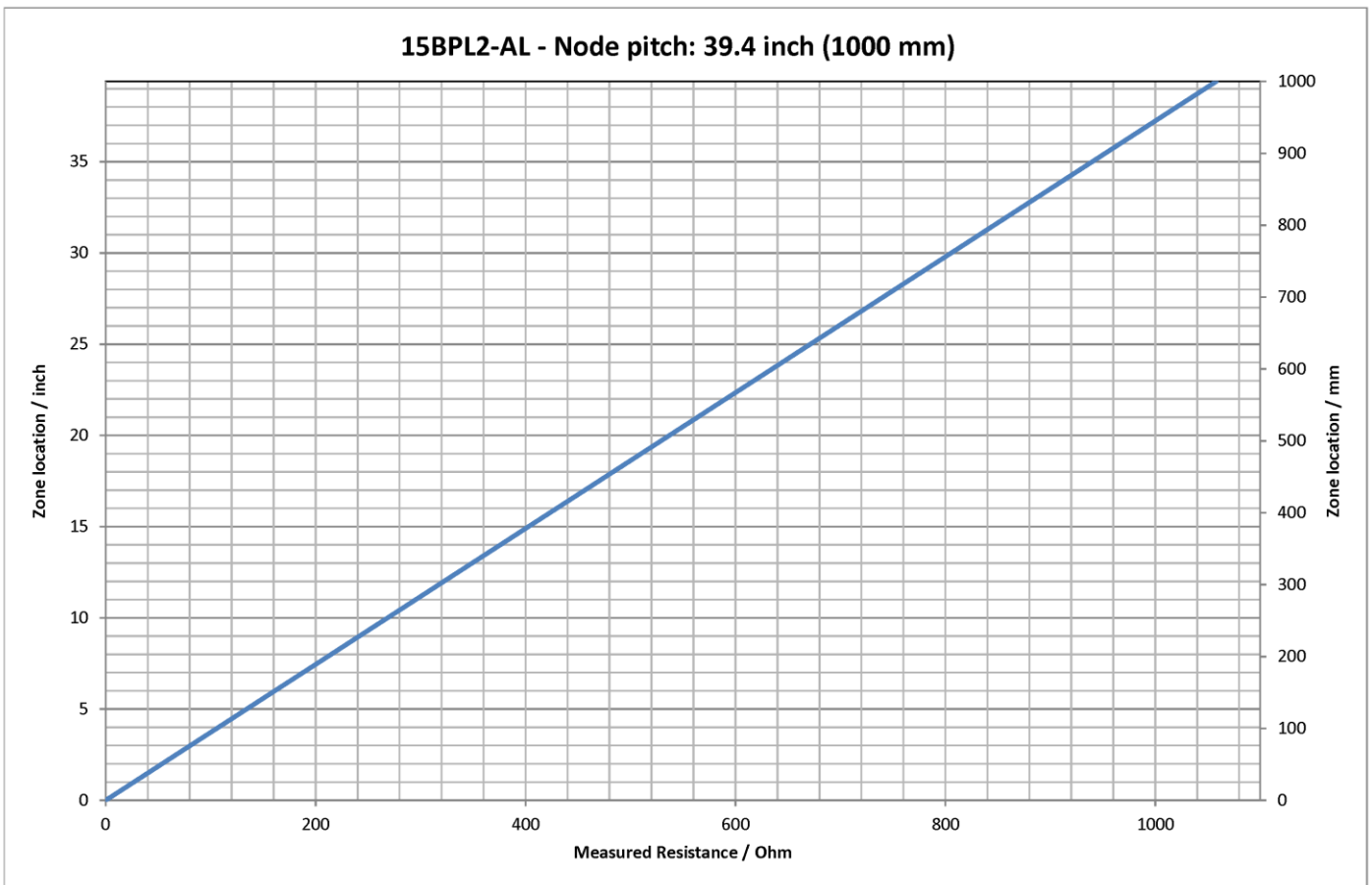
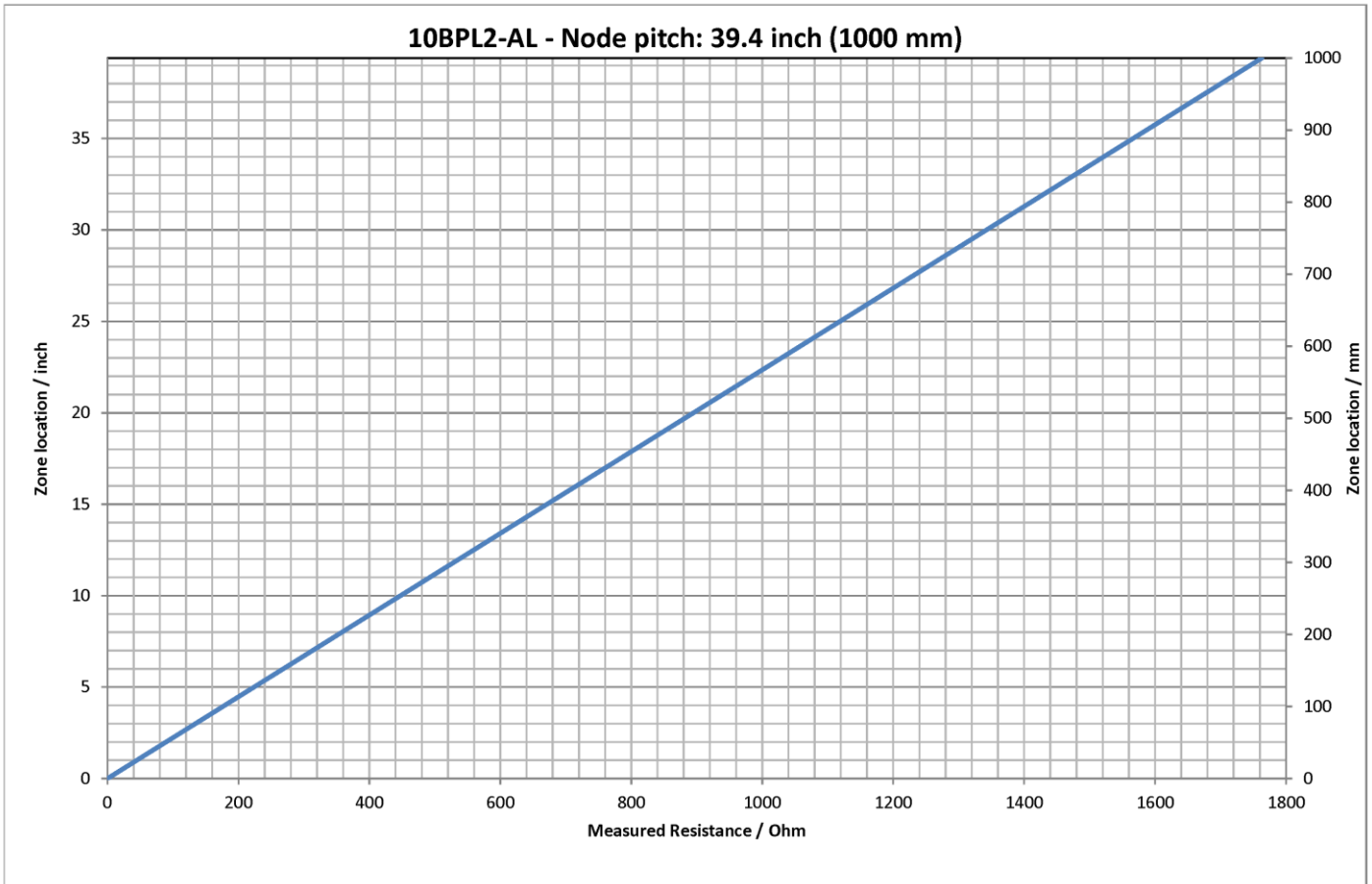


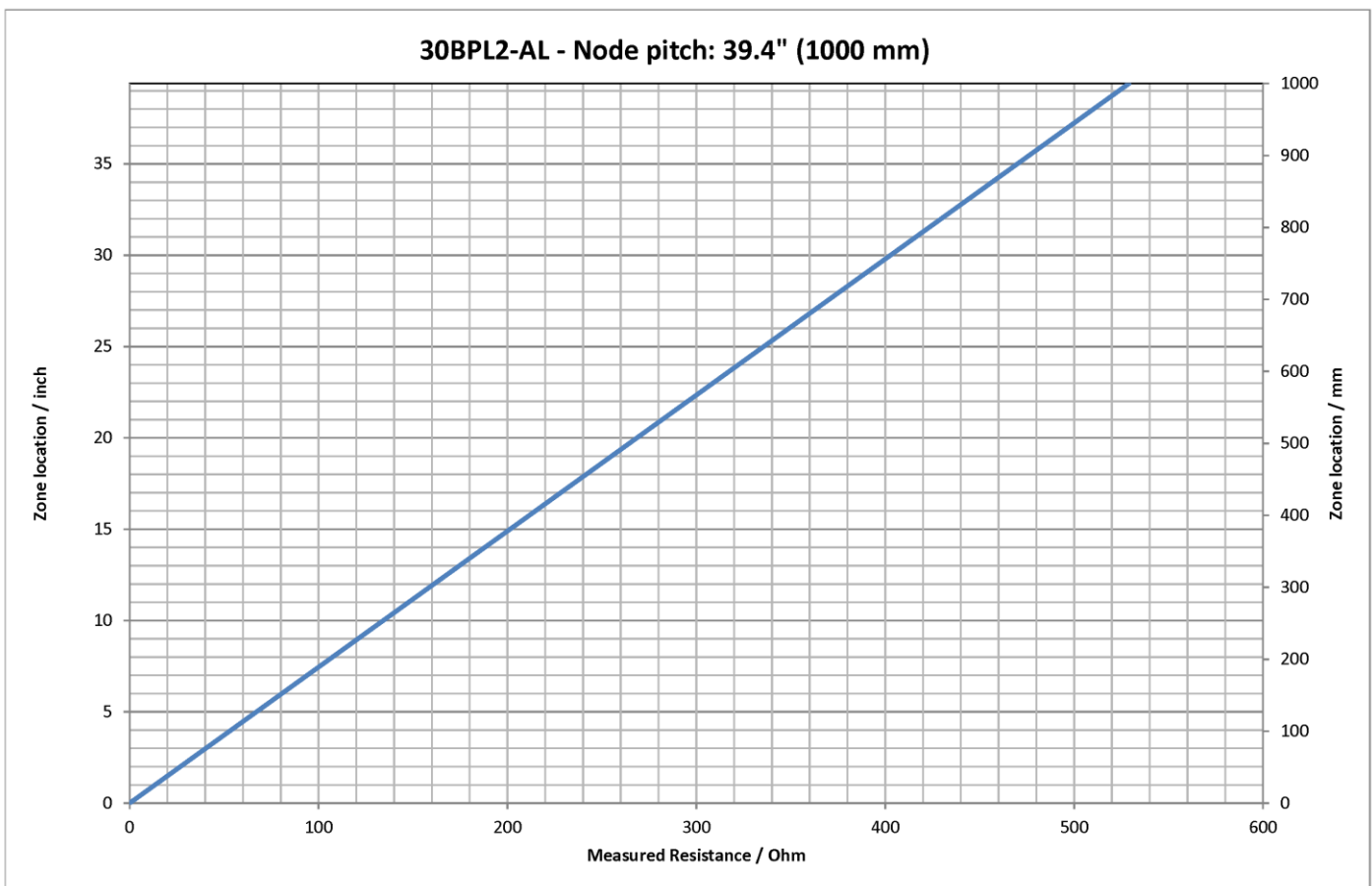
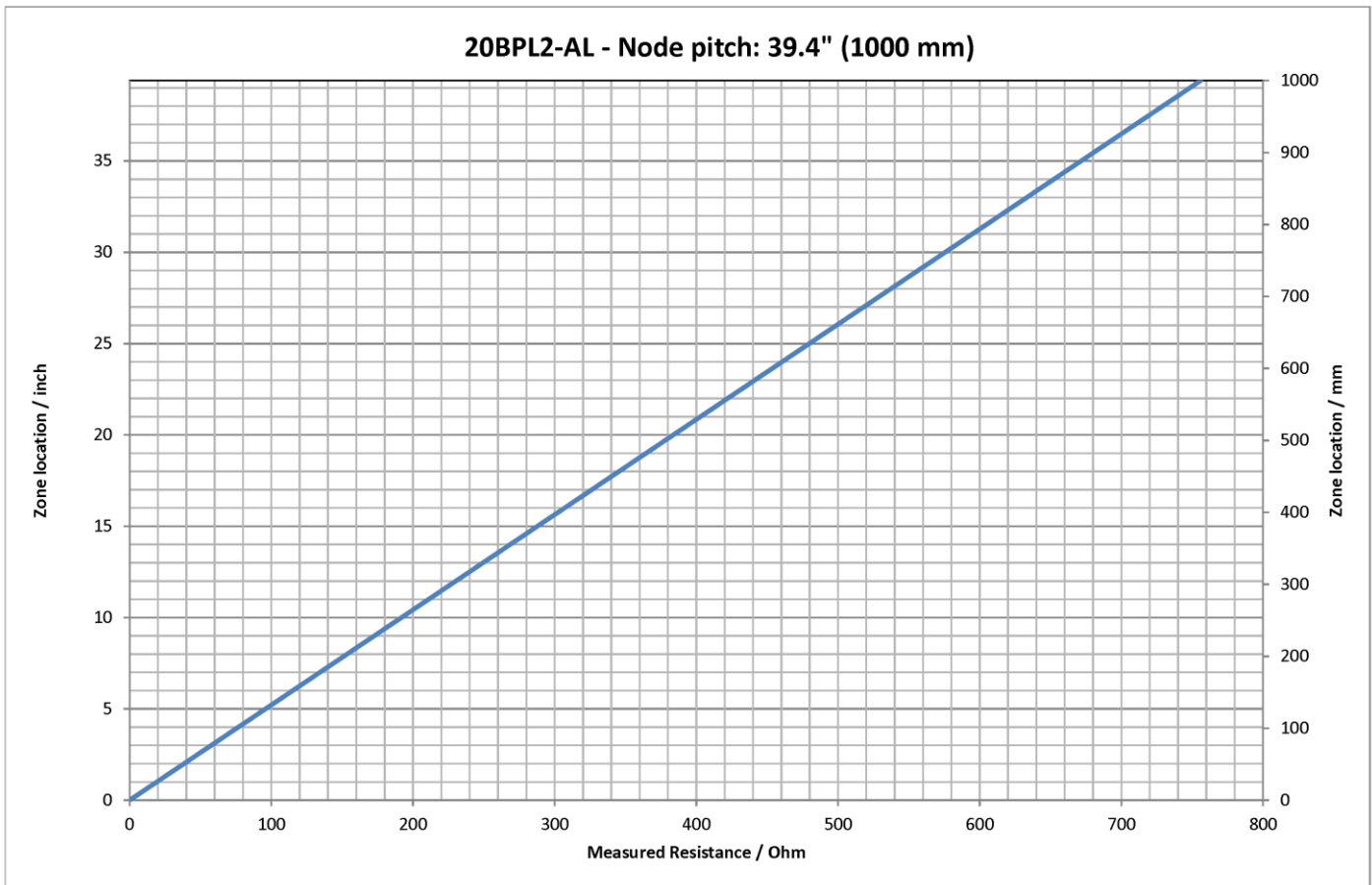
**3BPL2-AL - Node pitch: 39.4" (1000 mm)**

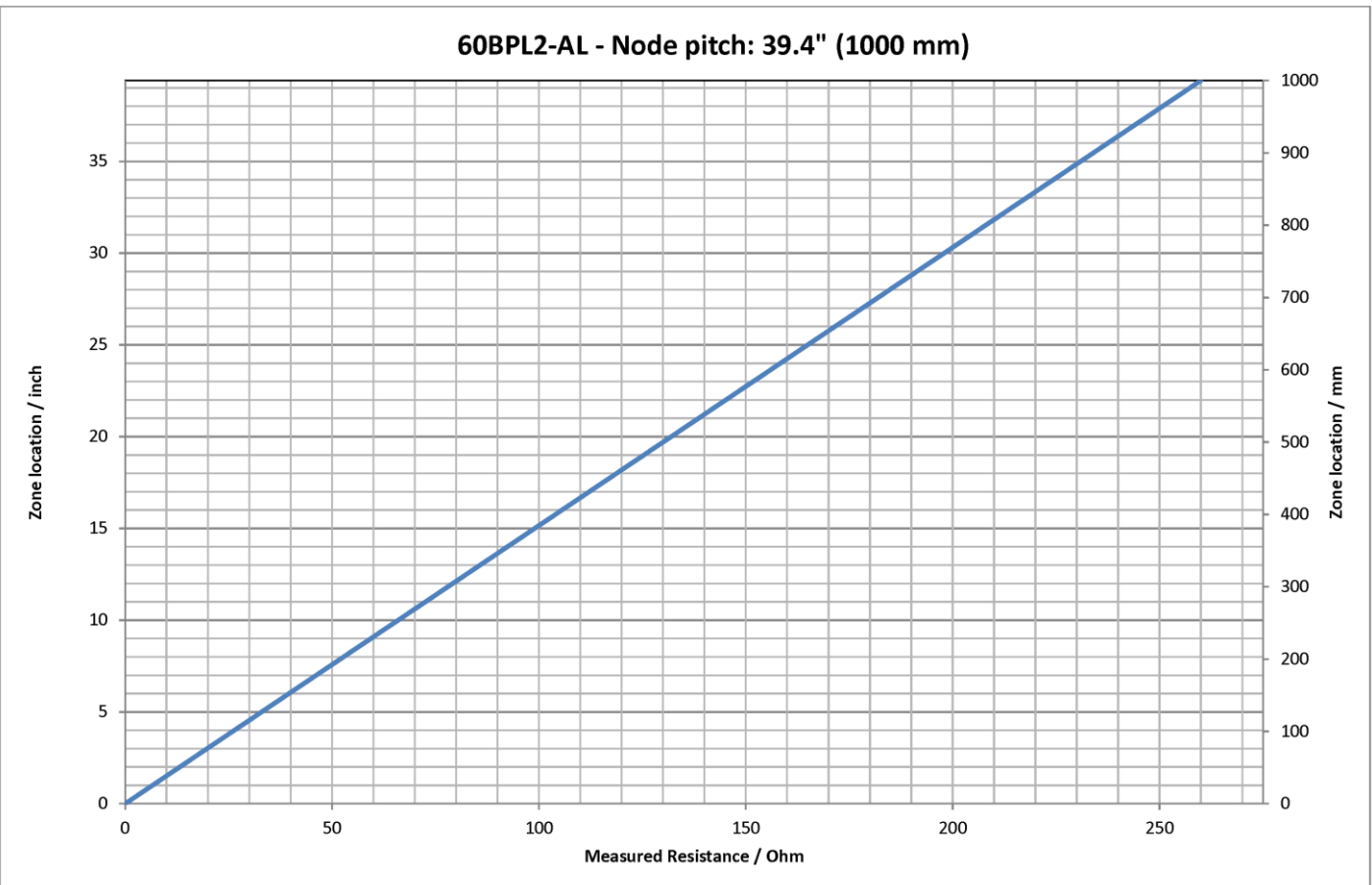
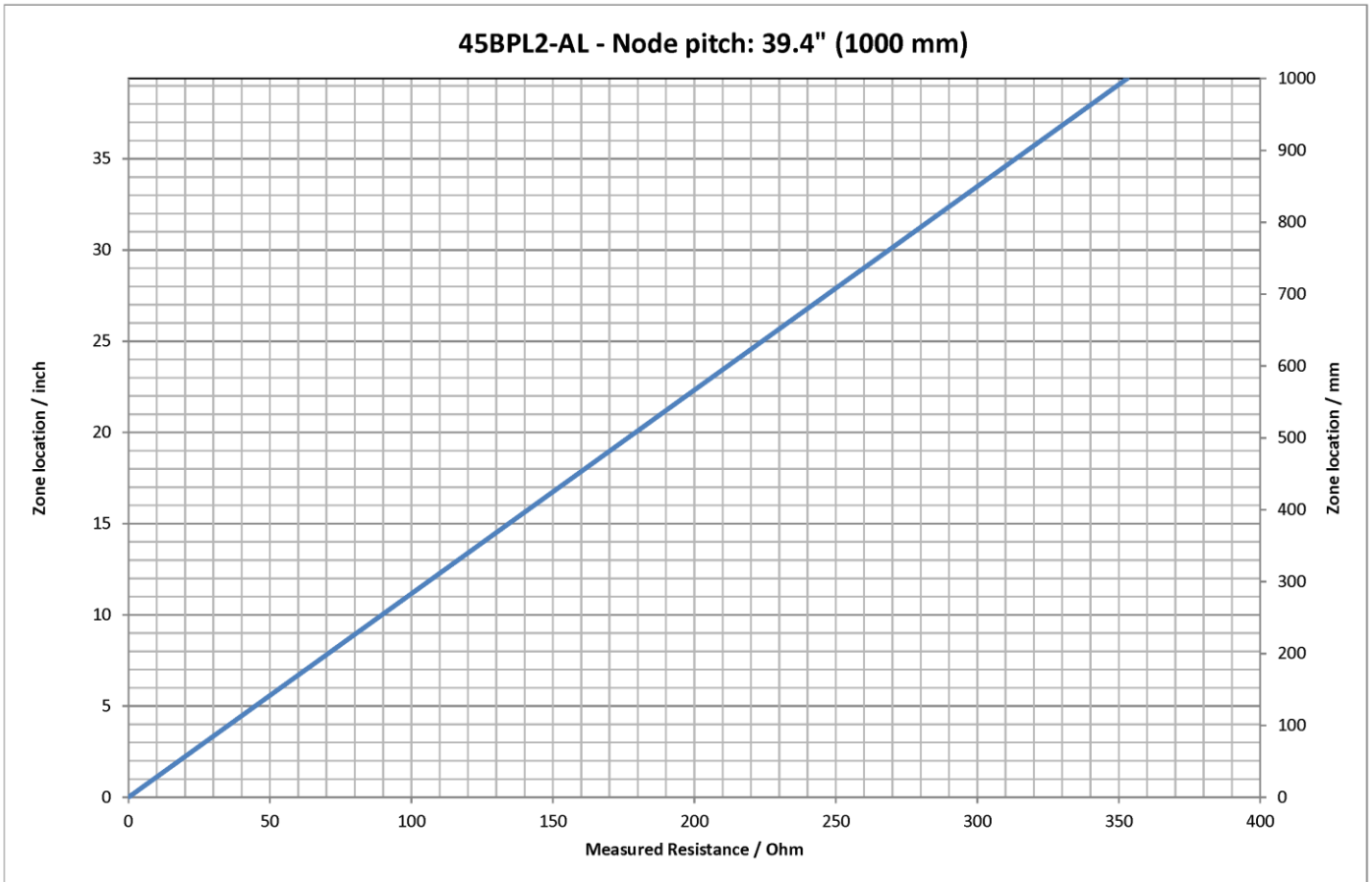


**5BPL2-AL - Node pitch: 39.4 inch (1000 mm)**









## Checklist customized entry port

For customized power entry port or capillary tube entry, the following data are mandatory for type selection of:					
Component:		Power cable gland	Power entry blind plug	Breather device; Drain device	Sensor cable gland
Identification:	Manufacturer: Type:	_____	_____	_____	_____
Identification:	Manufacturer: Type:	_____	_____	_____	_____
Standards to comply:	IEC 60079-0:2017; IEC 60079-7:2017; IEC 60079-31:2013 IEC EN 60079-0:2018; EN 60079-7:2015 + A1:2018; EN 60079-31:2014	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>
Type of protection:	Ex eb, Ex tb	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>
Ambient temperature range:	For T6 application: -40 °C to +55 °C For T5 application: -40 °C to +70 °C For T4 application: -40 °C to +75 °C For T3, T2, T1 application: -40 °C to 80 °C Temperature ranges are also valid for earth lugs with cord.	____ °C to ____ °C  yes <input type="checkbox"/>	____ °C to ____ °C  yes <input type="checkbox"/>	____ °C to ____ °C  yes <input type="checkbox"/>	____ °C to ____ °C  yes <input type="checkbox"/>
Degree of ingress protection:	IP64 in accordance with IEC 60529 and IEC 60079-0	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>
Grade of mechanical risk:	High (7J)	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>	yes <input type="checkbox"/>
Material	metal or plastic; For nuts and gland, mounted together, the material shall be equal for keeping the grade of mechanical risk at High (7J).	yes <input type="checkbox"/> kind of material: _____	yes <input type="checkbox"/> kind of material: _____	yes <input type="checkbox"/> kind of material: _____	yes <input type="checkbox"/> kind of material: _____
Thread size:	M20x1.5; M25x1.5; M32x1.5 also suitable for nuts	M ____x1.5 yes <input type="checkbox"/>	M ____x1.5 yes <input type="checkbox"/>	M ____x1.5 yes <input type="checkbox"/>	M12x1 only yes <input type="checkbox"/>

For installation of selected components, the manufacturer's installation manual must be observed. Thus above mentioned advice s may differ. It must be added to the junction box documentation.

It is not allowed to add or manipulate drillings and threads at the BARTEC junction box.

For selecting type of Power supply cable, see chapter Technical Data.

Remarks:

City/Date	Engineer Name / Signature	Customer Name / Signature
-----------	------------------------------	------------------------------

### NOTICE

Claims under warranty will not be considered if the check list is not filled in completely.

### ⚠ WARNING

**Risk of fire or electrical shock due to electric trace heating system.**  
**Risk of lost explosion protection.**  
**Only use heating cable glands delivered with the product or listed in chapter "Spare parts".**  
**Unauthorized technical modification to components or the system are not allowed.**

**Acceptance report / Record of inspection**

**Protocol type**

Inspection before commissioning	<input type="checkbox"/>	Inspection after modification	<input type="checkbox"/>	Periodic inspection	<input type="checkbox"/>
Visual inspection	<input type="checkbox"/>	Close inspection	<input type="checkbox"/>	Detailed inspection	<input type="checkbox"/>

**Project information**

<b>Project / Customer</b>	
<b>Order Comm. No. / BARTEC Order No.</b>	
<b>Date</b>	

**Installation details**

<b>Heating circuit type</b>	Electric Trace Heating of Pipes <input type="checkbox"/>	Electric Trace Heating of Vessels <input type="checkbox"/>
<b>Ex version</b>	yes <input type="checkbox"/> no <input type="checkbox"/> Zone <input type="text"/>	Temperature class T <input type="checkbox"/> Ex group <input type="text"/>
<b>Switchgear / Distribution panel</b>	Included in the scope of delivery	UV Name ESS/LDP
	yes <input type="checkbox"/> no <input type="checkbox"/>	Test report <input type="checkbox"/>
<b>Thermal insulation</b>	Thermal insulation material	Thermal insulation thickness in inch (mm) <input type="text"/>
	Check <b>before</b> installation of the insulation Date / Name / Signature	Check <b>after</b> installation of the insulation Date / Name / Signature

**Heating circuit data**

Heating Circuit No.									
<b>Sub-Heating circuit</b>	yes <input type="checkbox"/>	no <input type="checkbox"/>	yes <input type="checkbox"/>	no <input type="checkbox"/>	yes <input type="checkbox"/>	no <input type="checkbox"/>	yes <input type="checkbox"/>	no <input type="checkbox"/>	
<b>Pipe-/Vessel No.</b>									
<b>Building</b>									
<b>Product</b>									
<b>Trace heater type</b>									
<b>Lot No. of trace heater</b>									
<b>Trace heater length</b>	_____ m		_____ m		_____ m		_____ m		
<b>Serial No. connection kit</b>									
<b>Serial No. junction box</b>									
<b>Voltage</b>	_____ V		_____ V		_____ V		_____ V		
<b>Current (Switchon / operation)</b>	_____/_____ A		_____/_____ A		_____/_____ A		_____/_____ A		
<b>Output power trace heater</b>	_____ W/m		_____ W/m		_____ W/m		_____ W/m		
<b>Trace heater resistance</b>	_____ Ω		_____ Ω		_____ Ω		_____ Ω		
<b>Insulation resistance at ..... V</b>	> _____ MΩ		> _____ MΩ		> _____ MΩ		> _____ MΩ		
<b>Temperature settings</b>	°C	yes	no	°C	yes	no	°C	yes	no
Controller	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>
Limiter	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>
Low temperature	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>
<b>Temperature sensor limiter (Controlled design only)</b>									
Mounting temperature sensor	Sensor on pipe <input type="checkbox"/>		Limiter temperature setting		_____ °C				

Remarks:

City/Date

BARTEC Contractor Name / Signature

Customer Name / Signature

**NOTICE**

Claims under warranty will not be considered if the acceptance report is not filled in completely.

## 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 amperage of all components of the trace heating circuit!
	Maximum heating circuit length has been exceeded	Split the heating circuit into separate circuits.
	End seal has not been installed	Install the end seal according to the installation instructions.
	Short circuit	Identify the cause and remedy the fault (e.g. ensure that trace heater bus wires are not twisted together).
	Humidity inside the connection system or end seal	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/heating element and grounding braid at all power, splice and end seal 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.

*Note: High pipe temperature may lower the insulation resistance reading relative to earlier readings on a cold pipe.*

## 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://bartec.com/general-terms-and-conditions-for-deliveries-and-services>

### 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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