

# Resistance Thermometers Model TR10-L, EEx-d, for Additional Thermowell

WIKA Data Sheet TE 60.12



## Applications

- Chemical industry
- Petrochemical industry
- Off-Shore

## Special Features

- Type test certificate (ATEX)
- Measuring insert exchangeable
- For many thermowell designs

## Description

Resistance thermometers in this series can be combined with a large number of thermowell designs. Operation without thermowell is not allowed.

An extensive range of sensors, connection heads, insertion lengths, neck lengths, thermowell connections etc. are available for these thermometers, so that they are suitable for almost every thermowell design.

The models of the TR10-L series are provided with a type examination certificate for „flameproof enclosure“ type of protection according to directive 94/9/EC (ATEX), EEx-d, for gases and dusts. Measuring insert, connection head (flameproof) and integrated flame path guarantee a safe operation.

Thermowells in different dimensions and materials provide the use in zone 0, 1 or 2.



**Resistance Thermometer, Model TR10-L, EEx-d, for Additional Thermowell**

## Sensor

The sensor is located in the tip of the measuring insert, which is exchangeable and spring loaded.

### Sensor method of connection

- 2-wire The lead resistance of the measuring insert compounds the error.
- 3-wire With a cable length of approx. 30 m or longer measuring deviations can occur.
- 4-wire The inner lead resistance of the connecting wires is negligible.

### Sensor limiting error

- Class B per DIN EN 60 751
- Class A per DIN EN 60 751 (-50 °C ... +450 °C)
- 1/3 DIN B at 0 °C

It makes no sense to combine 2-wire connection with class A or 2-wire connection with 1/3 DIN B, because the lead resistance of the measuring insert, over-rides the higher sensor accuracy.

### Basic values and limiting errors

Basic values and limiting errors for the platinum measuring resistors are laid down in DIN EN 60 751. The nominal value of Pt 100 sensors is 100 Ω at 0 °C. The temperature coefficient α can be stated simply to be between 0 °C and 100 °C with:

$$\alpha = 3.85 \cdot 10^{-3} \text{ } ^\circ\text{C}^{-1}$$

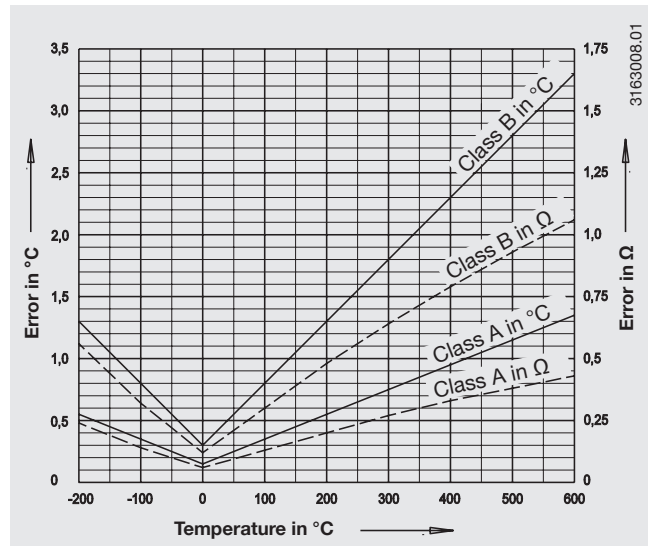
The relationship between the temperature and the electrical resistance is described by polynomes which are defined in DIN EN 60 751. Furthermore, this standard lays down the basic values in °C stages.

| Class | Limiting error in °C                   |
|-------|--|
| A     | $0.15 + 0.002 \cdot  t $ <sup>1)</sup> |
| B     | $0.3 + 0.005 \cdot  t $                |

1) |t| is the value of the temperature in °C without consideration of the sign

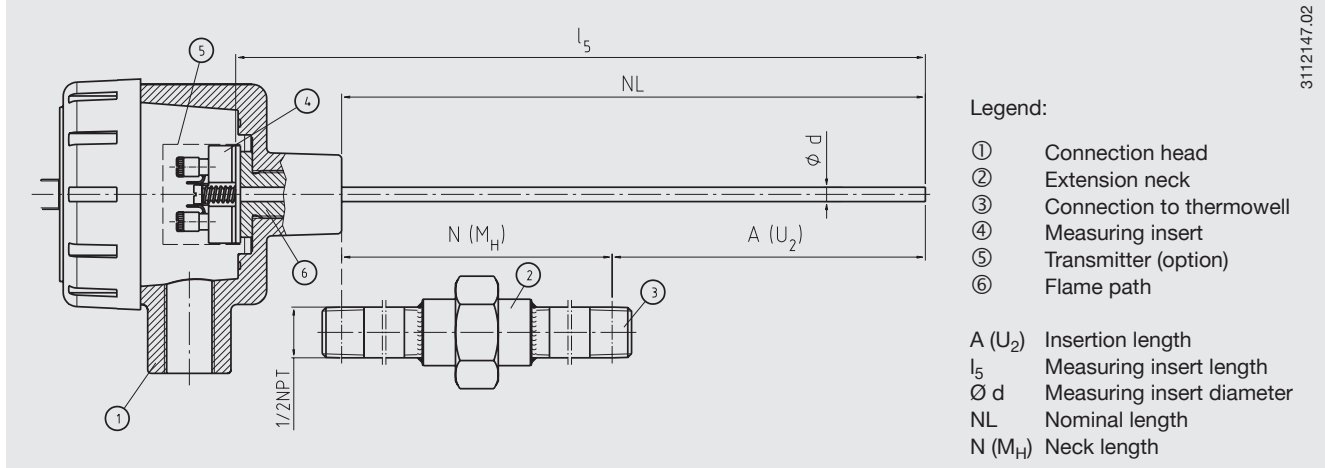
| Temperature (ITS 90) °C | Basic value Ω | Limiting error DIN EN 60 751 |        |         |        |
|-------------------------|---------------|------------------------------|--------|---------|--------|
|                         |               | Class A                      |        | Class B |        |
|                         |               | °C                           | Ω      | °C      | Ω      |
| -200                    | 18.52         | ± 0.55                       | ± 0.24 | ± 1.3   | ± 0.56 |
| -100                    | 60.26         | ± 0.35                       | ± 0.14 | ± 0.8   | ± 0.32 |
| -50                     | 80.31         | ± 0.25                       | ± 0.10 | ± 0.55  | ± 0.22 |
| 0                       | 100           | ± 0.15                       | ± 0.06 | ± 0.3   | ± 0.12 |
| 50                      | 119.40        | ± 0.25                       | ± 0.10 | ± 0.55  | ± 0.21 |
| 100                     | 138.51        | ± 0.35                       | ± 0.13 | ± 0.8   | ± 0.30 |
| 200                     | 175.86        | ± 0.55                       | ± 0.2  | ± 1.3   | ± 0.48 |
| 300                     | 212.05        | ± 0.75                       | ± 0.27 | ± 1.8   | ± 0.64 |
| 400                     | 247.09        | ± 0.95                       | ± 0.33 | ± 2.3   | ± 0.79 |
| 500                     | 280.98        | ± 1.15                       | ± 0.38 | ± 2.8   | ± 0.93 |
| 600                     | 313.71        | ± 1.35                       | ± 0.43 | ± 3.3   | ± 1.06 |

Please take the maximum permissible temperature values of the „Explosion protection“ table, page 6, into account as well!

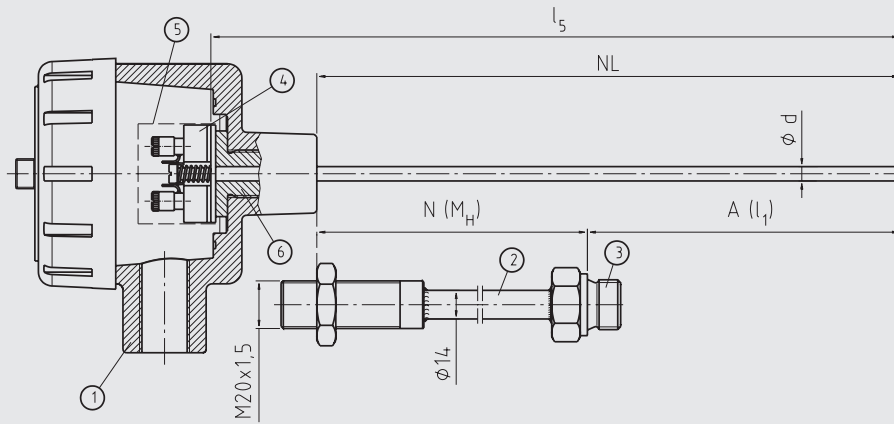


## TR10-L components

### Conical thread



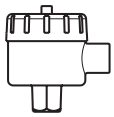
## Cylindrical thread



### Legend:

- ① Connection head
  - ② Extension neck
  - ③ Connection to thermowell
  - ④ Measuring insert
  - ⑤ Transmitter (option)
  - ⑥ Flame path
- A (l<sub>i</sub>) Insertion length  
 l<sub>5</sub> Measuring insert length  
 Ø d Measuring insert diameter  
 NL Nominal length  
 N (M<sub>H</sub>) Neck length

## Connection head



7000 W

| Model  | Material  | Cable entry               | Ingress protection | Cap         | Surface finish              |
|--------|-----------|---------------------------|--------------------|-------------|-----------------------------|
| 7000 W | Aluminium | ½ NPT, ¾ NPT or M20 x 1.5 | IP 65              | Screw cover | blue, painted <sup>1)</sup> |

1) RAL5022, polyester paint saltwater-proof

## Measuring insert

The measuring insert is made of a vibration-resistant sheathed measuring cable (MI cable). The diameter of the measuring insert shall be approx. 1 mm smaller than the hole diameter of the thermowell.

Gaps of more than 0.5 mm between thermowell and measuring insert will have a negative effect on the heat transfer, and they will result in an unfavourable response behaviour of the thermometer.

When fitting the measuring insert with a thermowell, it is very important to determine the correct insertion length (= thermowell length with bottom thicknesses of ≤ 5.5 mm). In this connection the fact that the measuring insert is spring-loaded (spring travel: max. 10 mm) has to be taken into account in order to ensure that the measuring insert presses against the bottom of the thermowell. Furthermore we recommend that a neck length be selected so that a standard length measuring insert can be used. Measuring inserts for TR10-L are produced with a fit below the terminal block. This guarantees a defined gap between measuring insert and integrated flame path according to the certificate.

**Due to the use of a flame path and its fit tolerances it is not permissible to use standard measuring inserts as replacement parts!**

**Replacement measuring insert with type examination certificate: Model TR10-K.**

## Extension neck (option)

The extension neck is screwed to the connection head. Connection to head: M20 x 1.5 or ½ NPT. The length of the extension neck depends on the application. The extension neck generally serves for bridging insulation. In many applications it is also used as a part cooling element between connection head and medium in order to protect any head mount transmitters from high medium temperatures.

Standard material of the extension neck is stainless steel.

Other extension neck designs and materials on request.

## Transmitter (option)

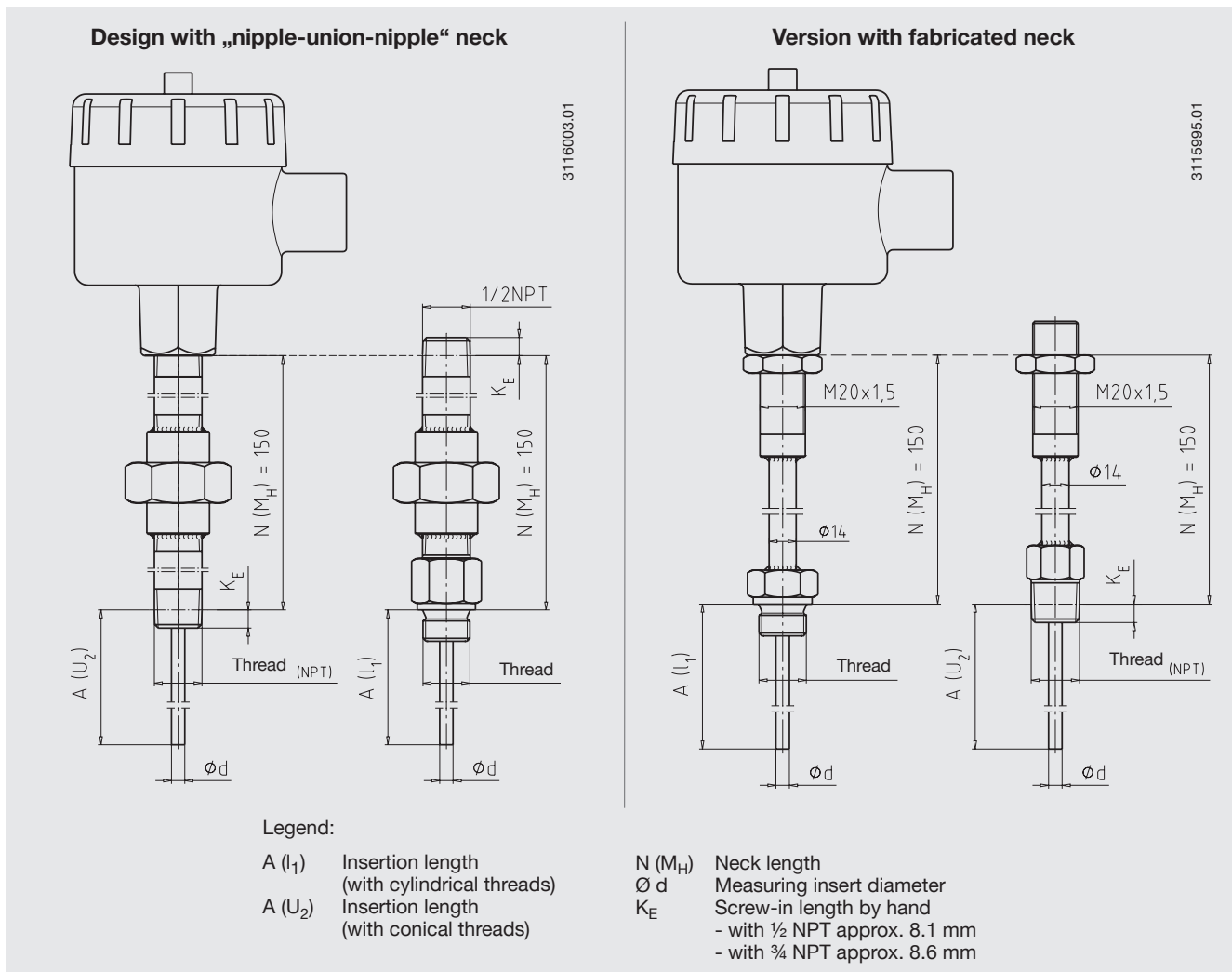
An optional transmitter can be mounted inside the connection head. (Note: Only on connection plate of the measuring insert). A certification of the built-in transmitter is not necessary. (Use in accordance with EN 50 018 and in accordance with intended use).

The thermometer has to be operated with a power limitation circuit that limits  $P_{max}$  in category 1 applications with a two fault safety and in category 2 applications with a one fault safety (e.g. intrinsically safe circuits of ia resp. ib).

| Model | Description   | Explosion protection | Data sheet |
|-------|---|----------------------|------------|
| T19   | Analogue transmitter, configurable                      | without              | TE 19.03   |
| T24   | Analogue transmitter, PC-configurable                   | optional             | TE 24.01   |
| T12   | Digital transmitter, PC-configurable                    | optional             | TE 12.03   |
| T32   | Digital transmitter, HART protocol                      | optional             | TE 32.03   |
| T53   | Digital transmitter FOUNDATION Fieldbus and PROFIBUS PA | standard             | TE 53.01   |

## Connection to thermowell

Many possible designs ensure that the resistance thermometer, Model TR10-L, can be combined with almost all thermowells. The most common designs of connection are shown in the following drawings. Others are available on request.



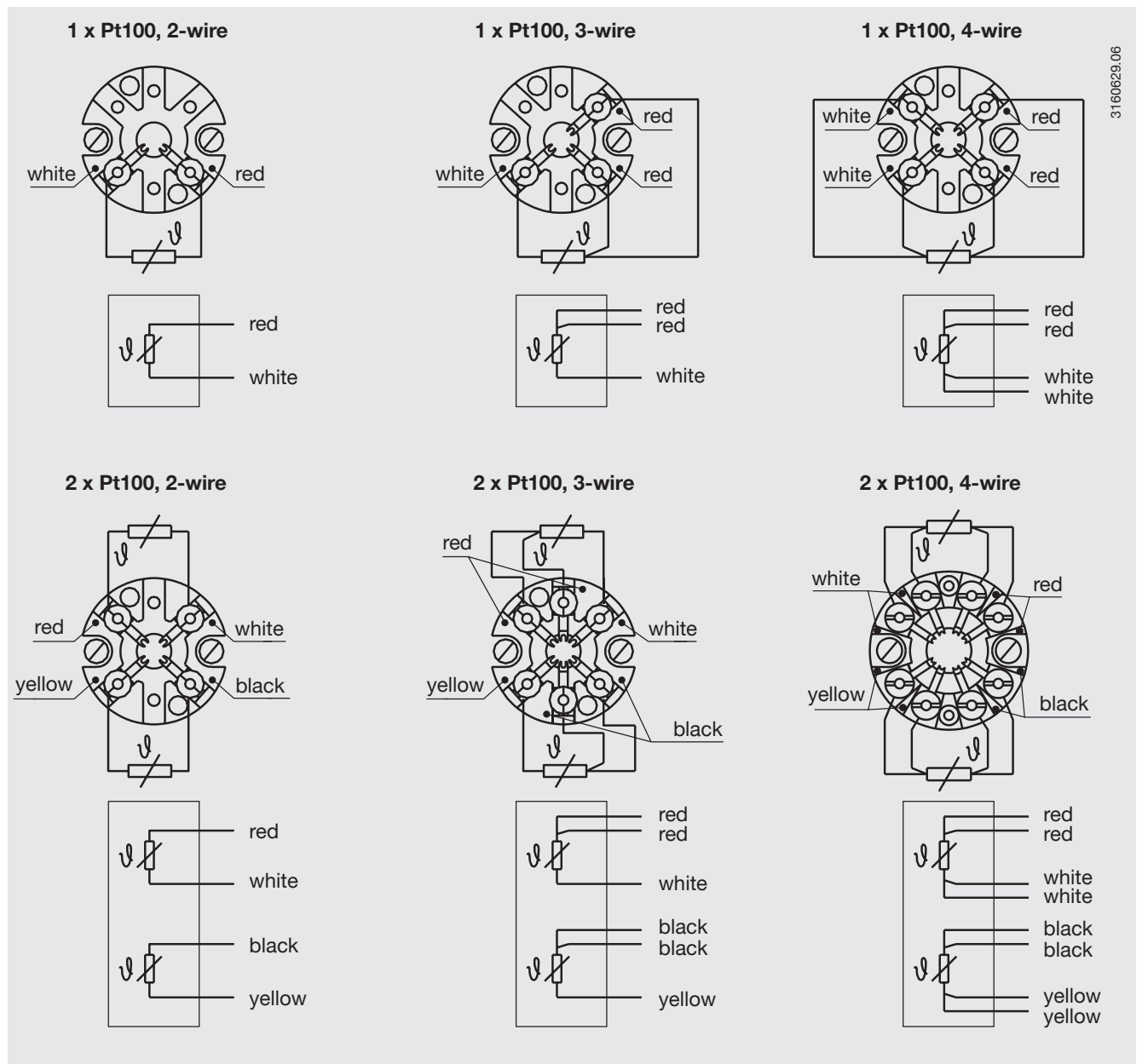
**Possible combinations of measuring insert diameter, number sensor and sensor method of connection**

| Measuring insert Ø<br>in mm | Sensor / sensor method of connection<br>1 x Pt100 |        |        | Sensor / sensor method of connection<br>2 x Pt100 |        |        |
|-----------------------------|---|--------|--------|---|--------|--------|
|                             | 2-wire  | 3-wire | 4-wire | 2-wire  | 3-wire | 4-wire |
| 3                           | x   | x      | x      | x   | x      | -      |
| 6                           | x   | x      | x      | x   | x      | x      |

**Possible thread sizes of the male thread at the extension neck**

| Thread to the thermowell | Thread to the head |
|--------------------------|--------------------|
| G ½ B                    | M20 x 1.5          |
| G ¾ B                    | ½ NPT              |
| M14 x 1.5                |                    |
| M18 x 1.5                |                    |
| ½ NPT                    |                    |
| ¾ NPT                    |                    |

**Electrical connection**



## Explosion protection

Resistance thermometers TR10-L are available with a type examination certificate for „flameproof enclosure“ type of ignition protection (TÜV 02 ATEX 1858 X). These thermometers comply with the requirements of directive 94/9/EC (ATEX).

The classification / suitability of the instrument for the respective category can be seen from the table.

The responsibility for using suitable thermowells rests with the user.

| Marking  | Temperature maximum in °C<br>at the thermowell / measuring insert |               |               |               | Neck length<br>minimum<br>N (M <sub>H</sub> ) <sup>2)</sup> | Temperature range<br>ambient<br>T <sub>amb</sub> <sup>3)</sup> |
|--|---|---------------|---------------|---------------|---|--|
|  | Power P <sub>max</sub> at the sensor <sup>1)</sup>                |               |               |               |   |  |
| <b>2 fault safety (e. g. with sensor supply circuit ia)</b>                      | <b>50 mW</b>  | <b>100 mW</b> | <b>250 mW</b> | <b>500 mW</b> |   |  |
| II ½ GD EEx-d IIC T80 °C IP 65<br>or II ½ G EEx-d IIC T6                         | 63  | 61            | 56            | 46            |   | -20 °C ... 55 °C   |
| II ½ GD EEx-d IIC T95 °C IP 65<br>or II ½ G EEx-d IIC T5                         | 75  | 73            | 68            | 58            |   | -20 °C ... 70 °C   |
| II ½ GD EEx-d IIC T130 °C IP 65<br>or II ½ G EEx-d IIC T4                        | 103   | 101           | 96            | 86            | 20 mm   | -20 °C ... 100 °C  |
| II ½ GD EEx-d IIC T195 °C IP 65<br>or II ½ G EEx-d IIC T3                        | 155   | 153           | 148           | 138           | 50 mm   | -20 °C ... 100 °C  |
| II ½ GD EEx-d IIC T290 °C IP 65<br>or II ½ G EEx-d IIC T2                        | 231   | 229           | 224           | 214           | 100 mm  | -20 °C ... 100 °C  |
| II ½ GD EEx-d IIC T440 °C IP 65<br>or II ½ G EEx-d IIC T1                        | 351   | 349           | 344           | 334           | 100 mm  | -20 °C ... 100 °C  |
| <b>1 fault safety with power reduction (e. g. with sensor supply circuit ib)</b> | <b>50 mW</b>  | <b>100 mW</b> |               |               |   |  |
| II ½ GD EEx-d IIC T80 °C IP 65<br>or II ½ G EEx-d IIC T6                         | 56  | 46            |               |               |   | -20 °C ... 55 °C   |
| II ½ GD EEx-d IIC T95 °C IP 65<br>or II ½ G EEx-d IIC T5                         | 68  | 58            |               |               |   | -20 °C ... 70 °C   |
| II ½ GD EEx-d IIC T130 °C IP 65<br>or II ½ G EEx-d IIC T4                        | 96  | 86            |               |               | 20 mm   | -20 °C ... 100 °C  |
| II ½ GD EEx-d IIC T195 °C IP 65<br>or II ½ G EEx-d IIC T3                        | 148   | 138           |               |               | 50 mm   | -20 °C ... 100 °C  |
| II ½ GD EEx-d IIC T290 °C IP 65<br>or II ½ G EEx-d IIC T2                        | 224   | 214           |               |               | 100 mm  | -20 °C ... 100 °C  |
| II ½ GD EEx-d IIC T440 °C IP 65<br>or II ½ G EEx-d IIC T1                        | 344   | 334           |               |               | 100 mm  | -20 °C ... 100 °C  |
| <b>1 fault safety (e. g. with sensor supply circuit ib)</b>                      | <b>50 mW</b>  | <b>100 mW</b> | <b>250 mW</b> | <b>500 mW</b> |   |  |
| II 2 GD EEx-d IIC T80 °C IP 65<br>or II 2 G EEx-d IIC T6                         | 78  | 75            | 68            | 59            |   | -20 °C ... 55 °C   |
| II 2 GD EEx-d IIC T95 °C IP 65<br>or II 2 G EEx-d IIC T5                         | 93  | 90            | 83            | 74            |   | -20 °C ... 70 °C   |
| II 2 GD EEx-d IIC T130 °C IP 65<br>or II 2 G EEx-d IIC T4                        | 128   | 125           | 118           | 109           | 20 mm   | -20 °C ... 100 °C  |
| II 2 GD EEx-d IIC T195 °C IP 65<br>or II 2 G EEx-d IIC T3                        | 193   | 190           | 183           | 174           | 50 mm   | -20 °C ... 100 °C  |
| II 2 GD EEx-d IIC T290 °C IP 65<br>or II 2 G EEx-d IIC T2                        | 288   | 285           | 278           | 269           | 100 mm  | -20 °C ... 100 °C  |
| II 2 GD EEx-d IIC T440 °C IP 65<br>or II 2 G EEx-d IIC T1                        | 438   | 435           | 428           | 419           | 100 mm  | -20 °C ... 100 °C  |

Further information see Ex operating instructions

- 1) When using multiple sensor resistors (or several single resistors) and operating them simultaneously, the sum of the individual power values must not exceed the value of the max. permissible power specified in the table.
- 2) The minimum neck length is to be defined as the distance between the lower edge of the connection head and the heat-emitting surface.
- 3) When using a transmitter, the permissible ambient temperature range is to be taken from the corresponding approval.

Modifications may take place and materials specified may be replaced by others without prior notice.  
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.

