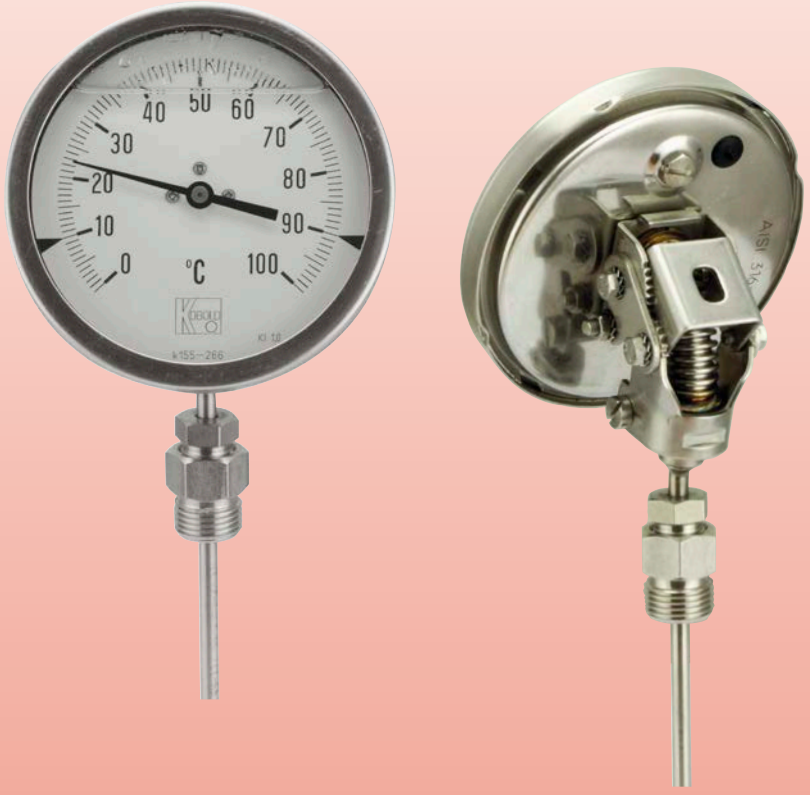
# Bi-metal Thermometers

all stainless steel construction



## TBE




- Fast response times
- Large selection of standard versions
- Special versions at customer request
- Nominal sizes: 100, 125 and 150 mm
- Temperatures: -50 ... +50 °C to 0 ... 600 °C



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## Description

These instruments are designed for use in food, beverage, pharmaceutical, chemical, petrochemical processing industries. They are built to resist the most severe operating conditions created by the ambient environment and the process medium. An Argon arc welded case/bulb strengthens the whole construction. A leak tight fit is ensured if the instrument is filled with a dampening fluid to prevent damage due to vibration.

The bi-metal thermometers are built from a stainless steel tube inside of which a bi-metal helicoidal spiral is placed. This spiral is welded to the tip of the tube and on the other side to a transmission shaft directly connected to the pointer. The temperature vibrations generate a deformation of the bi-metal which is transmitted to the pointer through a shaft rotation.

## Thermowells

Must be used on all applications where thermometer bulb is subjected to pressure, corrosive fluid or flow rate. Thermowells will make thermometer disassemble for calibration or replacement easier as the process will not be disturbed.

### Thermowells available:

- Thermowells with thread connection either built up type or machined from bar stock
- Thermowells with flange either built up type or machined from a bar stock

Type, material and constructive characteristics on datasheet TWL.

## Technical Details

| | |
|---|---|
| Indication ranges: | -50 ... +600 °C (-80 ... 1000 °F) |
| Measuring ranges: | the °C measuring range has been marked by two ▼ stamped on the dial. They represent the temperature span recommended for the use of instruments as per DIN 16203 |
| Accuracy: | Class 1.0 as per EN 13190 |
| Ambient temperature: | -25 ... +65 °C |
| Overtemperature limit: | 30% of full scale range for temperature ≤ 400 °C; max. 500 °C |
| Special overtemperature (option F02): | 100% of full scale range for temperature ≤ 150 °C; 50% of full scale range for temperature 150 °C ... 300 °C; max. 500 °C |
| Max working pressure: | 15 bar (without thermowell) |
| Protection degree: | IP 55 as per IEC 529 |
| Process connection: | AISI 316 stainless steel |
| Bulb: | Ø 6.0 - 6.4 - 8.0 - 9.6 mm AISI 316 stainless steel |
| Measuring element: | bi-metal spiral shaped |
| Welding: | AISI 304 stainless steel TIG |
| Case: | AISI 304 stainless steel |
| Ring: | AISI 304 stainless steel bayonet lock |
| Window: | tempered glass |
| Dial: | aluminium white with black markings |
| Pointer: | aluminium, black |
| Zero-Adjustement: | external zero-adjustment screw |

## Special version

| | |
|---|---|
| Measuring range: | °C, °F, and double range °C / °F |
| Protection degree: | IP 65 (option E65) |
| Case and ring: | AISI 316 stainless steel (option C40) |
| Dampening liquid filling: | glycerine 98 % and silicone oil (options R10-R11; see table on page 5 for limit operating conditions) |



No responsibility taken for errors; subject to change without prior notice.

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## Scale Ranges

### Single scales °C and bulb length S

| Code | °C | Ø 6 - 6.4 [mm] | Ø 8 [mm] | Ø 9.6 [mm] |
|---|---|---|---|---|
| C55 | -50 ... +50 | 100 ... 700 | 82 ... 900[1)] | 82 ... 900[1)] |
| C35 | -30 ... +50 | 114 ... 700 | 88 ... 900[1)] | 88 ... 900[1)] |
| C14 | -20 ... +120 | 83 ... 700 | 67 ... 900[1)] | 67 ... 900[1)] |
| C24 | -20 ... +40 | 137 ... 700 | 107 ... 900[1)] | 107 ... 900[1)] |
| C28 | -20 ... +80 | 100 ... 700 | 82 ... 900[1)] | 82 ... 900[1)] |
| C06 | 0 ... +60 | 137 ... 700 | 107 ... 900[1)] | 107 ... 900[1)] |
| C08 | 0 ... +80 | 114 ... 700 | 88 ... 900[1)] | 88 ... 900[1)] |
| C10 | 0 ... +100 | 100 ... 700 | 82 ... 900[1)] | 82 ... 900[1)] |
| C12 | 0 ... +120 | 88 ... 700 | 72 ... 900[1)] | 72 ... 900[1)] |
| C16 | 0 ... +160 | 116 ... 700 | 91 ... 900[1)] | 91 ... 900[1)] |
| C20 | 0 ... +200 | 98 ... 700 | 79 ... 900[1)] | 79 ... 900[1)] |
| C25 | 0 ... +250 | 84 ... 700 | 70 ... 900[1)] | 70 ... 900[1)] |
| C30 | 0 ... +300 | 100 ... 700 | 88 ... 900[1)] | 88 ... 900[1)] |
| C40 | 0 ... +400 | 150 ... 700 | 150 ... 900 | 150 ... 900 |
| C50 | 0 ... +500 | 150 ... 700 | 150 ... 900 | 150 ... 900 |
| C60 | 0 ... +600[2)] | 150 ... 700 | 150 ... 900 | 150 ... 900 |

### Single scales °F and bulb length S

| Code | °F | Ø 6 - 6.4 [mm] | Ø 8 [mm] | Ø 9.6 [mm] |
|---|---|---|---|---|
| F11 | -80 ... +120 | 94 ... 500 | 76 ... 900[1)] | 76 ... 900[1)] |
| F55 | -20 ... +120 | 114 ... 500 | 88 ... 900[1)] | 88 ... 900[1)] |
| F12 | 0 ... +200 | 94 ... 500 | 76... 900[1)] | 76... 900[1)] |
| F14 | 0 ... +250 | 83 ... 500 | 67... 900[1)] | 67... 900[1)] |
| F21 | +50 ... +400 | 108 ... 500 | 89 ... 900[1)] | 89 ... 900[1)] |
| F30 | +50 ... +550 | 112 ... 500 | 100 ... 900[1)] | 100... 900[1)] |
| F27 | +200 ... +700 | 150 ... 500 | 150 ... 900 | 150 ... 900 |
| F40 | +100 ... +800 | 150 ... 500 | 150 ... 900 | 150 ... 900 |
| F44 | +200 ... +1000[2)] | 150 ... 500 | 150 ... 900 | 150 ... 900 |

### Dual scales °C/°F and bulb length S

| Code | Primary °C (int.) | Secondary°F (ext.) | Ø 6 - 6.4 [mm] | Ø 8 [mm] | Ø 9.6 [mm] |
|---|---|---|---|---|---|
| D55 | -50 ... +50 | -58 ... +122 | 100 ... 500 | 82 ... 900[1)] | 82 ... 900[1)] |
| D35 | -30 ... +50 | -22 ... +122 | 114 ... 500 | 88 ... 900[1)] | 88 ... 900[1)] |
| D22 | -20 ... +120 | -4 ... +248 | 82 ... 500 | 67... 900[1)] | 67... 900[1)] |
| D06 | 0 ... +60 | +32 ... +140 | 137 ... 500 | 107... 900[1)] | 107... 900[1)] |
| D10 | 0 ... +100 | +32 ... +212 | 100 ... 500 | 82 ... 900[1)] | 82 ... 900[1)] |
| D12 | 0 ... +120 | +32 ... +248 | 88 ... 500 | 72 ... 900[1)] | 72 ... 900[1)] |
| D16 | 0 ... +160 | +32 ... +320 | 116 ... 500 | 91 ... 900[1)] | 91 ... 900[1)] |
| D20 | 0 ... +200 | +32 ... +392 | 98 ... 500 | 79 ... 900[1)] | 79 ... 900[1)] |
| D30 | 0 ... +300 | +32 ... +572 | 150 ... 500 | 88 ... 900[1)] | 88 ... 900[1)] |
| D40 | 0 ... +400 | +32 ... +752 | 150 ... 500 | 150 ... 900 | 150 ... 900 |
| D50 | 0 ... +500 | +32 ... +932 | 150 ... 500 | 150 ... 900 | 150 ... 900 |
| D60 | 0 ... +600[2)] | +32 ... +1112[2)] | 150 ... 500 | 150 ... 900 | 150 ... 900 |

[1)] Special minimum bulb lengh S is available on request, against add-on price, only for sliding and swivel nuts (Code7 and 9)
[2)] Max. working temperature 500 °C (932 °F)



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**Order Details** (Example: **TBE-1 1 C16 3 A 7 R10**)

| Model | Connection orientation | Nominal diameter | Indication range | Connection type | Process connection** | Bulb diameter | Options |
|---|---|---|---|---|---|---|---|
| TBE- | **1** = back connection<br>**2** = every-angle connection<br>**3** = lower connection | **1** = 100 mm<br>**2** = 125 mm<br>**3** = 150 mm | **C55**: -50 ... +50 °C<br>**C35**: -30 ... +50 °C<br>**C14**: -20 ... +120 °C<br>**C24**: -20 ... +40 °C<br>**C28**: -20 ... +80 °C<br>**C06**: 0 ... +60 °C<br>**C08**: 0 ... +80 °C<br>**C10**: 0 ... +100 °C<br>**C12**: 0 ... +120 °C<br>**C16**: 0 ... +160 °C<br>**C20**: 0 ... +200 °C<br>**C25**: 0 ... +250 °C<br>**C30**: 0 ... +300 °C<br>**C40**: 0 ... +400 °C<br>**C50**: 0 ... +500 °C<br>**C60**: 0 ... +600 °C*<br>**F11**: -80 ... +120 °F<br>**F55**: -20 ... +120 °F<br>**F12**: 0 ... +200 °F<br>**F14**: 0 ... +250 °F<br>**F21**: +50 ... +400 °F<br>**F30**: +50 ... +550 °F<br>**F27**: +200 ... +700 °F<br>**F40**: +100 ... +800 °F<br>**FHF**: +200 ... +1000 °F*<br>**D55**: -50 ... +50 °C/-58 ... +122 °F<br>**D35**: -30 ... +50 °C/-22 ... +122 °F<br>**D22**: -20 ... +120 °C/-4 ... +248 °F<br>**D06**: 0 ... +60 °C/+32 ... +140 °F<br>**D10**: 0 ... +100 °C/+32 ... +212 °F<br>**D12**: 0 ... +120 °C/+32 ... +248 °F<br>**D16**: 0 ... +160 °C/+32 ... +320 °F<br>**D20**: 0 ... +200 °C/+32 ... +392 °F<br>**D30**: 0 ... +300 °C/+32 ... +572 °F<br>**D40**: 0 ... +400 °C/+32 ... +752 °F<br>**D50**: 0 ... +500 °C/+32 ... +932 °F<br>**D60**: 0 ... +600 °C/+32 ... +1112 °F* | **3** = fixed male<br>**5** = male swivel nut<br>**9** = sliding male and swivel nut<br>**8** = female swivel nut<br>**7** = sliding female and swivel nut | **A** = ½" NPT<br>**B** = ¾" NPT<br>**1** = ½" BSP<br>**2** = ¾" BSP | **6** = 6 mm<br>**7** = 6.4 mm<br>**8** = 8 mm<br>**9** = 9.6 mm | **000** = none<br>**Other options** = see options table |

* Max. working temperature 500 °C (932 °F)
** Not all connection sizes are possible with all connection types. See page 6 for possible combinations

***Note:*** *Specify bulb length in clear text while ordering*

***Important!*** *Minimum order quantity per order (PO): 5 pieces*



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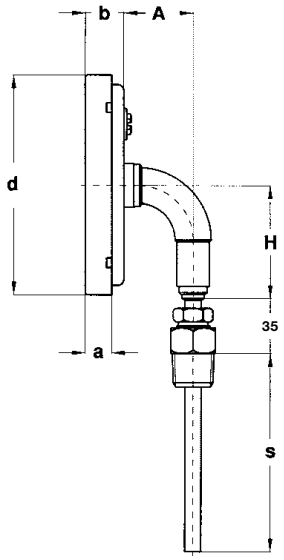
## Options

| Description | Code | DS100 | DS125 | DS150 |
|---|---|---|---|---|
| Case and ring AISI 316 stainless steel | **C40** | yes | yes | yes |
| Protection degree IP65 (without filling) | **E65** | yes | yes | yes |
| Special overtemperature* | **F02** | yes | yes | yes |
| Serial number on label | **ST2** | yes | yes | yes |
| Suitable for glycerine filling IP67 | **P00** | yes | yes | yes |
| Suitable for silicone IP67 | **P01** | yes | yes | yes |
| Glycerine filling (max. +160 °C), IP67 | **R10** | yes | yes | yes |
| Silicone filling (max. +250 °C), IP67 | **R11** | yes | yes | yes |
| Calibration report | **C01** | yes | yes | yes |
| Tropicalisation | **T01** | yes | yes | yes |
| AISI316 stainless steel label for initialing | **T25** | yes | yes | yes |
| Plexiglas window (for ranges from 0 °C ... +100 °C) | **T31** | yes | yes | yes |
| Safety double stratified glass | **T32** | yes | yes | yes |

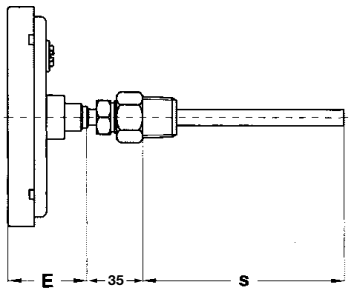
*100% of full range for temperature ≤150 °C
50% of full range for temperature 150 ... 300 °C
max. 500 °C

## **Dimensions** [mm]

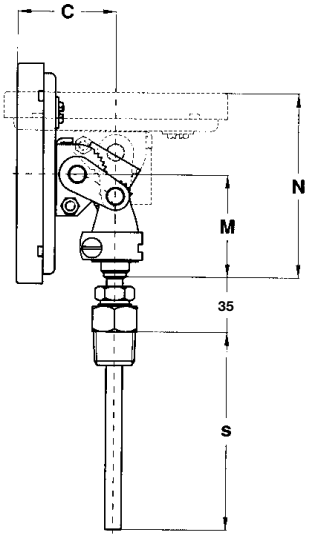
### Connection orientation* (Code 3)




### Connection orientation* (Code 1)




### Connection orientation* (Code 2)




* Connection orientations are shown as an example with connection type code 9.

| DS | A | a | b | C | d | E | H | M | N | S |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 34.5 | 13 | 19 | 49 | 110.6 | 39 | 57 | 51.5 | 92.5 | see page 3 |
| 125 | 34.5 | 14.5 | 19.5 | 49.5 | 130 | 39.5 | 65 | 51.5 | 93 | see page 3 |
| 150 | 34.5 | 15 | 20 | 50 | 161 | 40 | 82 | 51.5 | 93.5 | see page 3 |



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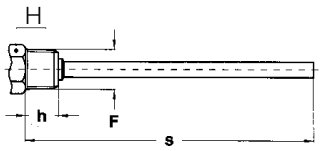
**Dimensions** [mm]
**Process connection**

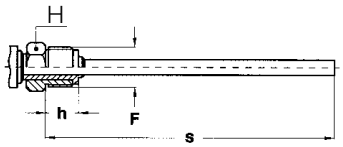
**Fixed male**
**(Code 3)**




| F | Code | H | h |
|---|---|---|---|
| ½" NPT | A | 22* | 17 |
| ½" BSP | 1 | 22* | 14 |

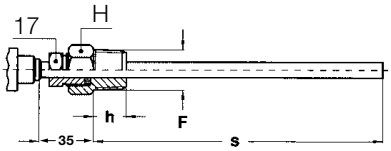
* Ø 24 for every-angle connection (code 2)

**Male swivel nut**
**(Code 5)**



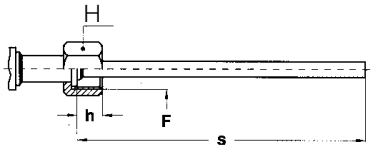

| F | Code | H | h |
|---|---|---|---|
| ½" BSP | 1 | 22 | 17 |
| ¾" BSP | 2 | 27 | 17 |

**Sliding male and swivel nut**
**(Code 9)**



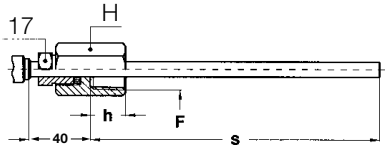

| F | Code | H | h |
|---|---|---|---|
| ½" BSP | 1 | 22 | 14 |
| ½" NPT | A | 22 | 17 |
| ¾" BSP | 2 | 27 | 16 |
| ¾" NPT | B | 27 | 17 |

**Female swivel nut**
**(Code 8)**

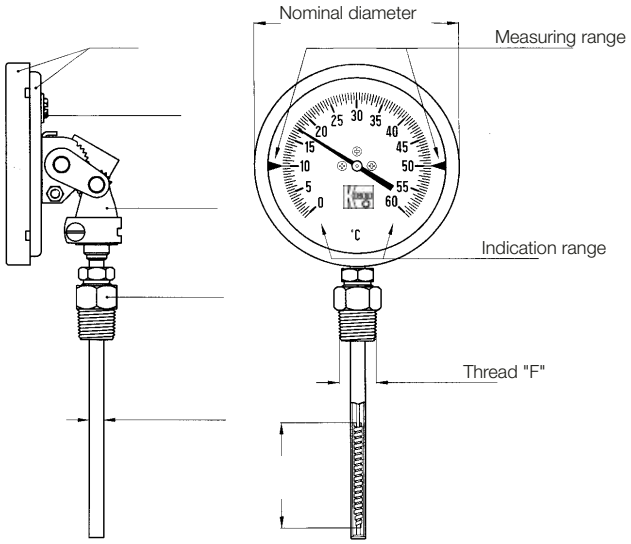



| F | Code | H | h |
|---|---|---|---|
| ½" BSP | 1 | 24 | 13 |
| ¾" BSP | 2 | 30 | 13 |

**Sliding female and swivel nut**
**(Code 7)**




| F | Code | H | h |
|---|---|---|---|
| ½" NPT | A | 24 | 18 |
| ¾" NPT | B | 32 | 18 |




| FIlling liquids | Ambient temperature | Working temperature |
|---|---|---|
| Glycerine 98% | +15 ... +65 °C (+60 ... +150 °F) | +15 ... +160 °C (-60 ... +320 °F) |
| Silicone oil | -45 ... +65 °C (-50 ... +150 °F) | -40 ... +250 °C (-40 ... +480 °F) |

Glycerine and silicone oil must not be used with strongly oxidant agents such as oxygen, chlorine, nitric acid and hydrogen peroxide. It could be dangerous because of spontaneous chemical reactions, inflammability or explosion.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