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# Technical Information
# TAF11, TAF12x, TAF16

## High-temperature thermometer
## With metal or ceramic thermowell

## Adjustable process connection
## Thermocouple sensor types J, K, N, R, S, B

**Field of application**

**TAF11**
Suitable for use in steel processing (heat treatment), in furnaces for concrete and non-ferrous metals. The thermometer comprises a single or double thermocouple insert and a ceramic thermowell.

**TAF12x**
The S/D/T versions are thermometers with single/double/triple ceramic thermowells specially designed for use in applications such as ceramic kilns, brickworks, porcelain production, and the glass industry. They comprise a single or double thermocouple insert in a ceramic insulator.

**TAF16**
Suitable for use in cement production, steel processing, combustion furnaces and fluidised bed furnaces. The TAF16 comprises a single or double thermocouple insert and a metal or ceramic thermowell.

**Process temperatures:**
- TAF11 up to +1 600 °C (+2 912 °F)
- TAF12x up to +1 700 °C (+3 092 °F)
- TAF16 up to +1 700 °C (+3 092 °F)

**Your benefits**

- Long operating life due to the use of innovative thermowell materials with increased wear resistance and chemical resistance
- Long-term stable measurement thanks to sensor protection with non-porous materials
- Flexible product selection thanks to modular design
- Optimized lifecycle costs through replaceable spare parts

Endress+Hauser
People for Process Automation

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# About this document

## Safety symbols

**DANGER**
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

**WARNING**
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

**CAUTION**
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

**NOTICE**
This symbol contains information on procedures and other facts which do not result in personal injury.

## Symbols in graphics

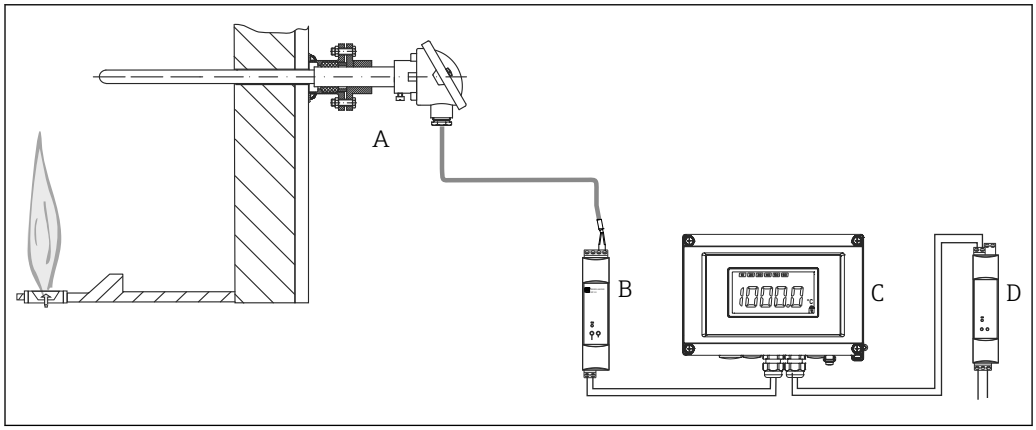
| Symbol | Meaning | Symbol | Meaning |
|---|---|---|---|
| **1, 2, 3,...** | Item numbers | 1., 2., 3.... | Series of steps |
| **A, B, C, ...** | Views | **A-A, B-B, C-C, ...** | Sections |
|  | Hazardous area |  | Safe area (non-hazardous area) |

# Function and system design

**Measuring principle**

Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors are subjected to a thermal gradient. This voltage is called thermoelectric voltage or electromotive force (emf). Its magnitude depends on the type of conducting materials and the temperature difference between the "measuring point" (the junction of the two conductors) and the "cold junction" (the open conductor ends). Accordingly, thermocouples primarily only measure differences in temperature. The absolute temperature at the measuring point can be determined from these if the associated temperature at the cold junction is known or is measured separately and compensated for. The material combinations and associated thermoelectric voltage/temperature characteristics of the most common types of thermocouple are standardized in the IEC 60584 and ASTM E230/ANSI MC96.1 standards.

**Measuring system**




*1 Application example*

A Thermometer from the TAF series, installed in the chamber wall of a combustion furnace

B Temperature transmitter iTEMP® DIN rail TMT12x. The two-wire transmitter records the measuring signals of the thermometer and converts them into an analog 4 to 20 mA measuring signal.

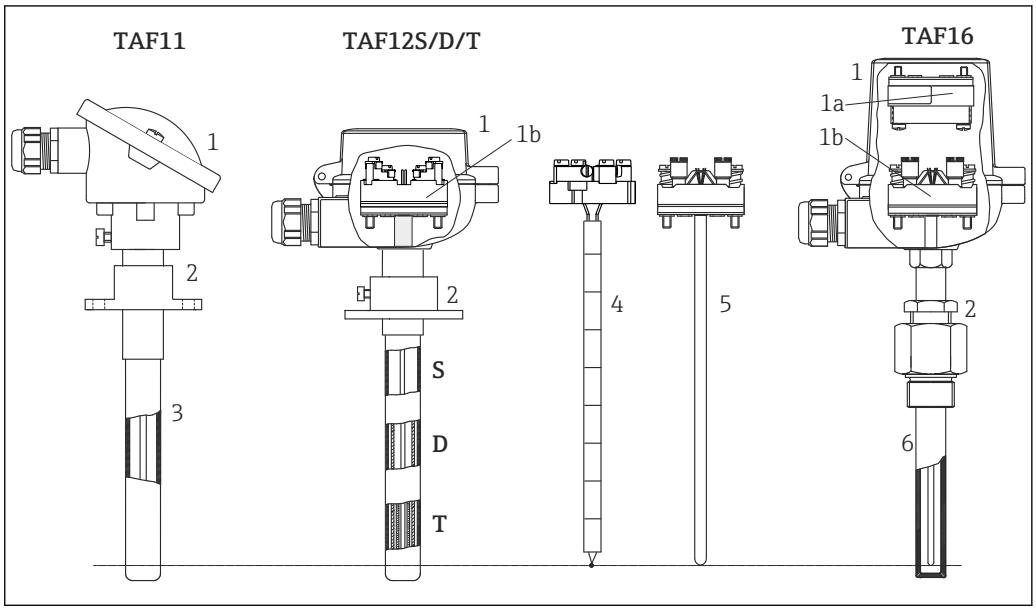
C RIA16 field indicator

The indicator records the analog measuring signal from the head transmitter and shows this on the display. The LC display shows the current measured value in digital form and as a bar graph indicating a limit value violation. The indicator is looped into the 4 to 20 mA circuit and gets the required energy from there. More information on this can be found in the Technical Information (see "Supplementary Documentation").

D RN series active barrier

The RN series active barrier (24 V DC, 30 mA) has a galvanically isolated output for powering 2-wire transmitters. The universal power supply works with an input supply voltage of 20 to 250 V DC/AC, 50/60 Hz, which means that it can be used in all international power grids. More information on this can be found in the Technical Information (see "Supplementary Documentation").

## Equipment architecture




*2 Thermometer designs for high-temperature applications*

*1 Terminal head DIN A (see left side) or DIN B (see, for example, right side) with the following available electrical connections:*
*1a Connection socket DIN B with head transmitter (only in terminal heads with high cover)*
*1b Terminal block (DIN B) or flying leads (only for MgO-insulated insert)*
*2 Available process connections: stop flange according to DIN EN 50446, adjustable flange, or gas-tight compression fitting*
*3 Ceramic thermowell (external sheath for TAF11)*
*4 TPC200 insert with ceramic insulation*
*5 TPC100 insert with MgO-insulation and metal sheath, selectable for TAF11 and TAF16*
*6 Metal or ceramic thermowell for TAF16*
*S Single ceramic thermowell (external sheath for TAF12)*
*D Double ceramic thermowell, external and internal sheath for TAF12*
*T Triple ceramic thermowell, external, middle and internal sheath for TAF12*

The high-temperature thermometers of the TAF series are manufactured in accordance with the international standard DIN EN 50446. These products comprise an insert, a thermowell, a metal sleeve (only TAF11/TAF12x) and a terminal head with a transmitter or terminal block for electrical connection.

### Insert

The measuring point of the thermocouple is located at the tip of the insert. The measuring ranges → 📄 6 and permitted limit value deviations of the thermoelectric voltages from the standard characteristic → 📄 9 vary depending on the type of thermocouple used. The thermocouple wires are embedded in suitable high-temperature ceramic insulators or in a mineral-insulated insert.

### Thermowell

Two types of thermowells are used for these thermometers:
- Metal thermowells made from pipe or barstock
- Ceramic thermowells

The selection of thermowell materials depends primarily on the following material properties, which directly affect the sensor's operating life:

- Hardness
- Chemical resistance
- Maximum operating temperature
- Wear/abrasion resistance
- Brittleness
- Porosity to process gases
- Creep resistance

Ceramic materials are usually used for high-temperature ranges and - due to their hardness - in processes with high wear rates. If these materials are subjected to significant mechanical stress in the process, particular attention must be paid to their brittleness. If porous ceramic materials are

used as the outer protective sheath, an additional non-porous inner protective sheath is required. This protects the sensor elements from contamination, which could otherwise cause temperature drift.

Metal alloys offer higher mechanical strength, but are less resistant to high temperatures and abrasion. Since metal alloys are non-porous, no additional internal protective sheath is required.

**Metal sleeve and process connection**

The TAF11 and TAF12 ceramic thermowells are mounted in a metal sleeve, which connects them to the terminal head. Due to the higher mechanical strength, the process connection is also attached to the metal sleeve. The sleeve dimensions and material type depend on the process temperatures and the immersion length of the ceramic thermowells.

All high-temperature thermometers are available with adjustable flange, stop flanges, or gas-tight compression fittings.

# Input

**Measured variable**

Temperature (temperature-linear transmission behavior)

**Measuring range**

| Input | Designation | Measuring range limits [1] | Min. measuring span |
|---|---|---|---|
| Thermocouples (TC) as per IEC 60584, part 1 - using an Endress +HauseriTEMP® temperature head transmitter | Type J (Fe-CuNi)<br>Type K (NiCr-NiAl)<br>Type N (NiCrSi-NiSi)<br>Type S (PtRh10-Pt)<br>Type R (PtRh13-Pt)<br>Type B (PtRh30-PtRh6) | typ. −200 to +1 200 °C (−328 to +2 192 °F)<br>typ. −200 to +1 372 °C (−328 to +2 502 °F)<br>typ. −270 to +1 300 °C (−454 to +2 372 °F)<br>typ. 0 to +1 768 °C (+32 to +3 214 °F)<br>typ. −50 to +1 768 °C (−58 to +3 214 °F)<br>typ. +40 to +1 820 °C (+104 to +3 308 °F) | 50K<br>50K<br>50K<br>500K<br>500K<br>500K |
| | ▪ Internal cold junction (Pt100)<br>▪ Cold junction accuracy: ± 1 K<br>▪ Max. sensor resistance 10 kΩ | | |
| Thermocouples (TC) [2] - flying leads - according to IEC 60584 | Type J (Fe-CuNi)<br>Type K (NiCr-NiAl)<br>Type N (NiCrSi-NiSi)<br>Type S (PtRh10-Pt)<br>Type R (PtRh13-Pt)<br>Type B (PtRh30-PtRh6) | −210 to +1 200 °C (−346 to +2 192 °F), typ. sensitivity ≈ 55 µV/K<br>−270 to +1 300 °C (−454 to +2 372 °F), typ. sensitivity ≈ 40 µV/K<br>−270 to +1 300 °C (−454 to +2 372 °F), typ. sensitivity ≈ 40 µV/K<br>0 to +1 768 °C (+32 to +3 214 °F), typ. sensitivity ≈ 11 µV/K<br>−50 to +1 768 °C (−58 to +3 214 °F), typ. sensitivity ≈ 13 µV/K<br>0 to +1 820 °C (+32 to +3 308 °F), typ. sensitivity ≈ 9 µV/K | |

1) For defined ranges, see the corresponding Technical Information → 🖹 23 of the head transmitter.
2) Typical sensitivity above 0 °C (+32 °F)

# Output

**Output signal**

Generally, the measured value can be transmitted in one of two ways:

- Directly-wired sensors - sensor measured values forwarded without an iTEMP transmitter
- Via all common protocols by selecting an appropriate Endress+Hauser iTEMP transmitter All the iTEMP transmitters listed below are mounted directly in the terminal head and wired with the sensory mechanism.

**Family of temperature transmitters**

Thermometers fitted with iTEMP transmitters are an installation-ready complete solution to improve temperature measurement by significantly increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

**4 to 20 mA head transmitters**
They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP transmitters can be configured quickly and easily at a PC. Endress+Hauser offers free configuration software which can be downloaded from the Endress+Hauser Website.

**HART® head transmitters**
The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART® communication. Swift and easy operation, visualization and maintenance using universal configuration software like FieldCare, DeviceCare or FieldCommunicator 375/475. Integrated Bluetooth® interface for the wireless display of measured values and configuration via Endress +Hauser SmartBlue (app), optional.

**PROFIBUS® PA head transmitters**
Universally programmable head transmitter with PROFIBUS® PA communication. Conversion of various input signals into digital output signals High measurement accuracy over the complete operating temperature range PROFIBUS PA functions and device-specific parameters are configured via fieldbus communication.

**FOUNDATION Fieldbus™ head transmitters**
Universally programmable head transmitter with FOUNDATION Fieldbus™ communication Conversion of various input signals into digital output signals High measurement accuracy over the complete operating temperature range All transmitters are approved for use in all the main process control systems. The integration tests are performed in Endress+Hauser's 'System World'.

**Head transmitter with PROFINET® and Ethernet-APL**
The temperature transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using the PROFINET® protocol. Power is supplied via the 2-wire Ethernet connection according to IEEE 802.3cg 10Base-T1. The transmitter can be installed as an intrinsically safe electrical apparatus in Zone 1 hazardous areas. The device can be used for instrumentation purposes in the terminal head form B (flat face) according to DIN EN 50446.

**Head transmitter with IO-Link®**
The temperature transmitter is an IO-Link® device with a measurement input and an IO-Link® interface. It offers a configurable, simple and cost-effective solution thanks to digital communication via IO-Link®. The device is mounted in a terminal head form B (flat face) as per DIN EN 5044.

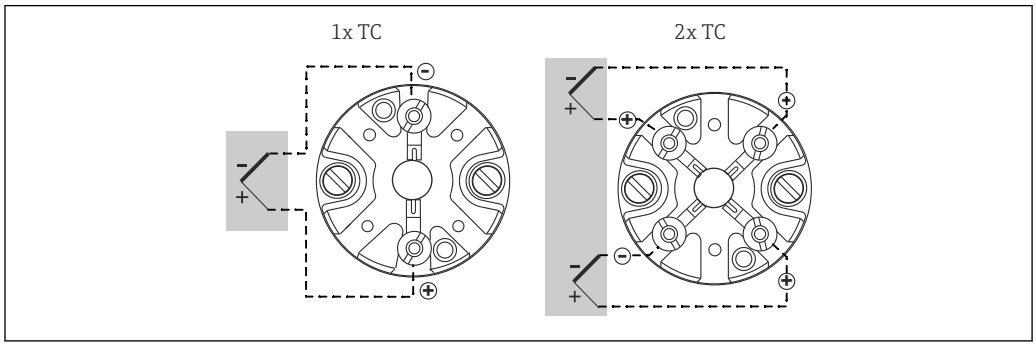
Advantages of the iTEMP transmitters:
- Double or single sensor input (optionally for certain transmitters)
- Attachable display (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions
- Sensor-transmitter-matching based on the Callendar van Dusen coefficients (CvD).

**Field transmitter**
Field transmitter with HART®, FOUNDATION Fieldbus™ or PROFIBUS® PA communication and backlighting. Can be read easily from a distance, in sunlight and at night. Large measurement value format, bar graphs and faults are displayed. The benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematical functions, thermometer drift monitoring and sensor back-up functionality, corrosion detection.

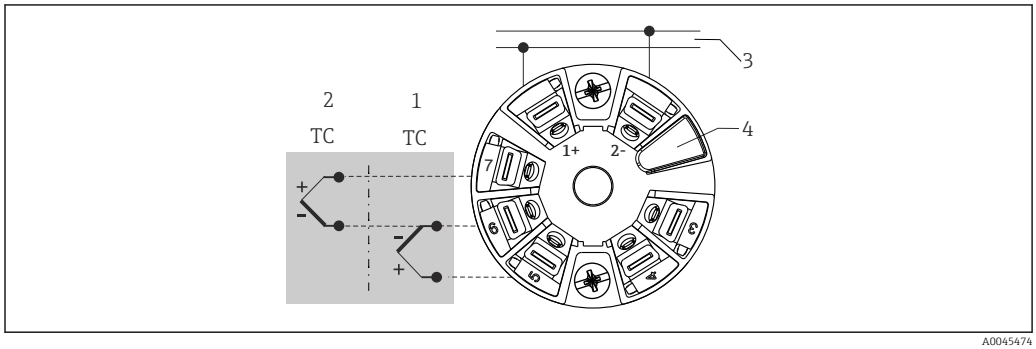
# Power supply

## Terminal assignment

### Thermocouple (TC) sensor connection type




*3 Installed ceramic terminal block for thermocouples.*




*4 Head-mounted iTEMP TMT8x transmitter (dual sensor input)*

*1 Sensor input 1*
*2 Sensor input 2*
*3 Fieldbus connection and power supply*
*4 Display connection*

*Thermocouple wire colors*

| As per IEC 60584 | As per ASTM E230 |
|---|---|
| ▪ Type J: black (+), white (-)<br>▪ Type K: green (+), white (-)<br>▪ Type N: pink (+), white (-) | ▪ Type J: white (+), red (-)<br>▪ Type K: yellow (+), red (-)<br>▪ Type N: orange (+), red (-) |

# Performance characteristics

## Reference operating conditions

### Ambient temperature

| Terminal head | Temperature in °C (°F) |
|---|---|
| Without mounted head transmitter | Depends on the terminal head used and the cable gland; see chapter "Terminal heads" → 13. |
| With mounted head transmitter | –40 to 85 °C (–40 to 185 °F) |

### Process pressure

Material-dependent.

Available process connections can be up to 1 bar gas-tight.

### Permitted flow velocity depending on the immersion length

Depends on material and application For process pressures ≥ 1 bar and a flow velocity ≥ 1 m/s, it is recommended to request a thermowell load calculation. Please contact your local Endress+Hauser sales organization for assistance.

### Shock and vibration resistance

Applicable to MgO-insulated measuring inserts: 4 g/2 to 150 Hz in accordance with IEC 60068-2-6

## Measurement accuracy

Permissible limits of deviation of the thermoelectric voltages from the standard curve for thermocouples according to IEC 60584:

| Standard | Type | Standard tolerance | | Special tolerance | |
|---|---|---|---|---|---|
| | | Class | Deviation | Class | Deviation |
| IEC 60584 | J (Fe-CuNi) | 2 | ±2.5 °C (-40 to 333 °C) ±0.0075 \|t\| [1)] (333 to 750 °C) | 1 | ±1.5 °C (-40 to 375 °C) ±0.004 \|t\| [1)] (375 to 750 °C) |
| | K (NiCr-NiAl) | 2 | ±2.5 °C (-40 to 333 °C) ±0.0075 \|t\| [1)] (333 to 1200 °C) | 1 | ±1.5 °C (-40 to 375 °C) ±0.004 \|t\| [1)] (375 to 1000 °C) |
| | N (NiCrSi-NiSi) | 2 | | 1 | |
| | R (Ptrh13-Pt) and S (Ptrh10-Pt) | 2 | ±1.5°C (0 to 600°C) ±0.0025 \|t\| [1)] (600 to 1600 °C) | 1 | ±1°C (0 to 1100°C) ±[1 + 0.003(\|t\| [1)] -1100)] (1100°C to 1600 °C) |
| | S (PtRh13-Pt) | 2 | | 1 | |
| | B (PtRh30-PtRh6) | 2 | ±1.5 °C or ±0.0025 \|t\| [1)] (600 to 1700 °C) | - | - |

1) |t| = absolute temperature value in °C

Thermocouples made of non-precious metals are generally supplied such that they meet the manufacturing tolerances for temperatures ≥ −40 °C (−40 °F). These materials are generally not suitable for temperatures ≤ −40 °C (−40 °F). The tolerances of Class 3 cannot be met. A special material selection is required for this temperature range. This cannot be handled via the standard product.

## Response time

| Thermometer sensing element | Response time [1)] for rapid temperature changes around 1000 °C (1832 °F) in still air | |
|---|---|---|
| TAF12T with Ø26/Ø14/Ø9 mm triple ceramic thermowell (material C530+C610) | t50<br>t90 | 195 s<br>500 s |

1) ~For TC insert without transmitter.

## Insulation resistance

Insulation resistance between the terminals and the extension neck is measured with a voltage of 500 V DC.

Insulation resistance ≥ 1000 MΩ at ambient temperature 25 °C (77 °F).

Insulation resistance ≥ 5 MΩ at 500 °C (932 °F).

For TAF16 with 6 mm (0.24 in) mineral-insulated inserts, the DIN EN 61515 standard is applied.

## Calibration

Endress+Hauser provides comparison temperature calibration from −80 to +1400 °C (−110 to 2552 °F) based on the International Temperature Scale (ITS90). Calibrations are traceable to national and international standards. The calibration certificate is referenced to the serial number of the thermometer. Only the insert is calibrated. Thermometers without replaceable inserts are calibrated completely - from the process connection to the tip of the thermometer.

| | Minimum insertion length of insert in mm (in) | |
|---|---|---|
| Temperature range | Without head transmitter | With head transmitter |
| −80 to +80 °C (−112 to +176) | No minimum insertion length required | |

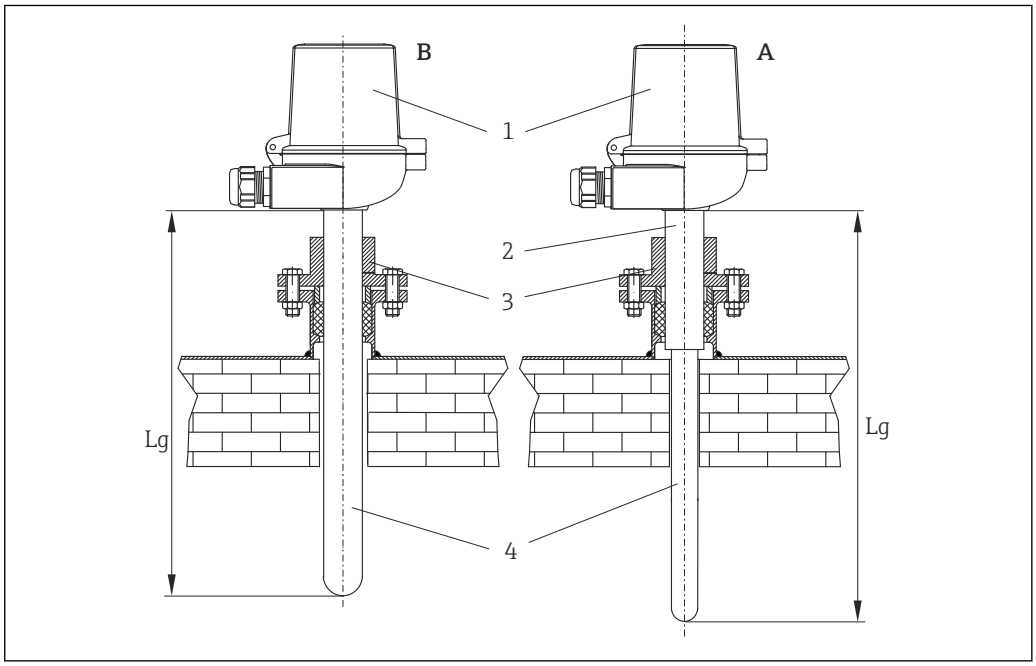
| | Minimum insertion length of insert in mm (in) | |
|---|---|---|
| +81 to +250 °C (+177 to +482) | No minimum insertion length required | 50 mm (1.97 in) |
| 250 to 550 °C (480 to 1 020 °F) | 300 mm (11.81 in) | |
| 550 to 1 400 °C (1 020 to 2 552 °F) | 450 mm (17.75 in) | |

# Installation

**Orientation**

Vertical and horizontal installation Vertical installation is recommended, as the metal thermowells would otherwise bend or the ceramic thermowells can be irreversibly damaged due to the brittleness of the material when struck by falling parts.

**Installation instructions**




5 *Examples of vertical thermometer installation*

*A TAF11 and TAF12x with ceramic sheath thermowell*
*B TAF16 with metal or ceramic sheath thermowell*
*1 Terminal head*
*2 Metal sleeve*
*3 Stop flange according to DIN EN 50446*
*4 Thermowell*
*Lg Immersion length*

Recommended maximum immersion length Lg for horizontal installation:

- 1 500 mm (59 in) For diameter > 20 mm (0.8 in)
- 1 200 mm (47.3 in) For diameter < 20 mm (0.8 in)

In the case of horizontal orientation in a high-temperature environment, the thermowell may bend or break irreversibly under its own weight.

### Installation of ceramic sheaths

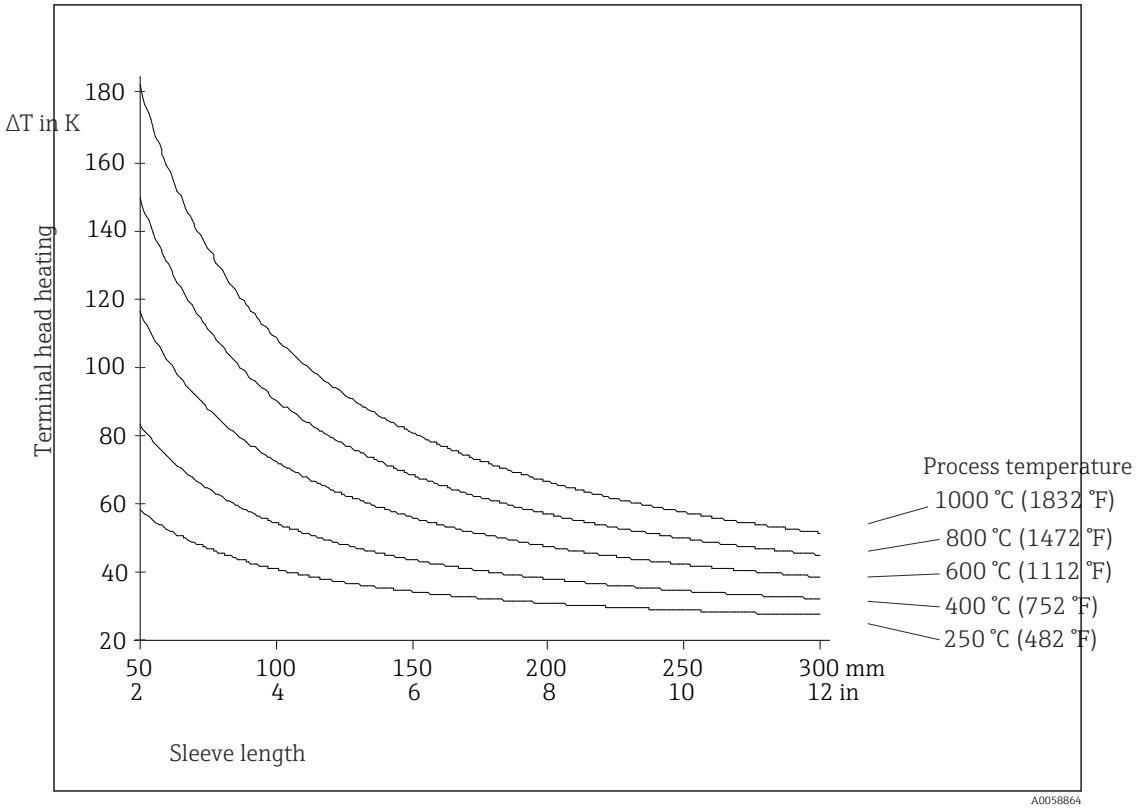
Gas-tight ceramic thermowells and inserts are sensitive to rapid temperature changes. To reduce the risk of thermal shock and to protect the ceramics from cracking, gas-tight ceramic sheaths must be preheated before installation. There are two possibilities to do so:

- Installation with preheating
  For process temperatures ≥ 1 000 °C (1 932 °F) the ceramic part of the thermowell must be preheated from room temperature to 400 °C (752 °F). It is recommended to use a horizontal cylindrical tube furnace or to heat the ceramic part with electric heating elements. Do not expose the ceramic sheath to direct flames.
  It is also advisable to preheat the ceramic sheath on-site and then insert it directly. The thermowell or insert must be installed carefully to avoid mechanical shocks, at an insertion speed of 100 mm/min. If preheating cannot be carried out near the system, the insertion speed must be reduced to 30 mm/min due to cooling during transport.
- Installation without preheating
  The insert must be installed at the process operating temperature in such a way that the ceramic sheath is inserted into the system to a depth corresponding to the wall thickness, including insulation material. The insert must remain in this position for 2 hours. Afterwards, the insert must be inserted, avoiding mechanical shocks, at an insertion speed of 30 mm/min.
  For process temperatures < 80 °C (176 °F) the insertion speed can be disregarded. Any kind of shock or collision between the ceramic sheath and system components must be avoided.

**Sleeve length**

The sleeve is the part between the process connection and the terminal head.

As illustrated in the following diagram, the sleeve length influences the temperature in the terminal head. This temperature must remain within the limit values defined in the "Operating conditions" section.




*6 Heating of the terminal head as a function of the process temperature. Temperature in terminal head = ambient temperature 20 °C (68 °F)+ ΔT*

Diameter of sleeve = ¾" schedule 40

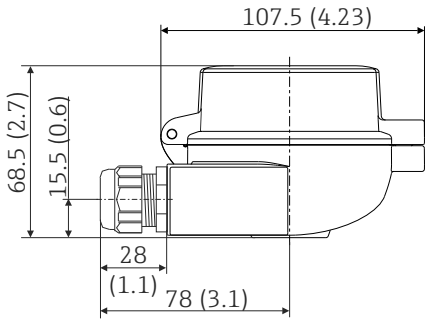
# Mechanical construction

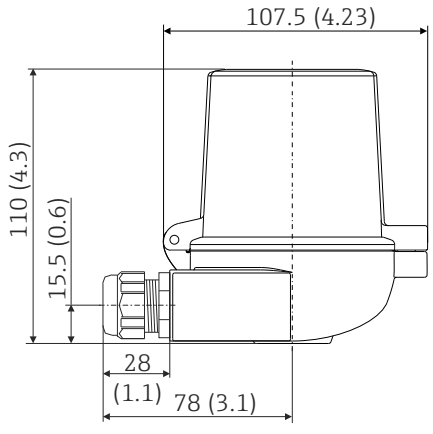
**Terminal heads**

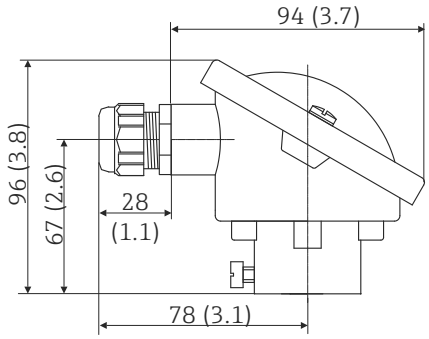
The terminal heads have an internal geometry in accordance with DIN EN 50446, typically in Form B, and a thermometer connection with M24×1.5 or ½" NPT thread. All dimensions in mm (in). The sample cable glands in the diagrams correspond to M20x1.5 connections with non-Ex polyamide cable glands. Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see the "Environment" section.

As a special feature, Endress+Hauser offers terminal heads with optimized terminal accessibility for easy installation and maintenance.

IP 68 = 1.83 m (6 ft), 24 h, with cable gland without cable (with plug), type 6P as per NEMA250-2003

| TA30A | Specification |
|---|---|
|  | ▪ Degree of protection:<br>▪ IP66/68 (NEMA Type 4x encl.)<br>▪ For ATEX: IP66/67<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland<br>▪ Material: aluminum, polyester powder coated<br>Seals: silicone<br>▪ Threaded cable entry: G ½", NPT ½" and M20x1.5;<br>▪ Color of head: blue, RAL 5012<br>▪ Color of cap: gray, RAL 7035<br>▪ Weight: 330 g (11.64 oz)<br>▪ Ground terminal, internal and external<br>▪ Available with sensors with 3-A® symbol |

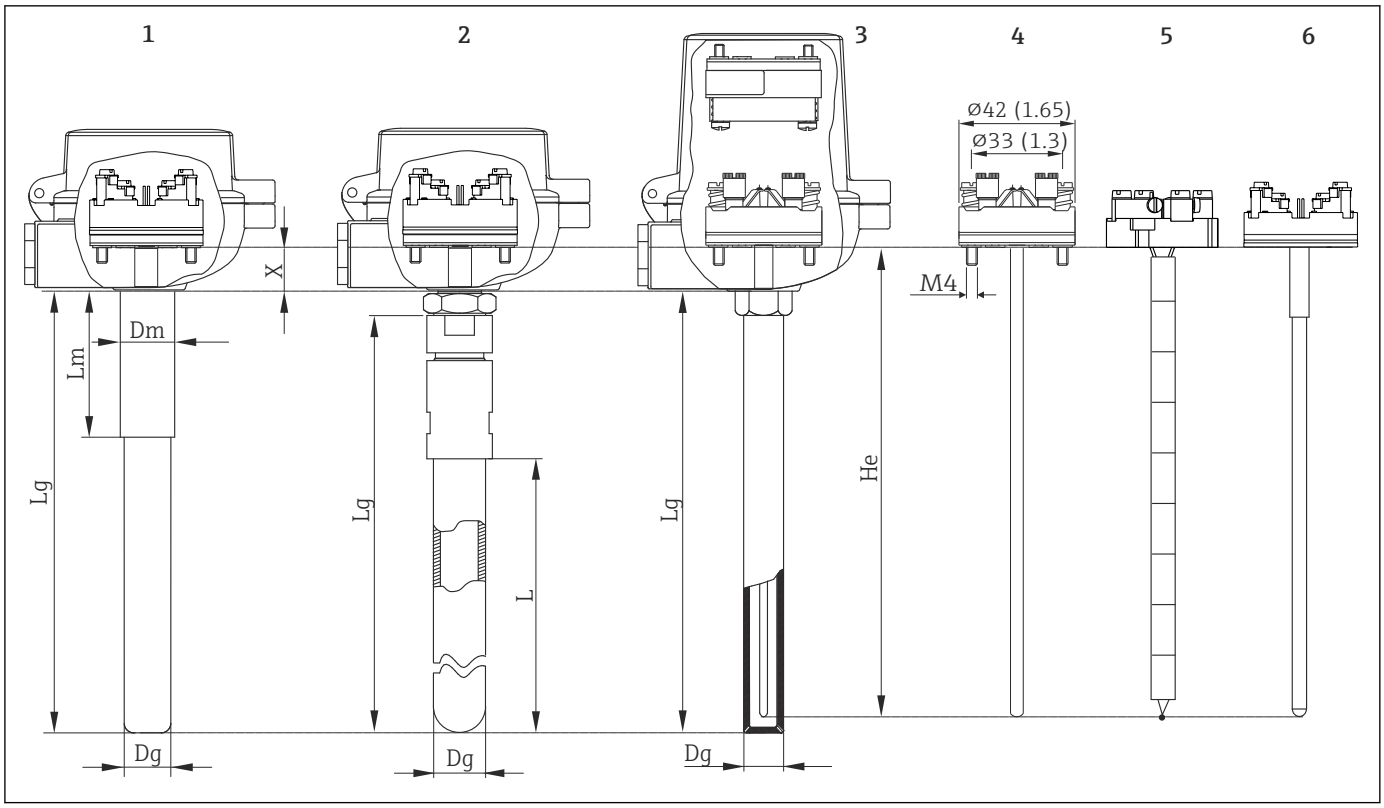
| TA30D | Specification |
|---|---|
|  | ▪ Degree of protection:<br>▪ IP66/68 (NEMA Type 4x encl.)<br>▪ For ATEX: IP66/67<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland<br>▪ Material: aluminum, polyester powder coated<br>Seals: silicone<br>▪ Threaded cable entry: G ½", NPT ½" and M20x1.5<br>▪ Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert.<br>▪ Color of head: blue, RAL 5012<br>▪ Color of cap: gray, RAL 7035<br>▪ Weight: 390 g (13.75 oz)<br>▪ Ground terminal, internal and external<br>▪ Available with sensors with 3-A® symbol |

| DIN A | Specification |
|---|---|
|  | ▪ Degree of protection: IP66<br>▪ Max. temperature: 130 °C (266 °F)<br>▪ Material: aluminum, polyester powder coated<br>Seals: CR (neoprene® rubber)<br>▪ Cable entry thread: G ½"<br>▪ Head and cap color: white, RAL 9006<br>▪ Weight: 270 g (9.52 oz) |

| Maximum ambient temperatures for cable glands | |
|---|---|
| **Type** | **Temperature range** |
| Cable gland ½" NPT, M20x1.5 (non Ex) | −40 to +100 °C (−40 to 212 °F) |
| Cable gland M20x1.5 (for dust ignition-proof area) | −20 to +95 °C (−4 to 203 °F) |

**Design, dimensions**

All dimensions in mm (in).




A0058234

*1 TAF11/TAF12*
*2 TAF16 with SiN thermowell*
*3 TAF16 with metal thermowell*
*4 TPC100: mineral-insulated (MgO powder) insert, metal sheath and mounted terminal block (DIN B) for TC types J, K and N*
*5 TPC200: Segmented, ceramic-insulated insert with mounted terminal block (DIN B) for TC types J and K*
*6 TPC200: Ceramic-insulated insert with mounted terminal block for TC types B, R and S*
*Lg Immersion length*
*L Usable immersion length, L = Lg - 97 mm (3.82 in)*
*Lm Sleeve length*
*Dg Thermowell diameter*
*Dm Sleeve diameter = 33.4 mm (1.31 in)*
*He Installed length of insert; for TAF16 simplified: He = Lg + 80 mm (3.15 in), for measuring insert replacement: He = Lg + X*
*X Additional length; see the following table.*

For cases where the insert is replaced, the following table must be observed. The insert length is calculated from the total length of the thermowell (Lg) and a specific additional length (X) that depends on the type of thermowell. Dimensions in mm (in).

| **Calculation rules for measuring insert length (He = Lg + X)** | | | | | | |
|---|---|---|---|---|---|---|
| **Material** | **Insert TPC 200** | | **Insert TPC100, MgO-insulated** | | | |
| | | | Without internal ceramic sheath 14x10 (contact with tip) | | With internal ceramic sheath 14x10 (-10 mm) | |
| | Terminal head DIN A (41 mm) | Terminal head DIN B (26 mm) | Terminal head DIN A (41 mm) | Terminal head DIN B (26 mm) | Terminal head DIN A (41 mm) | Terminal head DIN B (26 mm) |
| TAF11 thermowell: | | | | | | |
| C610 + sleeve | Lg + 30 (1.2) | Lg + 15 (0.6) | Lg + 30 (1.2) | Lg + 15 (0.6) | - | - |
| Sintered silicon carbide SIC + sleeve | Lg + 20 (0.8) | Lg + 5 (0.2) | Lg + 20 (0.8) | Lg + 5 (0.2) | - | - |
| Special silicon nitride ceramic SiN + sleeve | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 25 (1.0) | Lg + 10 (0.4) | - | - |
| TAF16 thermowell: | | | | | | |

| Calculation rules for measuring insert length (He = Lg + X) | | | | | | |
|---|---|---|---|---|---|---|
| Special nickel/cobalt alloy NiCo (metal cap) | Lg + 20 (0.8) | Lg + 5 (0.2) | Lg + 30 (1.2) | Lg + 15 (0.6) | Lg + 20 (0.8) | Lg + 5 (0.2) |
| All metal thermowells, e.g. 310, 446, 316, etc. | Lg + 30 (1.2) | Lg + 15 (0.6) | Lg + 40 (1.57) | Lg + 25 (1.0) | Lg + 30 (1.2) | Lg + 15 (0.6) |
| Thermowell tip made of barstock NiCo and INCOLOY 800HT | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 30 (1.2) | Lg + 15 (0.6) | Lg + 20 (0.8) | Lg + 5 (0.2) |
| Kanthal Super | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 15 (0.6) | Lg + 0 (0) |
| SiN (special silicon nitride ceramic) | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 15 (0.6) | Lg + 0 (0) |
| Kanthal AF | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 40 (1.57) | Lg + 25 (1.0) | Lg + 30 (1.2) | Lg + 15 (0.6) |
| Thermowell made of barstock and INCOLOY 800HT, end thickness : 12 mm | Lg + 20 (0.8) | Lg + 5 (0.2) | Lg + 25 (1.0) | Lg + 10 (0.4) | Lg + 15 (0.6) | Lg + 0 (0) |

During configuration of high-temperature thermometers in the TAF product series, the thermocouple wire diameter must be defined. The higher the temperature, the larger the wire diameter that must be selected. A large wire diameter increases the operating life of the sensor. The insert diameter depends on the internal diameter of the thermowell. If possible, the larger insert diameter is installed, which leads to stable high-temperature measurement.

*Replaceable insert TPC200:*

| Insert version | Wire diameter in mm(in) | Max. temperature according to IEC EN 60584-1 | Max. recommended continuous operating temperature | Insert diameter in mm(in) |
|---|---|---|---|---|
| 1x K, 2x K | 1.63 mm (0.06 in) | 1 200 °C (2 192 °F) | 1 100 °C (2 012 °F) | 8 mm (0.31 in), 12 mm (0.47 in), 14 mm (0.55 in) |
| 1x K, 2x K | 2.3 mm (0.09 in) | | | |
| 1x K, 2x K | 3.26 mm (0.13 in) | | | 12 mm (0.47 in), 14 mm (0.55 in) |
| 1x J, 2x J | 1.63 mm (0.06 in) | 750 °C (1 382 °F) | 700 °C (1 292 °F) | 8 mm (0.31 in), 12 mm (0.47 in), 14 mm (0.55 in) |
| 1x J, 2x J | 2.3 mm (0.09 in) | | | |
| 1x J, 2x J | 3.26 mm (0.13 in) | | | 12 mm (0.47 in), 14 mm (0.55 in) |
| 1x S, 2x S | 0.35 mm (0.014 in) | 1 600 °C (2 912 °F) | 1 300 °C (2 372 °F) | 6 mm (0.24 in), |
| 1x S, 2x S | 0.5 mm (0.02 in) | | 1 500 °C (2 732 °F) | |
| 1x R, 2x R | 0.5 mm (0.02 in) | | | |
| 1x B, 2x B | 0.5 mm (0.02 in) | 1 700 °C (3 092 °F) | 1 600 °C (2 912 °F) | |

*Replaceable insert TPC100:*

| Insert version | MgO sheath material | Max. temperature according to IEC EN 60584-1 | Max. recommended continuous operating temperature | Insert diameter in mm(in) |
|---|---|---|---|---|
| 1x K, 2x K | INCONEL® 600 | 1 100 °C (2 012 °F) | 1 100 °C (2 012 °F) | 6 mm (0.24 in) |
| 1x J, 2x J | INCONEL® 600 | 750 °C (1 382 °F) | 750 °C (1 382 °F) | |
| 1x N, 2x N | Pyrosil® | 1 150 °C (2 102 °F) | 1 150 °C (2 102 °F) | |

**Thermowells**

Diameters of ceramic tubes. Dimensions in mm.

| Version | Order options - sheath material, diameter, max. Length | Outer tube (Ø outer x inner) | Wall thickness | Material | Intermediate tube (Ø outer x inner) | Wall thickness | Material | Inner tube (Ø outer x inner) | Wall thickness | Material |
|---|---|---|---|---|---|---|---|---|---|---|
| TAF11 | AA/AB/AC | 14 x 10 | 2 | C610 | - | - | - | - | - | - |
| | AD/AE/AF | 17 x 13 | 2 | | - | - | - | - | - | - |
| | AG/AH/AJ | 24 x 19 | 2.5 | | 17 x 13 | 2 | - | - | - | - |
| | BA/BB/BC | 17 x 7 | 5 | SiC, sintered | - | - | - | - | - | - |
| | BD/BE/BF/BG/BH/BI | 26.6 x 13 | 6.8 | | - | - | - | - | - | - |
| | CA/CB/CC | 16 x 9 | 3.5 | SiN | - | - | - | - | - | - |
| | CD/CE/CF/CG | 22x12 | 5 | | - | - | - | - | - | - |
| TAF12S | SA/SB/SC/SD/SE / SF | 9 x 6 | 1.5 | C610 or C799 | - | - | - | - | - | - |
| TAF12D | DA/DB/DC | 14 x 10 | 2 | C610 | - | - | - | 9 x 6 | 1.5 | C610 |
| | DD/DE/DF | 15 x 11 | | C799 | - | - | - | 9 x 6 | 1.5 | C799 |
| TAF12T | TA/TB/TC | 26 x 18 | 4 | C530 | 14 x 10 | 2 | C610 | 9 x 6 | 1.5 | C610 |
| | TD/TE/TF | | | | 15 x 11 | 2 | C799 | 9 x 6 | 1.5 | C799 |
| | TG/TH/TJ | 24 x 18 | 3 | C799 | 15 x 11 | 2 | C799 | 9 x 6 | 1.5 | C799 |

**Weight**

From 2 to 30 kg (4.4 to 66.1 lb), depending on the version. Some examples:

- TAF11, length 1000 mm (39.4 in), metal sleeve 100 mm (3.93 in), terminal head DIN B: 2 kg (4.4 lb)
- TAF12S, length 1000 mm (39.4 in), metal sleeve 100 mm (3.93 in), terminal head DIN B: 2 kg (4.4 lb)
- TAF12D, length 1000 mm (39.4 in), metal sleeve 100 mm (3.93 in), terminal head DIN B: 2.5 kg (5.5 lb)
- TAF12T, length 1000 mm (39.4 in), metal sleeve 100 mm (3.93 in), terminal head DIN B: 3 kg (6.6 lb)
- TAF16, length 1000 mm (39.4 in), thermowell 310, D =21.3 mm (0.84 in), terminal head DIN B: 3 kg (6.6 lb)

**Materials**

**Thermowell and ceramic sheath**

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load. The maximum operating temperatures are reduced considerably in cases where process conditions such as high mechanical load occur or in aggressive media.

Endress+Hauser supplies threaded process connections in accordance with DIN/EN and flanges made of stainless steel AISI 316 L (DIN/EN material number 1.4404 or 1.4435). Due to their

temperature stability, the materials 1.4404 and 1.4435 are grouped together in EN 1092-1 Table 18 under 13E0. The chemical composition of the two materials can be identical.

| Designation | Short formula | Recommended max. temperature for continuous use in air | Properties |
|---|---|---|---|
| AISI 316L/ 1.4404 1.4435 | X2CrNiMo17-12-2 X2CrNiMo18-14-3 | 650 °C (1 200 °F) [1] | ▪ Austenitic stainless steel<br>▪ High corrosion resistance in general<br>▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)<br>▪ Increased resistance to intergranular corrosion and pitting<br>▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content |
| AISI 310/ 1.4841 | X15CrNiSi25-20 | 1 100 °C (2 012 °F) | ▪ Austenitic stainless steel<br>▪ Generally good resistance to oxidizing and reducing atmospheres<br>▪ Due to the higher chromium content, good resistance to oxidizing aqueous solutions and neutral salts melting at higher temperatures<br>▪ Only low resistance to sulfur-containing gases |
| AISI 304/ 1.4301 | X5CrNi18-10 | 850 °C (1 562 °F) | ▪ Austenitic stainless steel<br>▪ Suitable for use in water and slightly contaminated wastewater<br>▪ Only resistant to organic acids, salt solutions, sulfates, basic solutions, etc., at relatively low temperatures. |
| AISI 446/ ~1.4762/ ~1.4749 | X10CrAl24 / X18CrNi24 | 1 100 °C (2 012 °F) | ▪ Ferritic, heat resistant, high-chromium stainless steel<br>▪ Very high resistance to sulfurous and low-oxygen gases and salts<br>▪ Very good corrosion resistance under both constant and cyclic temperature stress, and against combustion ash, copper, lead, and zinc smelting<br>▪ Low resistance to gases containing nitrogen |
| INCONEL® 600/ 2.4816 | NiCr15Fe | 1 100 °C (2 012 °F) | ▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures<br>▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water, and much more.<br>▪ Prone to corrosion in ultrapure water<br>▪ Not to be used in sulfur-containing atmospheres |
| INCONEL®601 / 2.4851 | NiCr23Fe | 1 200 °C (2 192 °F) | ▪ Enhanced corrosion resistance at high temperatures due to aluminum content<br>▪ Resistant to oxidation and carburization under stress caused by temperature changes<br>▪ Good resistance to corrosion from molten salts<br>▪ Particularly sensitive to sulfidation |
| INCOLOY® 800HT / 1.4959 | X8NiCrAlTi32-21 | 1 100 °C (2 012 °F) | ▪ A nickel/chromium/iron alloy with the same base composition as INCOLOY ® 800, but with improved long-term temperature resistance due to restricted carbon, aluminium and titanium content<br>▪ Excellent strength and resistance to oxidation and carburization in high-temperature environments<br>▪ Good resistance to stress corrosion cracking, sulfur, internal oxidation, boiler scale formation and corrosion in a wide range of industrial environments. Suitable for sulfur-containing environments |
| Kanthal AF | FeCrAl | 1 300 °C (2 372 °F) | ▪ A ferritic iron/chromium/aluminium alloy for high temperatures<br>▪ High resistance to sulfur-containing, carburizing and oxidizing environments<br>▪ Good hardness and weldability<br>▪ Good form stability at high temperatures<br>▪ Must not be used in chloride-containing atmospheres and nitrogenous gases (cracked ammonia) |

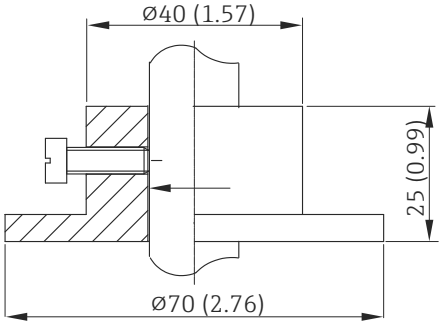
| Designation | Short formula | Recommended max. temperature for continuous use in air | Properties |
|---|---|---|---|
| Special nickel/cobalt alloy | NiCo | 1 200 °C (2 192 °F) | ▪ Excellent resistance to sulfidizing and chlorine-containing environments<br>▪ Outstanding resistance to oxidation, high-temperature corrosion, carburization, metal dusting, and nitriding<br>▪ Good creep resistance<br>▪ Average surface hardness<br>▪ High wear resistance<br>**Recommended applications**<br>▪ Cement industry<br>  ▪ Gas riser pipes: Successfully tested with up to 20 times the operating life compared to AISI310<br>  ▪ Clinker coolers: Successfully tested with up to 5 times the operating life compared to AISI310<br>▪ Waste incineration plants: Successfully tested with up to 12 times the operating life of INCONEL®600 and C276<br>▪ Fluidized bed reactors (biogas reactors): Successfully tested with up to 5 times the operating life of, for example, INCOLOY®800HT or INCONEL®600. |
| Ceramic materials as per DIN VDE0335 | | | |
| C530 | | 1 400 °C (2 552 °F) | ▪ $Al_2O_3$-content approx. 73 - 75%<br>▪ Least expensive porous ceramic material<br>▪ Very resistant to temperature shocks; mainly used as external thermowell |
| C610 | | 1 500 °C (2 732 °F) | ▪ $Al_2O_3$-content approx. 60%, alkali content 3%<br>▪ Most cost-effective, non-porous ceramic material<br>▪ Highly resistant to hydrofluoric acid, thermal shock, and mechanical stress; use for internal and external thermowells as well as insulators |
| C799 | | 1 800 °C (3 272 °F) | ▪ $Al_2O_3$-content approx. 99.7%<br>▪ Can be used for both internal and external thermowells and insulators<br>▪ Resistant to fluorine-containing acids, alkaline vapors, and oxidizing, reducing, and neutral atmospheres, as well as changes in temperature<br>▪ This material is very pure, with very low porosity (gas-tight) compared to other ceramic types. |
| Sintered silicon carbide | SiC | 1 650 °C (3 000 °F) | ▪ High resistance to thermal shocks due to its porosity<br>▪ Good thermal conductivity<br>▪ Very hard and stable at high temperatures<br>**Recommended applications**<br>▪ Glass industry: glass feeders, float glass fabrication<br>▪ Ceramic industry<br>▪ Industrial ovens |
| Kanthal Super | $MoSi_2$ with a glass-phase component | 1 700 °C (3 092 °F) | ▪ High resistance to thermal shocks<br>▪ Very low porosity (< 1%) and very high hardness<br>▪ Must not be used in environments containing chlorine or fluorine compounds<br>▪ Not suitable for applications where the material is exposed to mechanical impact<br>▪ Must not be used in powder applications |
| Special silicon nitride ceramic | SiN | 1 400 °C (2 552 °F) | ▪ Excellent wear resistance and resistance to thermal shocks<br>▪ No porosity<br>▪ Rapid heat reaction<br>**Recommended applications**<br>▪ Cement industry<br>  ▪ Cyclone preheaters: Successfully tested with up to 5 times the operating life compared to AISI310<br>  ▪ Secondary air ducts<br>▪ In general, any application with extremely aggressive conditions, where mechanical impact/shock must be absorbed due to brittleness |

1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Please contact your Endress+Hauser Sales Center for further information.

## Process connections

**Version**

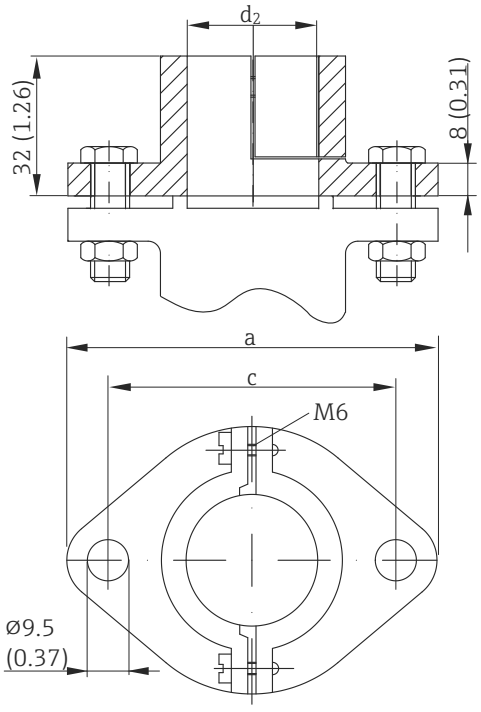
Adjustable flange




- Maximum temperature: +350 °C (+662)
- Material: Aluminum
- Internal diameter dependent on diameter of the metal sleeve (TAF11 and TAF12) or thermowell (TAF16)
- Not gas-tight

| Inner diameter in mm (in): | Accessory order number: |
|---|---|
| 22 mm (0.87 in) | 71217094 |
| 14.5 mm (0.57 in) | 71217093 |

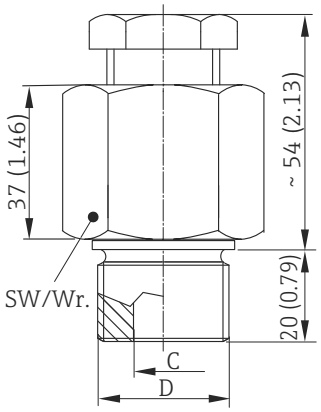
Stop flange according to DIN EN 50446




- Maximum temperature: +400 °C (+752)
- Material: cast iron
- Not gas-tight
- Counterflange and seal are not included in the delivery.

| $d_2$ in mm (in) | a in mm (in) | c in mm (in) | Clampable sleeve diameter in mm (in): | Accessory order number: |
|---|---|---|---|---|
| 23 mm (0.91 in) | 90 mm (3.54 in) | 70 mm (2.76 in) | 21 to 22 mm (0.83 to 0.87 in) | 60000516 |
| 34 mm (1.34 in) | 90 mm (3.54 in) | 70 mm (2.76 in) | 31 to 33.7 mm (1.22 to 1.33 in) | 60000517 |
| 16 mm (0.63 in) | 75 mm (2.95 in) | 55 mm (2.16 in) | 14 to 15 mm (0.55 to 0.59 in) | 60008385 |
| 29 mm (1.14 in) | 90 mm (3.54 in) | 70 mm (2.76 in) | 27 to 28 mm (1.06 to 1.1 in) | 71039792 |

Gas-tight coupling




- Maximum temperature: +350 °C (+662)
- Material: AISI 316Ti
- Maximum process pressure ≤ 1 bar (14.5 psi)

| D | C in mm (in) | Clampable sleeve diameter r in mm (in): | AF/Wr. | Accessory order number: |
|---|---|---|---|---|
| G ½ | 15.5 mm (0.61 in)<br>17.5 mm (0.69 in) | 13.7 to 15 mm (0.54 to 0.6 in)<br>17 to 17.2 mm (0.67 to 0.67 in) | 36<br>36 | 60019126<br>60019129 |
| G ¾ | 15.5 mm (0.61 in)<br>18 mm (0.71 in)<br>19 mm (0.75 in)<br>22.5 mm (0.89 in) | 13.7 to 15 mm (0.54 to 0.6 in)<br>17 to 17.2 mm (0.67 to 0.67 in)<br>17.5 to 18 mm (0.69 to 0.71 in)<br>21.3 to 22 mm (0.84 to 0.86 in) | 36<br>36<br>36<br>41 | 71031438<br>60019130<br>71125362<br>60020836 |

| Version | | | | | |
|---|---|---|---|---|---|
| | G1 | 15.5 mm<br>(0.61 in)<br>18 mm<br>(0.71 in)<br>19 mm<br>(0.75 in)<br>22.5 mm<br>(0.89 in)<br>28 mm<br>(1.1 in) | 13.7 to 14 mm<br>(0.54 to 0.55 in)<br>13.7 to 14 mm<br>(0.54 to 0.55 in)<br>17.5 to 18 mm<br>(0.69 to 0.71 in)<br>21.3 to 22 mm<br>(0.84 to 0.86 in)<br>26.7 to 27 mm<br>(1.05 to 1.06 in) | 41<br>41<br>41<br>41<br>46 | 71364153<br>60021758<br>71125364<br>60021757<br>71001827 |
| | G ¼ | 29 mm<br>(1.14 in) | 27.5 to 28 mm<br>(1.1 to 1.06 in) | 55 | 71125353 |
| | G ¼ | 32 mm<br>(1.26 in) | 30 mm (1.18 in) | 55 | - |
| | G ½ | 22.5 mm<br>(0.89 in)<br>29 mm<br>(1.14 in)<br>35 mm<br>(1.38 in) | 21.3 to 22 mm<br>(0.84 to 0.86 in)<br>27.5 to 28 mm<br>(1.1 to 0.86 in)<br>33.4 to 34 mm<br>(1.32 to 1.34 in) | 55<br>55<br>55 | 60021425<br>71125354<br>60022497 |

## Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

## Order information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

**Product Configurator - the tool for individual product configuration**
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

**Scope of delivery**

## Accessories

The accessories currently available for the product can be selected at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.

3. Select **Spare parts & Accessories**.

Various accessories are available for the device, and can be ordered with the device or at a later stage. Detailed information on the relevant order code is available from the supplier.

## Device-specific accessories

| Type |
|---|
| **Thermowells**<br>TWF11 for high-temperature thermometers<br>TAF11 TWF16 for high-temperature thermometers TAF16 |
| **Inserts**<br>TPC100, for high-temperature thermometers TAF11 and TAF16<br>TPC200, for high-temperature thermometers TAF11 and TAF16<br>Inserts for TAF12x are available as Technical Special Products (TSP). [1]. |
| **Process connections**<br>Adjustable flange, stop flange as per DIN EN 50446 and gas-tight coupling |

1) For TSP orders, please contact your Endress+Hauser sales office

## Service-specific accessories

**Applicator**
Software for selecting and sizing Endress+Hauser measuring devices:
- Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections.
- Graphic illustration of the calculation results

Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.

Applicator is available:
https://portal.endress.com/webapp/applicator

**Configurator**
Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

The Configurator is available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

**DeviceCare SFE100**
DeviceCare is an Endress+Hauser configuration tool for field devices using the following communication protocols: HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, IO/Link, Modbus, CDI and Endress+Hauser Common Data Interfaces.

Technical Information TI01134S

www.endress.com/sfe100

**FieldCare SFE500**
FieldCare is a configuration tool for Endress+Hauser and third-party field devices based on DTM technology.
The following communication protocols are supported: HART, WirelessHART, PROFIBUS, FOUNDATION Fieldbus, Modbus, IO-Link, EtherNet/IP, PROFINET and PROFINET APL.

Technical Information TI00028S

www.endress.com/sfe500

**Netilion**
With the Netilion lIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem

designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

www.netilion.endress.com

**System components**

**Data Manager of the RSG product family**

Data Managers are flexible and powerful systems to organize process values. Up to 20 universal inputs and up to 14 digital inputs for direct connection of sensors, optionally with HART, are available as an option. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. The values can be forwarded via common communication protocols to higher-level systems and connected to one another via individual plant modules.

For more information, please refer to: www.endress.com

**Surge arrester modules from the HAW product family**

Surge arrester modules for DIN rail and field device mounting, for the protection of plants and measuring instruments with power supply and signal/communication lines.

More detailed information: www.endress.com

**Process indicators from the RIA product family**

Easily readable process indicators with various functions: loop-powered indicators for displaying 4 to 20 mAvalues, display of up to four HART variables, process indicators with control units, limit value monitoring, sensor power supply, and galvanic isolation.

Universal application thanks to international hazardous area approvals, suitable for panel mounting or field installation..

For more information, please refer to: www.endress.com

**RN series active barrier**

Single- or two-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively.

For more information, please refer to: www.endress.com

# Documentation

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

| Document type | Purpose and content of the document |
|---|---|
| Technical Information (TI) | **Planning aid for your device**<br>The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device. |
| Brief Operating Instructions (KA) | **Guide that takes you quickly to the 1st measured value**<br>The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning. |
| Operating Instructions (BA) | **Your reference document**<br>The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal. |
| Description of Device Parameters (GP) | **Reference for your parameters**<br>The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations. |

| Document type | Purpose and content of the document |
|---|---|
| Safety instructions (XA) | Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions.<br>The nameplate indicates which Safety Instructions (XA) apply to the device. |
| Supplementary device-dependent documentation (SD/FY) | Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation. |

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