



# Thermocouples with protection tube to DIN

Protection tube to DIN 43 763

Termination head to DIN 43 729

High doomed cover for transmitter mounting

Exchangeable measuring inserts

Doublex sensors

## PROFILE

Depending on version, industrial thermocouples can be used between -200 and +2315 °C, whereby the sensor as also the protection tube is exposed directly to the measured temperature. The type of sensor and the construction of the protection tube are essential factors for the useful life of the sensor and for the stability of the measurement.

## DESCRIPTION

Protective fittings for industrial thermometers always consists of a protection tube and the termination head. Fitted inside the protection tube are one or two thermocouples. The termination head contains the connector block for connecting the extension (thermo or compensating) leads. The connector block can be replaced by a two-wire head transmitter. More suitable and easier for mounting and service is the use of a head with high doomed cover which will take the transmitter instead. This transmitter converts the thermovoltage signal into a standardized temperature linear 4...20 mA signal.

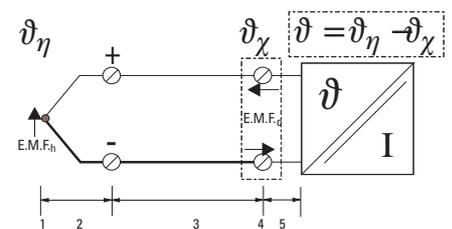
Depending from application, industrial thermocouples can be mounted in various ways, by means of an adjustable flange or an adjustable sheeth mounting fitting; with a welded bush or by welding (the thermowell). For the last mentioned type, the measuring insert is screwed into the thermowell. To reduce temperature effects to the head and possibly to a built-in transmitter, a distance between mounting fitting and head is necessary. For fixed bushes this is between 120 and 140 mm.

## PRINCIPLE OF OPERATION

If a temperature gradient is present in an electrical conductor, the heat flow will create a movement of electrons and an electromotive force (e.m.f.) will be generated in that region. Magnitude and direction depend of magnitude and direction of the temperature gradient and the material forming the conductor. The voltage existing across the ends will represent the sums of the e.m.fs. generated along it. In practice two materials having different electrothermal characteristics are combined to produce a thermocouple.

As the junctions (4) represent the limits of the + and - conductors generating the e.m.f., the remaining conductors linking the measuring device being copper wire, the output of the thermocouple will effectively become a function of all the junction temperatures. Thus the extension lead must have similar thermoelectric characteristic as the main conductor. Usually the temperature of the cold junction  $\vartheta_C$  is used as reference by the transmitter and compensated for (internal temperature compensation).

Fig 1. thermoelectrical temperature



- |                               |  |
|-------------------------------|--|
| 1 = measuring junction        | 5 = copper lead  |
| 2 = thermocouple              | $\vartheta_h$ = temperature of measuring junction        |
| 3 = compensation/ thermo lead | $\vartheta_C$ = temperature of cold junction (reference) |
| 4 = reference junction        | $\rightarrow$ = direction e.m.f.                         |

E.m.f. = electromotoric force

## TECHNICAL DATA

### THERMOCOUPLES (TC)

to DIN IEC 584, class 2

Elements	type	tolerance
FeCu-Ni	J	$\pm 2,5 \text{ K to } 333^\circ\text{C}, \pm 0,0075 \cdot  t $ from 333 to 750 °C
Ni-CrNi	K	$\pm 2,5 \text{ K to } 333^\circ\text{C}, \pm 0,0075 \cdot  t $ from 333 to 1200 °C
Pt13Rh-Pt	S	$\pm 1,5 \text{ K to } 600^\circ\text{C}, \pm 0,0075 \cdot  t $ from 600 to 1600 °C
FeCu-Ni	L <sup>1)</sup>	$\pm 3 \text{ K to } 400^\circ\text{C}, \pm 0,75\% \cdot  t $ from 400 to 700 °C

Depending on version, there can be up to two sensors mounted inside one protection tube.

### PROTECTION TUBE

#### FORM AM

For temperatures  $\leq 1000^\circ\text{C}$ , short term up to  $1200^\circ\text{C}$

Heat resistant steel X10 CrAl24, no 1.4762, 22 x 2 mm (fig.1)

#### FORM AMK

For temperatures  $\leq 1200^\circ\text{C}$ , as mentioned before, but gas tight inner ceramic tube made of KER 610 (fig.2).

#### FORM AKK

For temperatures  $\leq 1300^\circ\text{C}$ , short term up to  $1600^\circ\text{C}$ .

Porous ceramic KER 530 with steel supporting tube 32 x 2 mm.

Gas tight inner ceramic tube made of KER 610 (fig.3).

**Mounting:** with adjustable flange or adjustable compression fitting (fig 8, 9)

#### FORM B

Stainless steel 1.4571 (SS316Ti), 9 x 1 mm (fig. 4)

#### Operating limits

Medium	temperature	pressure
In water	$\leq 200^\circ\text{C}$	$\leq 43 \text{ bar}$
In air	$\leq 400^\circ\text{C}$	$\leq 36,5 \text{ bar}$

**Mounting:** tapered bush, welded to stem, G 1/2 A

#### FORM D (2)

Steel 13CrMo 44, material no. 1.7335 (fig. 5)

**Mounting:** weld-in

Fig. 2 protection tube form AM, form AMK

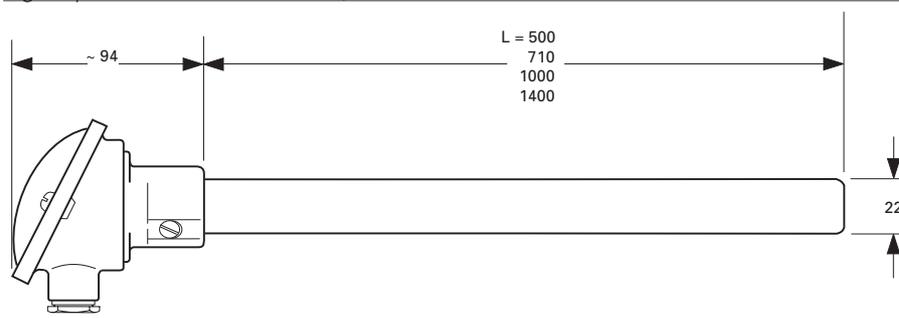


Fig. 3 protection tube form AKK

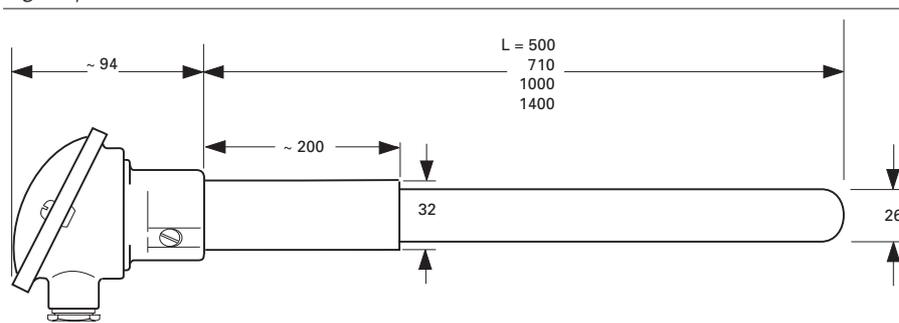


Fig. 4 protection tube form B

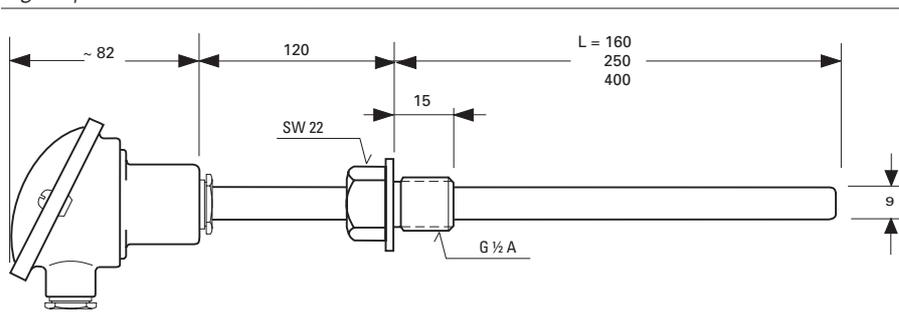
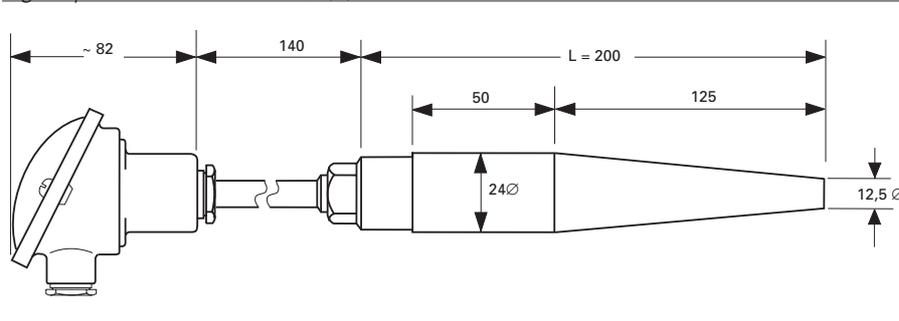


Fig. 5 protection tube form D (2)

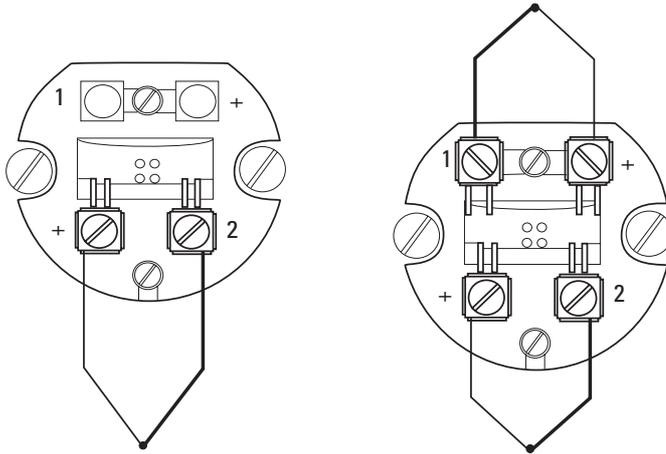


#### Operating limits

Medium/speed	temperature	pressure
In water, $V_{\max} \leq 5 \text{ m/s}$	$350^\circ\text{C}$	450 bar
In steam respectively air, $V_{\max} \leq 60 \text{ m/s}$	$500^\circ\text{C}$	225 bar
	$525^\circ\text{C}$	180 bar
	$540^\circ\text{C}$	136 bar

<sup>1)</sup> to DIN 43 710, not recommended for new installations

Fig. 6 connections



**TERMINATION HEAD**

Weather proof diecast alloy to DIN 43 729, M24 x 1.5 tube entry  
 Mode of protection to IP 54, cable entry PG 16  
 Either with standard cover (flat, fig. 2 to 5) or for mounting of one or two head transmitters with high doomed cover IP 65 (fig. 7).

**Electrical connection**

- Connection to measuring and control system with compensation or thermo leads

With built-in head transmitter - copper lead from transmitter onwards.

**Weight:** see version list

**Operating conditions:** see protection tube

**ACCESSORIES**

- Adjustable flange (fig. 8)
- Adjustable compression fitting (fig. 9)
- Head transmitter (see separate data sheets UNIFLEX T, Tiso)

Fig. 7 high doomed termination head

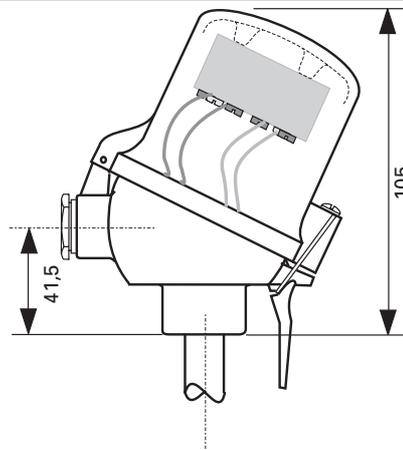
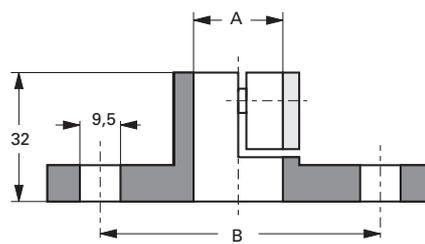
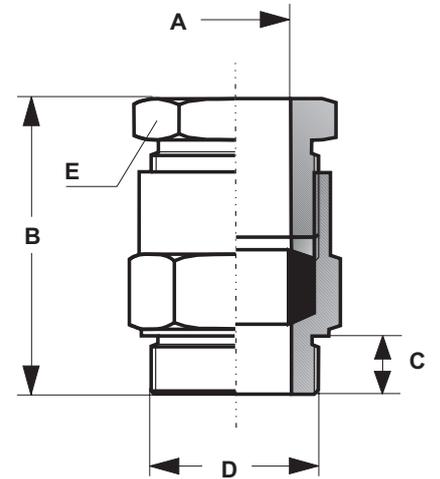


Fig. 8 adjustable flange



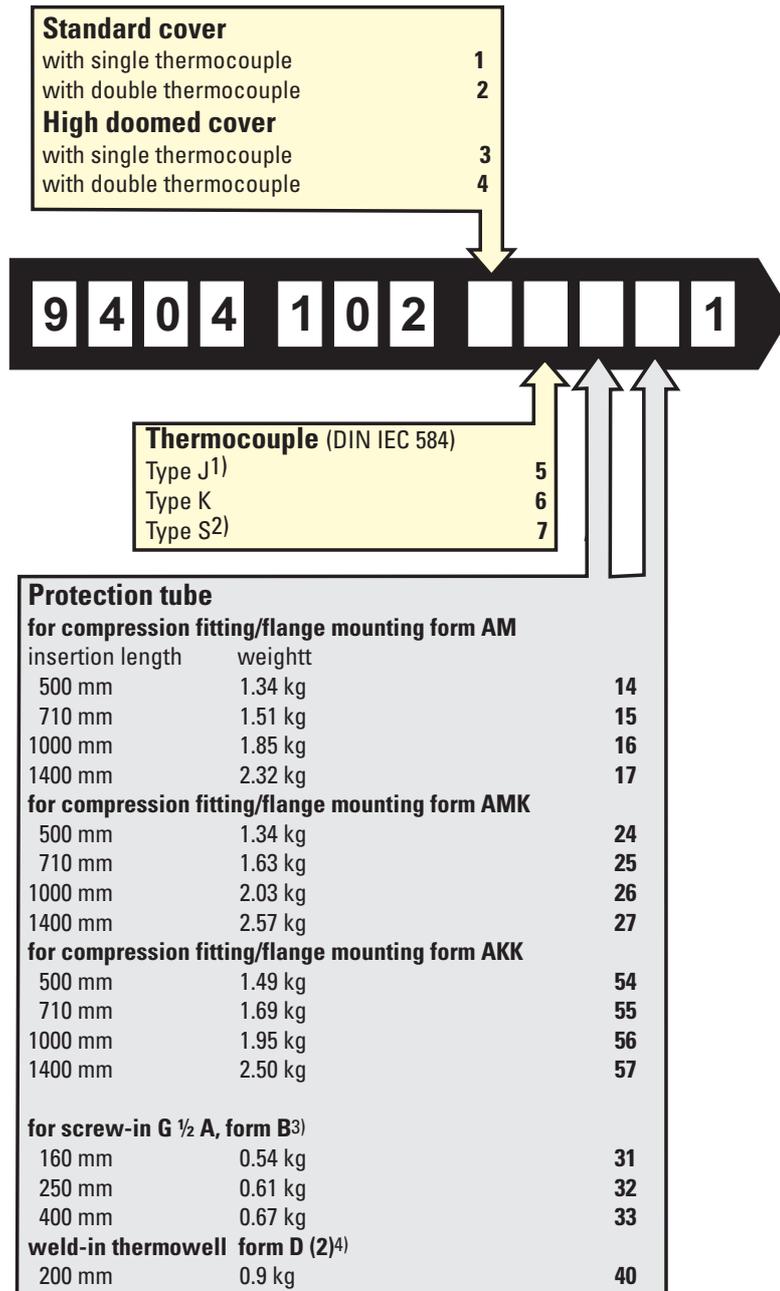
A	B	Tube [mm]	Order-no.
16 mm	55 mm	appr.15	9404 193 50031
22 mm	70 mm	appr.22	9404 193 50041
33 mm	70 mm	appr.32	9404 193 50051

Fig. 9 adjustable compression fitting



A	B	C	D	E	Order-no
16.5	78	17	G½A	SW27	9404 193 50231
23.5	88	20	G1A	SW36	9404 193 50241
33	111	25	G1¼A	SW46	9404 193 50251

## ORDERING STRUCTURE



- 1) Only for protection tube form AM  
 2) Highdoomed cover with double sensor only with tube form AKK  
 3) not thermocouple S  
 4) only thermocouple K



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