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## MEASURING INSERTS WITH METAL PROTECTING TUBES

THERMOCOUPLES AND RESISTANCE THERMOMETERS DESIGNED FOR INSTALLATION IN PROTECTIVE FITTINGS

Measuring inserts are components for straight thermocouples and process fittings in plant engineering and furnace construction. Measuring inserts can be replaced quickly and easily for repairs or removed and calibrated for quality assurance purposes.

The measuring inserts form a unit with thermowells and connection heads as a thermometer fitting. Standardized neck tubes are used in a number of plant engineering processes in the chemical, petrochemical and power plant industries as an additional part of the fittings. They help to set a boundary between the process and the environment and protect the measuring insert base and any electronic components in the connection head from excessive temperature loads. The neck tube length is generally determined by the thickness of the insulation around the system component.

The neck tube types are described in the DIN 43772 standard and in factory standards, particularly in the chemical industry. RÖSSEL-Messtechnik offers the entire range of neck tube types as spare parts. Neck tubes can be supplied as one-piece or multi-piece assemblies with a material certificate.

### SPECIAL ADVANTAGES:

- ✓ Standardized neck tubes for thermocouples or resistance thermometers
- ✓ Material certificates, vibration calculations
- ✓ European and US standards applicable
- ✓ Metal protective sheath

## Order code structure

The code number refers to the diameter of the tube/sheath. Code number 600 sets the tolerance range to + 0/- 0.1 mm; code number 610/810 sets the tolerance range to +/- 0.1 mm. The tolerance ranges for the sheath version are nominal diameter d +/- 0.01 \* d.

The measuring insert length L5 listed in the following tables only applies when using a type B connection head in accordance with EN 60 446. If a type A connection head is used, the specified measuring insert lengths must be extended by 10 mm.

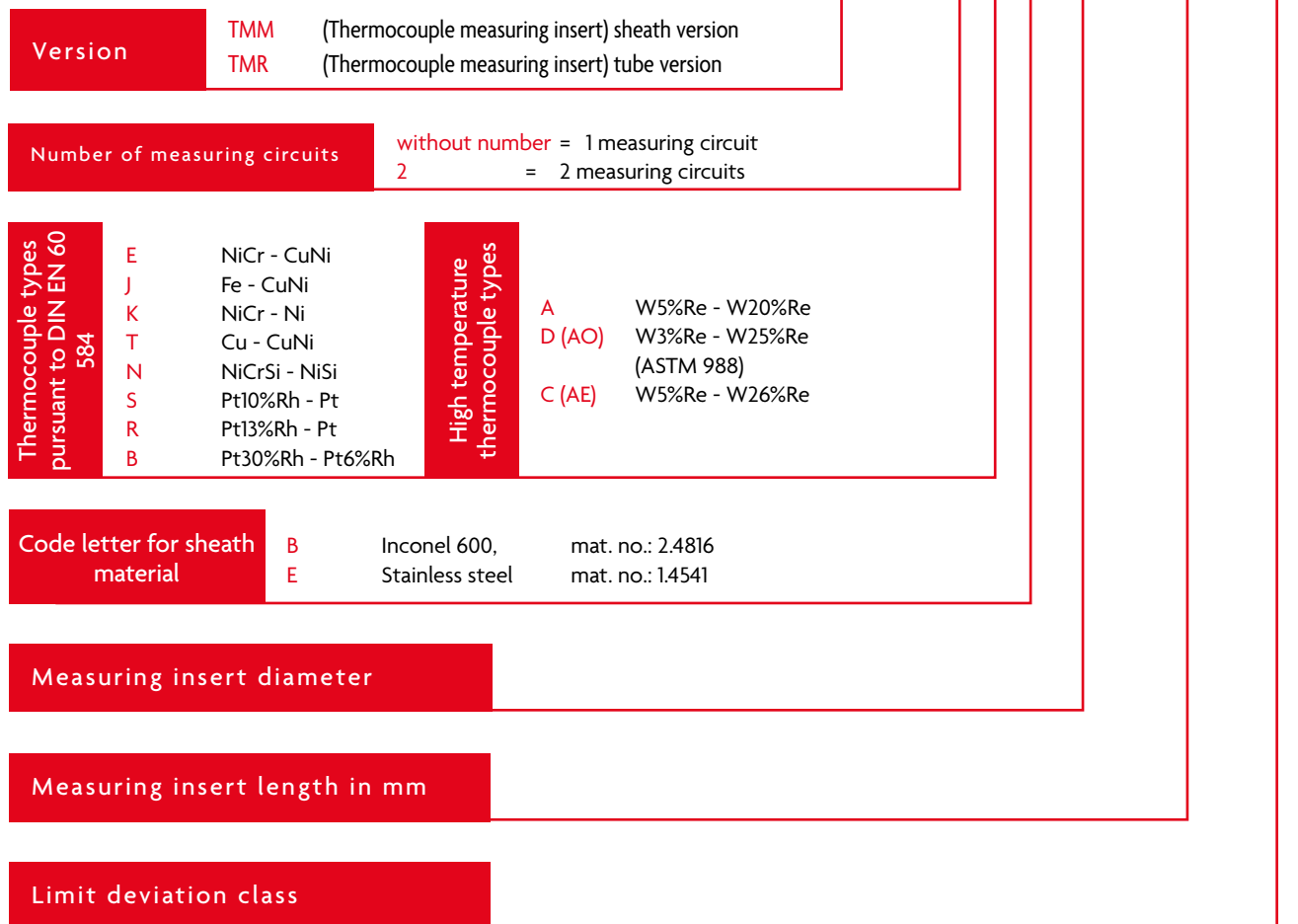
The WMM/WMR duplex version in a 4-wire circuit is available in diameters 6.0/8.0 mm (WMM) or code number 610/810 (WMR). This version is only available for a connection head with an elongated terminal compartment (BKD-SP/-RP or BKD-SPH/RPH). The ATEX versions in this circuit type (duplex 4-wire) are only available from diameter 6.0 (WMM) or code number 610.

In addition to the standardized measuring inserts with a continuous diameter, reinforced (e.g. 5.0 to 6.0 mm) or reduced (e.g. 6.0 to 3.0 mm) versions are also available on request.

## ORDER KEY for thermocouples

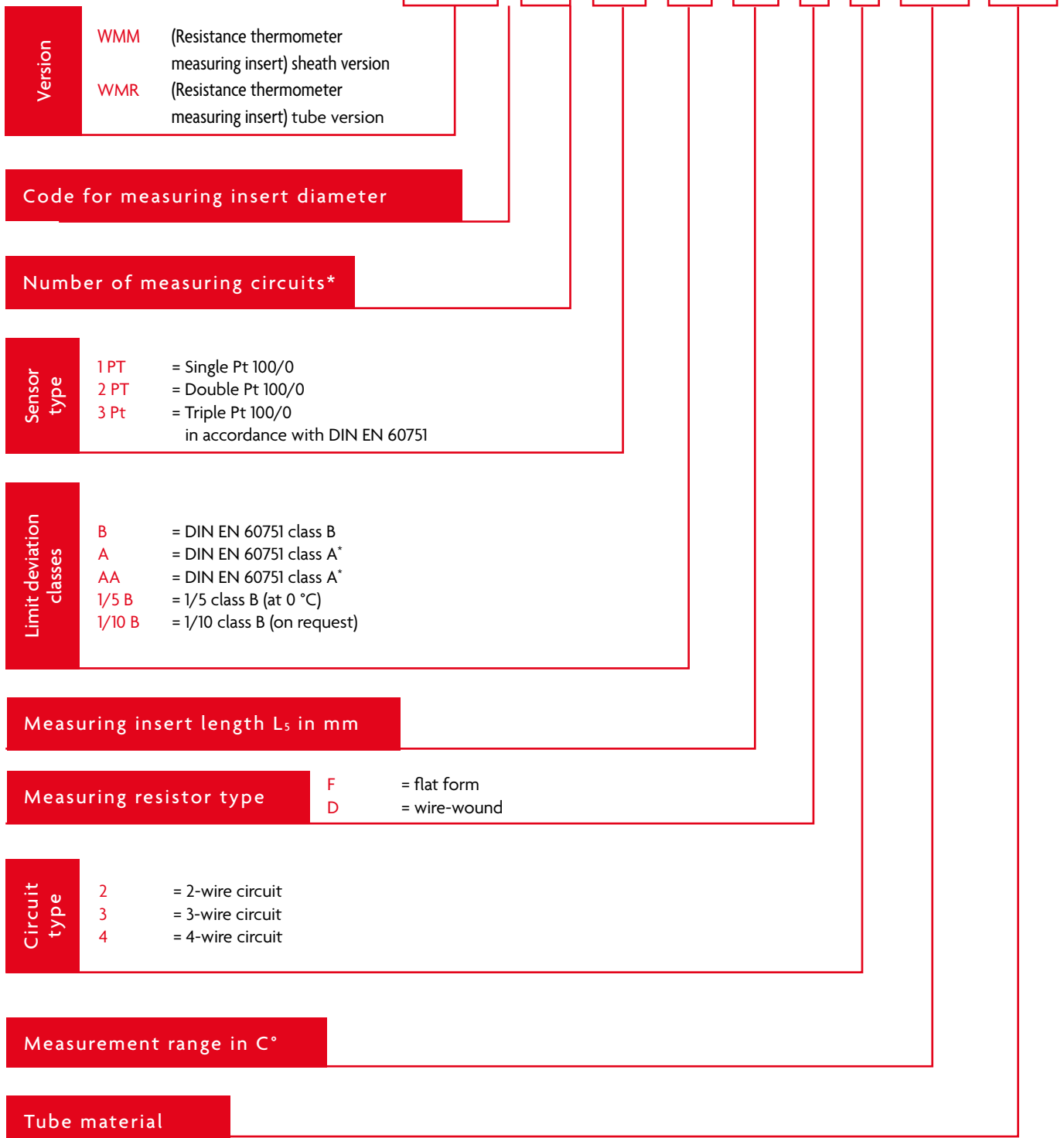
Example:

**MMT - 2 KB - 6.0 - 315 - 1**



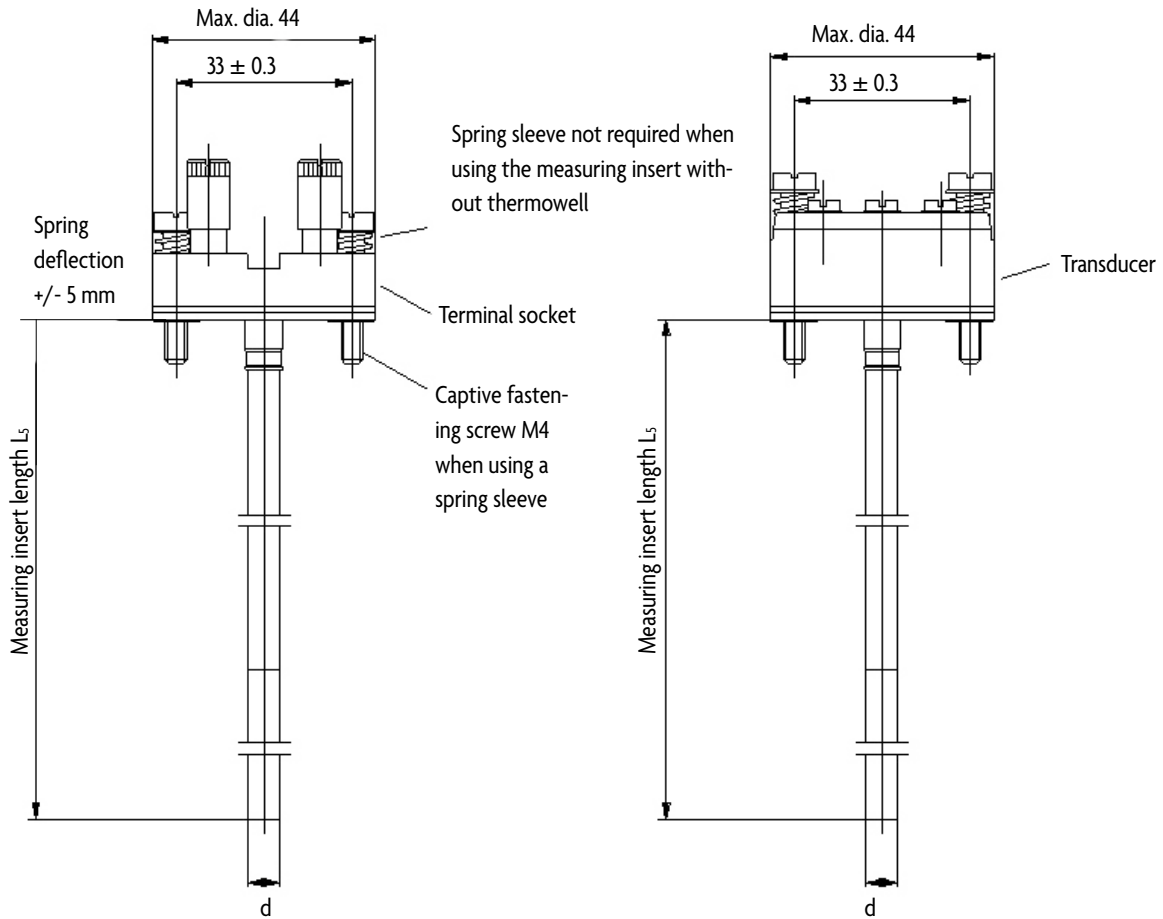
ORDER CODE for resistance thermometers

Example: **WMR** - **610** - **1 Pt** - **AA** - **315** - **F** - **4** - **0-250** - **1.4571**



\*) In the case of measuring inserts with measuring resistors, a double or triple measuring resistor can also be used instead of two or three measuring resistors.

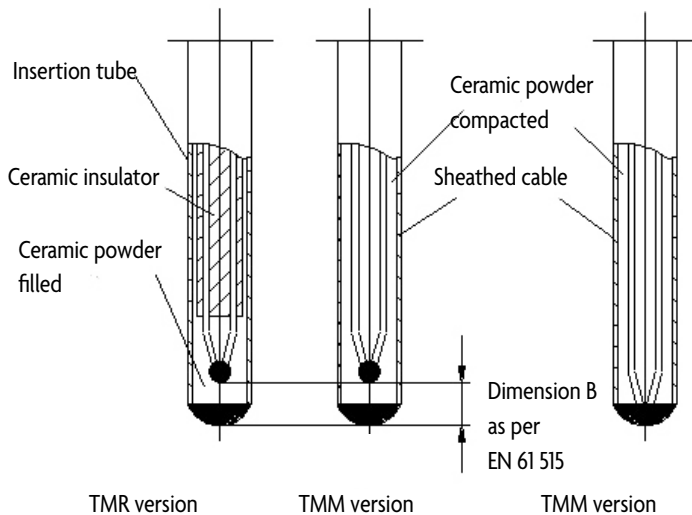
Measuring inserts and examples of versions for measuring points



**THERMOCOUPLE**

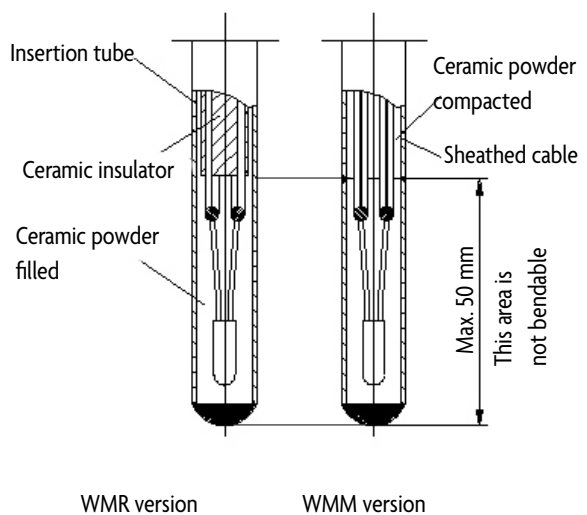
Version I  
insulated

Version G  
grounded



**RESISTANCE THERMOMETER**

Version I  
insulated



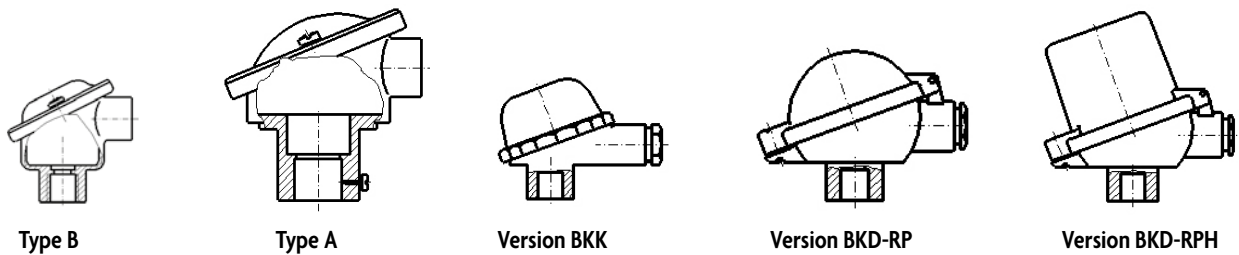
## Thermowell/thermocouple material and connection head types

Table 1 Code letters for metal thermowells			Table 2 Code letters for ceramic thermowells		Table 3 Code letters for thermocouples	
Code letter	Symbol	Material no.	Code letter	Material as per DIN 40 685-1/ VDE 0335-1	Code letter	Thermocouple DIN EN 60 584-1
BF	St 35.8	1.0305	CX	C 530 (K 530)	E	NiCr - CuNi
BL	C 22.8	1.0460	CY	C 610 (K 610)	J	Fe - CuNi
J	X 6 CrNiMoTi 17-12-2	1.4571	CZ	C 710 (K 710)	K	NiCr - Ni
DU	X 18 CrNi 28	1.4749	RSiC	Silicon carbide recrystallized <sup>1</sup>	N	NiCrSi - NiSi
R	X 10 CrAl 24	1.4762	SiSiC	Silicon carbide reaction-bonded <sup>1</sup>	S	Pt10%Rh - Pt
D	X 15 CrNiSi 25-20	1.4841			R	Pt13%Rh - Pt
E	X 6 CrNiTi 18-10	1.4541			B	Pt30%Rh - Pt6%Rh
B	INCONEL 600	2.4816			D (AO)	W3%Re - W25%Re
Y	INCOLOY 800 <sup>1</sup>	1.4876			C (AE)	W5%Re - W26%Re
CS	Kanthal Super/AF/APM <sup>1</sup>	----			A (AI)	W5%Re - W20%Re
SAH	Pt10%Rh	----			L	Fe - CuNi <sup>2</sup>
N	Tantalum	----				
O	Molybdenum	----				

1) Deviating diameter  
Please get in touch for more detailed specifications

2) Standard retracted

## Aluminum and plastic connection heads



Connection heads with raised covers are suitable for installing one or two transducers (types BKD-SPH or BKD-RPH). Heads made from plastic with a screw cover, type BKK and hinged cover, type BKK-RPH, are also available. The cable connection on all connection heads is M 20 x 1.5 as standard. The protection classes of the heads vary depending on the version (IP 43/44/65/66). Heads made from other materials are available on request.

## Type A and B aluminum connection heads as per EN 50 446

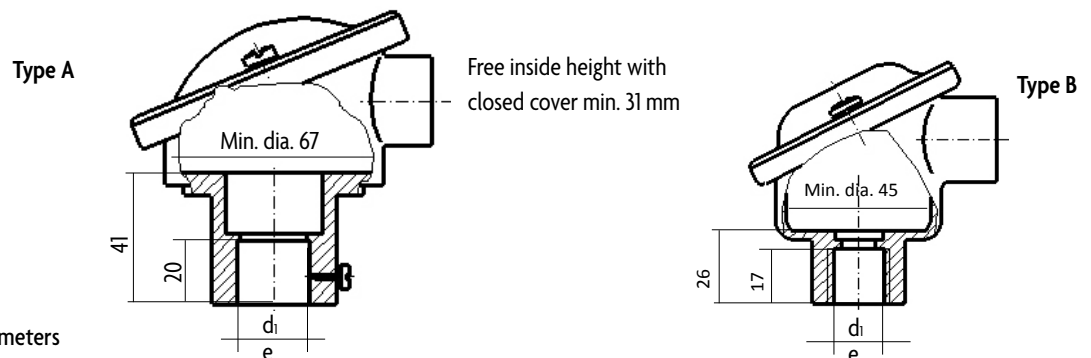
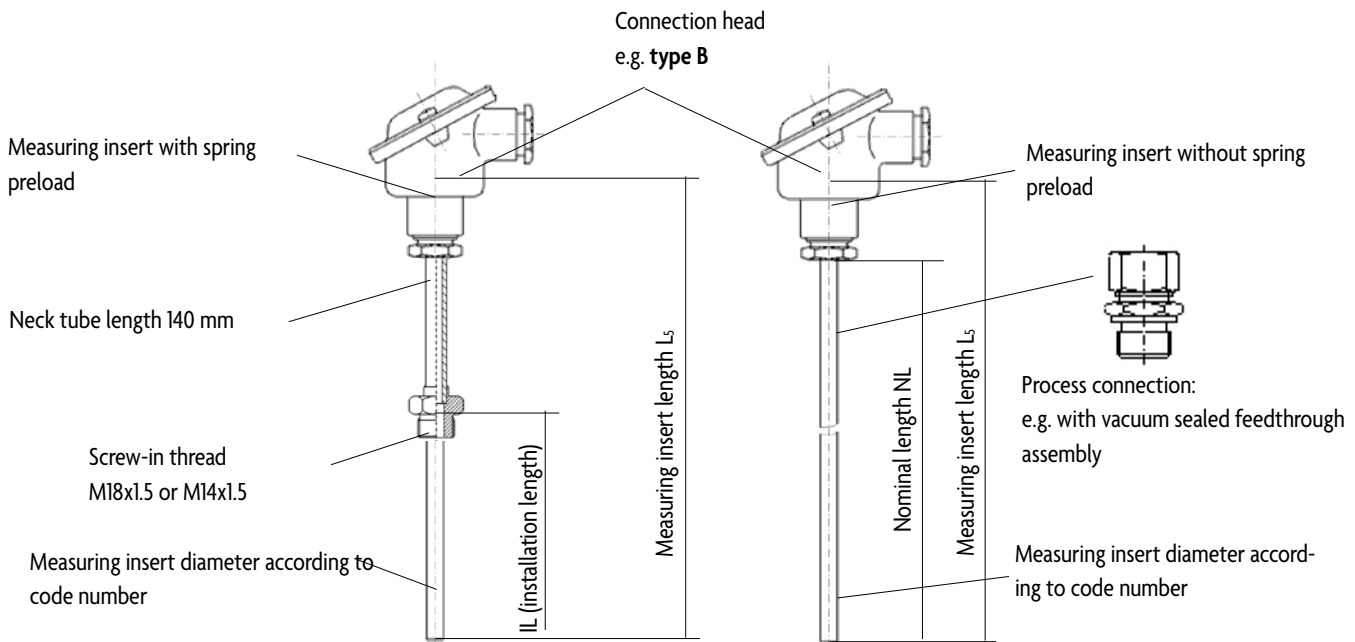


Table 4 Connection head diameters				
Type	Nominal diameter d1	Installed for	thread Dimension e	Installed for
	22.8	Neck tube or thermowell with 22 mm nominal diameter	M 24 x 1.5	Thermowell with head-mounted screw joint
A	24.8 / 26.8 / 32.8	Neck tube or thermowell with 24 mm/26 mm/32 mm nominal diameter	T1/2B; T3/4 B 1/2" NPT; 3/4" NPT	Thermowell with cylindrical thread Thermowell with conical thread
B	15.8/ 22.8	Neck tube or thermowell with 15 or 22 mm nominal diameter	M 24 x 1.5 T 1/ 2 B	Thermowell with head-mounted screw joint Thermowell with cylindrical thread

## Thermocouple and resistance thermometer without additional thermowell



Remark: The image in the top right shows a version with a pipe screw joint. As a result, the available immersion length is reduced to the nominal length minus 10 mm (NL - 10 mm).

The lengths that match the listed thermowells are specified in table 5 below. Deviating lengths and diameters are available on request based on the application.

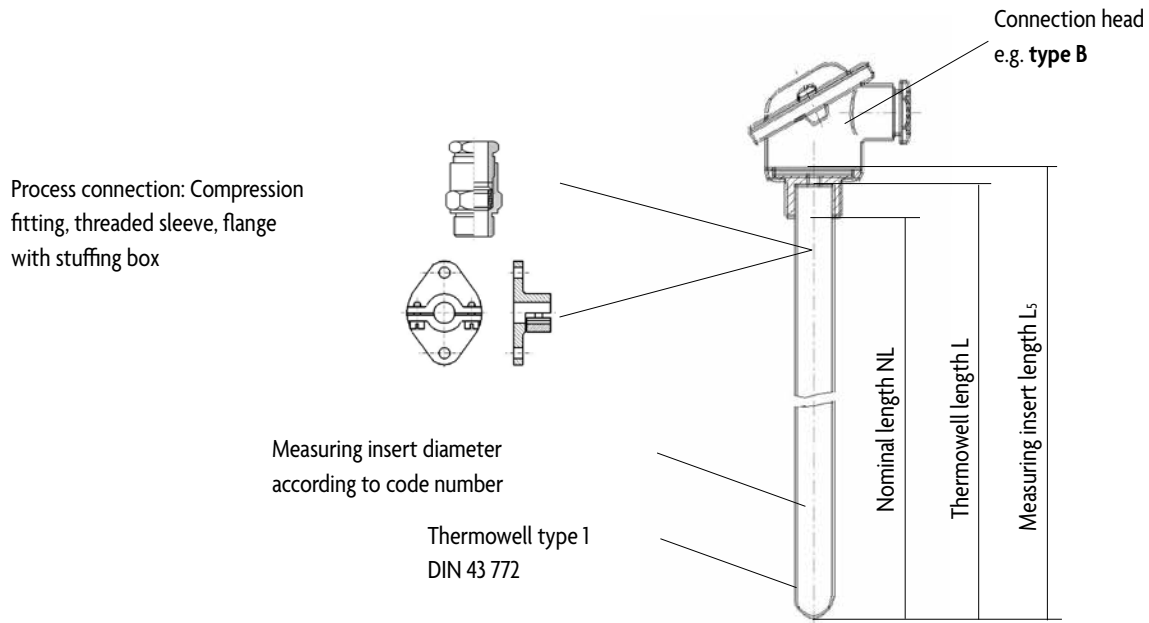
**Table 5** Nominal length of the thermometer to the measuring insert length

Nominal length NL in mm	Measuring insert length $L_s$ in mm			
	Diameter in mm	3.0	6.0 or 610	8.0 or 810
250		275	275	---
260		285	285	---
290		315	315	---
320		345	345	---
350		375	375	---
380		405	405	---
410		435	435	---
500		525	525	525
530		555	555	555
610		635	635	635
630		655	655	655
710		735	735	735
800		---	825	825
1 000		---	1 025	1 025
1 250		---	1 275	1 275
1 400		---	1 425	1 425
1 600		---	1 625	1 625
1 800		---	1 825	1 825
2 000		---	2 025	2 025

Diameter 3.0 and measuring insert length above 375 mm only available as sheathed design

# Thermocouple and resistance thermometer with thermowell type 1

## Straight immersion thermocouple and resistance thermometer



Straight thermocouples are available in all versions listed in production information 072 and in various custom versions on request.

**Table 6** Measuring insert length to thermowell length type 1

Nominal length NL in mm	Thermowell length L in mm Connection head type B/A	Measuring insert length L5 in mm for connection head type B	Measuring insert length L5 in mm for connection head type A
500	517/ 520	525	535
710	727/ 730	735	745
1000	1017/ 1020	1025	1035
1400	1417/ 1420	1425	1435
2000	2017/ 2020	2025	2035

Deviating measuring insert lengths and diameters are available on request based on the thermowell version. In addition to single, duplex and triplex versions, profile thermocouples with various sensor lengths in a complete thermowell are available.

When a ceramic inner thermowell is used, the measuring insert is approx. 10 - 15 mm shorter.

Thermocouple and resistance thermometer with thermowell type 2G and 2F Bolt or flange thermocouple and resistance thermometer

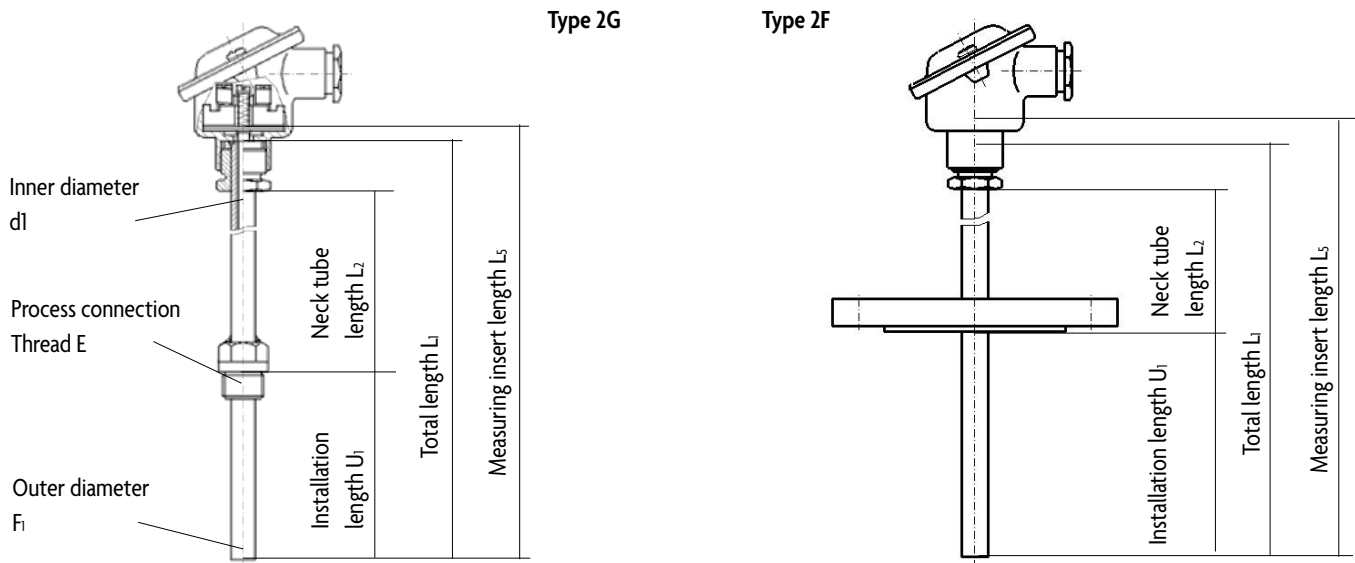


Table 7 Measuring insert length to thermowell length type 2G and 2F \*

Type	Measuring insert length L5 in mm for connection head type B	Total length L1 in mm	Installation length U1 in mm	Neck tube length L2 in mm	Process connection thread E	Outer diameter FI in mm	Inner diameter dI in mm
2 T (B 9)	315 / dia. 6	305	160	120	T 1/2" B (M18 x 1.5)	9	7
	405 / dia. 6	395	250				
	555 / dia. 6	545	400				
2 T (B 11)	340 / dia. 8	330	160	145	T 1/2" B (M18 x 1.5)	11	9
	430 / dia. 8	420	250				
	580 / dia. 8	570	400				
2 T (B 12)	315 / dia. 6	305	160	120	T 1/2" B (M18 x 1.5)	12	7
	405 / dia. 6	395	250				
	555 / dia. 6	545	400				
2 T (C 11)	340 / dia. 6	330	160	145	T 1" B (M27 x 2)	11	7
	430 / dia. 6	420	250				
	580 / dia. 6	570	400				
2 T (C 12)	340 / dia. 6	330	160	145	T 1" B (M27 x 2)	12	7
	430 / dia. 6	420	250				
	580 / dia. 6	570	400				
2 T (C 14)	340 / dia. 8	330	160	55	T 1" B (M27 x 2)	14	9
	430 / dia. 8	420	250				
	580 / dia. 8	570	400				
2F	315 / dia. 6	305	225	55	Flange in accordance with EN 1092-1 or customer specification	9	7
	405 / dia. 6	395	315				
	555 / dia. 6	545	465				
2F	315 / dia. 6 or dia. 8	305	225	55	Flange in accordance with EN 1092-1 or customer specification	11	7 or 9
	405 / dia. 6 or dia. 8	395	315				
	555 / dia. 6 or dia. 8	545	465				
2F	315 / dia. 6	305	225	55	Flange in accordance with EN 1092-1 or customer specification	12	7
	405 / dia. 6	395	315				
	555 / dia. 6	545	465				
2F	315 / dia. 8	305	225	55	Flange in accordance with EN 1092-1 or customer specification	14	9
	405 / dia. 8	395	315				
	555 / dia. 8	545	465				

Thermocouple and resistance thermometer with thermowell type 3G and 3F Bolt or flange thermocouple and resistance thermometer

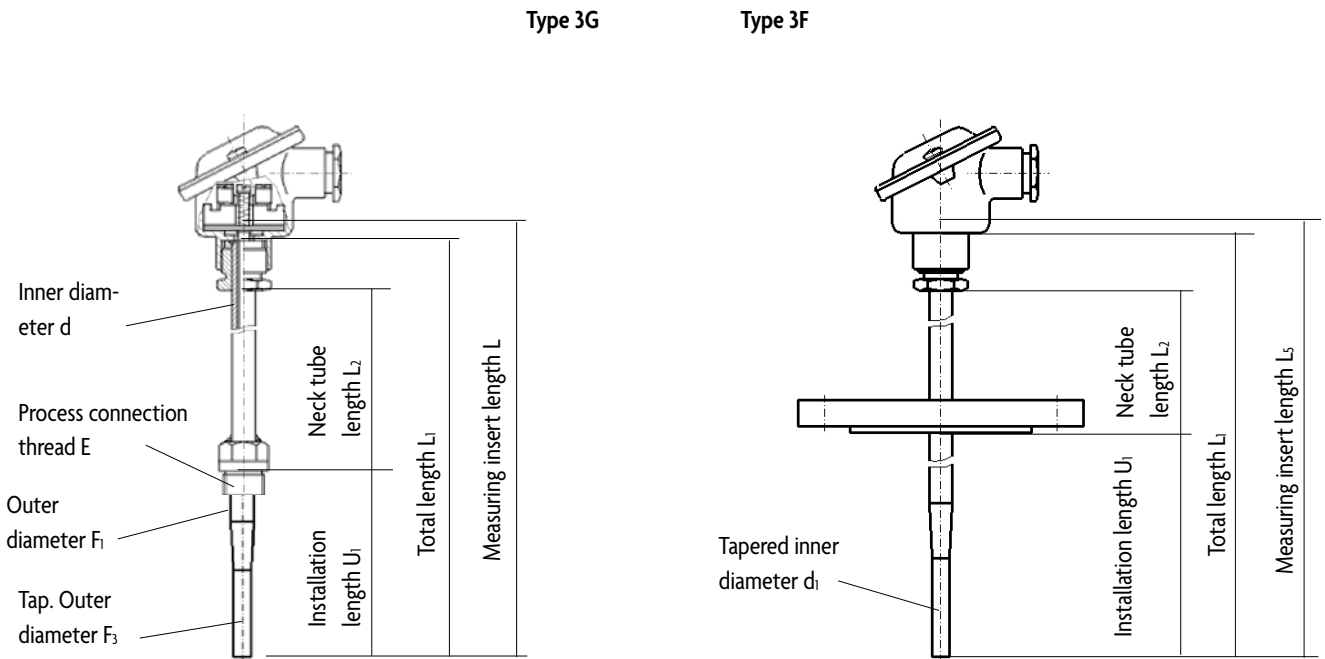


Table 8 Measuring insert length to thermowell length type 3G and 3F \*

Type DIN 43 772	For connection head type B measuring insert length L5 in mm	Total length L1 in mm	Installation length U1 in mm	Neck tube length L2 in mm	Process connection thread E	Outer diame- ter F1 in mm	Tap. Outer diameter F3 in mm	Tap. Inner diameter d1 in mm					
3 T	315 / dia. 6	305	160	120	T 1/2" B (M22 x 1.5) or T 1" B (M27 x 2)	12 (d = 7)	9	6 +0.1/+0.05					
	375 / dia. 6	365	220										
	435 / dia. 6	425	280										
3 T	315 / dia. 8	305	160	55	Flange in accordance with EN 1092-1 or customer specification	14 (d = 9)	11	8 +0.1/+0.05					
	375 / dia. 8	365	220										
3 F	315 / dia. 6	305	225						55	Flange in accordance with EN 1092-1 or customer specification	12 (d = 7)	9	6 +0.1/+0.05
	375 / dia. 6	365	285										
	435 / dia. 6	425	345										
3 F	315 / dia. 8	305	225	55	Flange in accordance with EN 1092-1 or customer specification	14 (d = 9)	11	8 +0.1/+0.05					
	375 / dia. 8	365	285										
	435 / dia. 8	425	345										

\*)Deviating measuring insert lengths and diameters are available on request based on the thermowell version. In addition to single, duplex and triplex versions, profile thermocouples with various sensor lengths in a complete thermowell are available.

Thermocouple and resistance thermometer with thermowell type 4 and 4F  
Welding or flange thermocouple and resistance thermometer

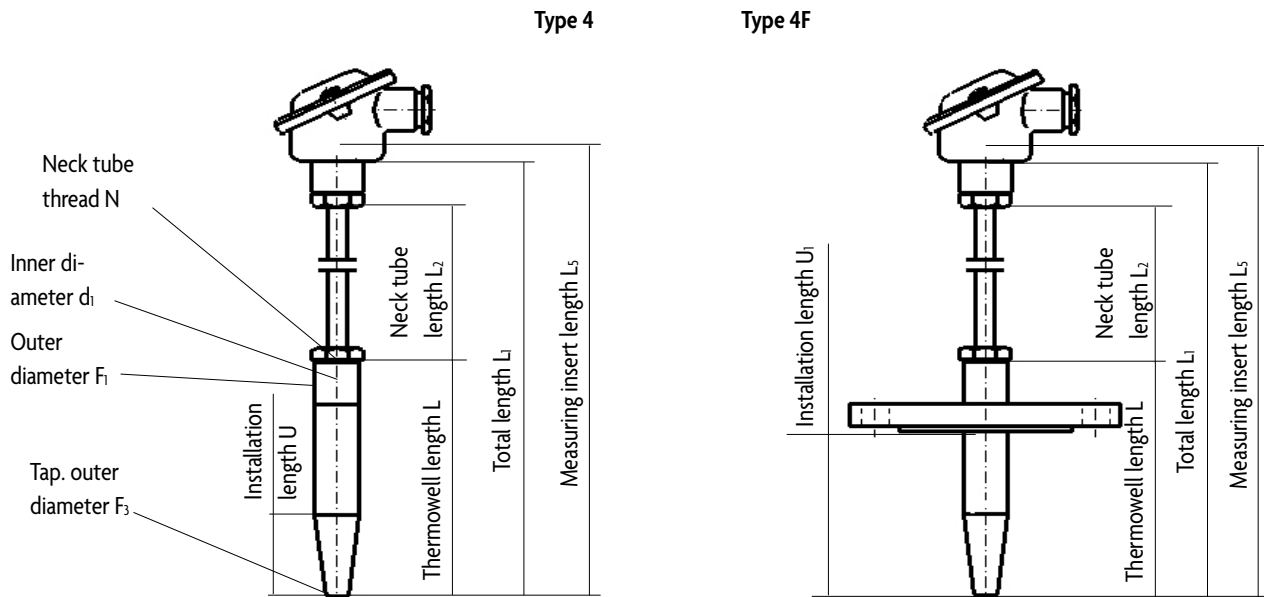


Table 9 Measuring insert length to thermowell length type 4 and 4F

Thermowell Type	Connection head type B measuring insert length $L_3$ in mm	Thermowell length $L$ in mm	Installation length $U$ or $U_1$ in mm	Neck tube length $L_2$ in mm	Total length $L_1$ in mm	Neck tube thread $N$	Thermowell outer diameter in mm	Inner diameter $d_1$ in mm
4	285 / dia. 6	110	65		275	M 18 x 1.5	F1 = 24 h7 F3 = 12.5	7
	315 / dia. 6	140	65		305			
	375 / dia. 6	200	65	140	365			
	375 / dia. 6	200	125		365			
	435 / dia. 6	260	125		425			
	585 / dia. 6	410	275		575			
4F	540 / dia. 6	365	130		530	M 18 x 1.5	F1 = 24 h7 F3 = 12.5	7
	600 / dia. 6	425	190	140	590			
	750 / dia. 6	575	340		740			
4	285 / dia. 3	110	65		275	M 14 x 1.5	F1 = 18 h7 F3 = 9	3.5
	315 / dia. 3	140	65		305			
	375 / dia. 3	200	65	140	365			
	375 / dia. 3	200	125		365			
4F	435 / dia. 3	260	125		425	M 14 x 1.5	F1 = 18 h7 F3 = 9	3.5
	375 / dia. 3	200	125	140	365			
	435 / dia. 3	260	125		425			

↑ Thermowell types 4 and 4F (F1 = 24 h7) are also available for measuring inserts with an outer diameter of 8.0 mm or code number 810 on request.

Deviating measuring insert lengths and diameters are available on request based on the thermowell version. In addition to single, duplex and triplex versions, profile thermocouples with various sensor lengths in a complete thermowell are available.

The thermocouple material available as standard satisfies the limit deviations for temperatures above -40 °C according to the table above. At low temperatures, these materials do not necessarily comply with the limit deviations for class 3 (4.0 °C or 0.005 \* |t| in °C). If type E, J, K and N thermocouples are required that satisfy the limit deviations for class 3 as well as class 1 or 2, this must be explicitly specified by the user as this generally requires the specific selection of available material. →

## Color coding, basic values and limit deviations

**Table 10** Color coding for extension or compensating cables pursuant to DIN EN IEC 60584-3

Material	Fe-CuNi	NiCr-Ni	Cu-CuNi	NiCr-CuNi	NiCrSi-NiSi	Pt10%Rh-Pt	Pt13%Rh-Pt	Pt30%Rh-Pt6%Rh
Code letter	J	K	T	E	N	S	R	B
Color + pole	Black ---	Green (Red)	Brown (Red)	Purple ---	Pink ---	Orange (Red)	Orange (Red)	Gray ---
Color - pole	White ---	White (Green)	White (Brown)	White ---	White ---	White (White)	White (White)	White ---
Sheath color	Black ---	Green (Green)	Brown (Brown)	Purple ---	Pink ---	Orange (White)	Orange (White)	Gray ---

Color letters pursuant to DIN EN 60584

Code colors in brackets pursuant to DIN 43 714

**Table 11** Basic values for thermoelectric voltages pursuant to DIN EN IEC 60584-1

Temperature in °C	Type J in µV	Type K in µV	Type T in µV	Type E in µV	Type N in µV	Type S in µV	Type R in µV	Type B in µV	Type C in µV	Type A in µV
-200	-7890	-5891	-5603	-8825	-3990					
-100	-4633	-3554	-3379	-5237	-2407					
0	0	0	0	0	0	0	0	0	0	1
100	5269	4096	4279	6319	2774	646	647	33	1451	1337
200	10779	8138	9288	13421	5913	1441	1469	178	3090	2872
300	16327	12209	14862	21036	9341	2323	2401	431	4865	4513
400	21848	16397	20872	28946	12974	3259	3408	787	6732	6204
500	27393	20644		37005	16748	4233	4471	1242	8657	7908
600	33102	24905		45093	20613	5239	5583	1792	10609	9606
700	39132	29129		53112	24527	6275	6743	2431	12559	11284
800	45494	33275		61017	28455	7345	7950	3154	14494	12934
900	51877	37326		68787	32371	8449	9205	3957	16398	14550
1000	57953	41276		76373	36256	9587	10506	4834	18260	16128
1100	63792	45119			40087	10757	11850	5780	20071	17662
1200	69553	48838			43846	11951	13228	6786	21825	19150
1300		52410			47513	13159	14629	7848	23520	20589
1400						14373	16040	8956	25155	21976
1500						15582	17451	10099	26729	23311
1600						16777	18849	11263	28243	24593
1700						17947	20222	12433	29696	25822
1800								13591	31087	26998
1900									32413	28120
2000									33669	29186

Reference junction temperature 0 °C

Type C (AE) and type A (AI) pursuant to DIN EN 60584

**Table 12** Limit deviations for thermocouples pursuant to DIN EN IEC 60584-2

Limit deviation	Class 1	Class 2	Class 3
Limit deviation ± *	0.5 °C or 0.004 ** (t) °C	1.0 °C or 0.0075 * (t) °C	
Measurement range type T	Measurement range -40 to + 350 °C	Measurement range -270 to + 400 °C	
Limit deviation ± *	1.5 °C or 0.004 ** (t) °C	2.5 °C or 0.0075 * (t) °C	4.0 °C or 0.005 * (t) °C
Measurement range type J	Measurement range -40 to + 750 °C	Measurement range -40 to + 750 °C	Types J, K, E and N
Measurement range type K and N	Measurement range -40 to + 1000 °C	Measurement range -40 to + 1200 °C	Measurement range -200 to - 40 °C
Measurement range type E	Measurement range -40 to + 800 °C	Measurement range -40 to + 900 °C	
Limit deviation ± *	1.0 or (1+(t-1100)*0.003) °C	1.5 °C or 0.0025 * (t) °C	
Measurement range type S and R	0 to 1600 °C	Measurement range 0 to + 1600 °C	
Measurement range type B	Not standardized	Measurement range + 600 to + 1700 °C	

\*) The highest value applies in each case

\*\* ( t ) = numerical value for temperature in °C without algebraic sign

# Limit deviations for resistance thermometers

In DIN EN 60 751, the relationship between temperature in °C and resistance in ohm is defined at a resistance of 100 ohm at 0 °C for platinum resistance thermometers. The entire temperature range spans from - 200 °C to + 850 °C. In addition to resistance thermometers with a basic resistance of 100 ohm at 0 °C, resistance thermometers with a basic resistance of 500, 1000, 5000 and 10000 ohm are also available.

**Table 14** Limit deviations for resistance thermometers as per DIN EN 60 751

Tolerance class	Valid temperature range in °C		Tolerance value in °C
	Wire-wound resistors	Flat form resistors	
AA	-50 to 250	0 to 150	$\pm (0.1+0.0017*t   t  )$
A	-100 to 450	-30 to 300	$\pm (0.15+0.002*t   t  )$
B	-196 to 600	-50 to 500	$\pm (0.3+0.005*t   t  )$
C	-196 to 600	-50 to 600	$\pm (0.6+0.01*t   t  )$

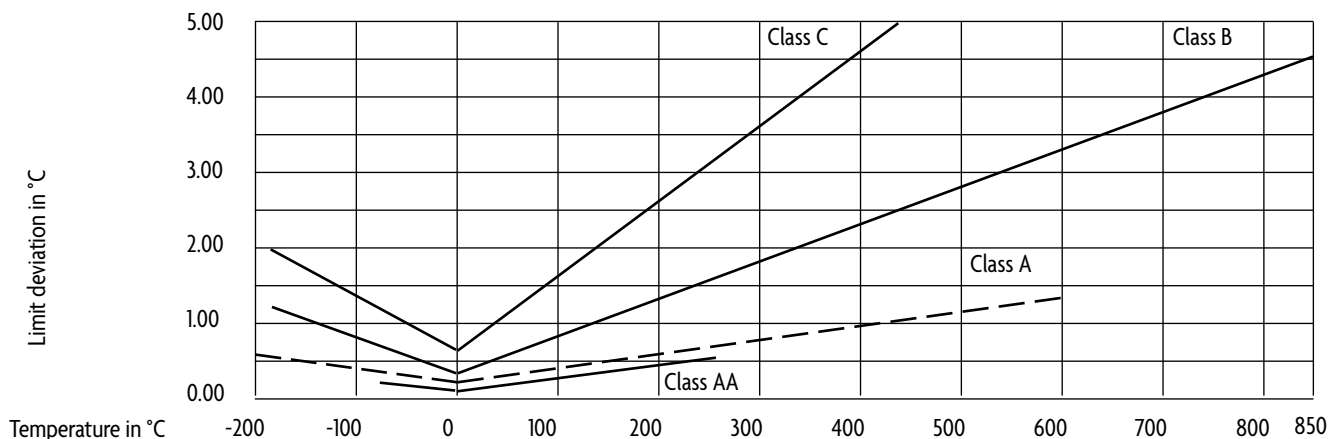
| t | = absolute value for temperature in °C independent of the algebraic sign

**Table 13** Limit deviations for resistors as per DIN EN 60 751

Wire-wound resistors		Flat form resistors		Tolerance value in °C
Tolerance class	Valid temperature range in °C	Tolerance class	Valid temperature range in °C	
W 0.1	-100 to 350	F 0.1	0 to 150	$\pm (0.1+0.0017*t   t  )$
W 0.15	-100 to 450	F 0.15	-30 to 300	$\pm (0.15+0.002*t   t  )$
W 0.3	-196 to 550	F 0.3	-50 to 500	$\pm (0.3+0.005*t   t  )$
W 0.6	-196 to 660	F 0.6	-50 to 600	$\pm (0.6+0.01*t   t  )$

| t | = absolute value for temperature in °C independent of the algebraic sign

## Graphical representation of limit deviations



The limit deviation is axisymmetrical to the horizontal zero line. Only the positive segment is illustrated.

## GET TO KNOW US CONTACT



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