

TW30..39 || Screw-in Resistance Thermometers

Application

Resistance thermometers are suited for direct temperature measurement of gaseous and liquid media.

The applications for the measuring inserts are not limited to the specified resistance thermometers. They are adapted to the given request with regard to temperature, length, bending property, vibration resistance and accuracy. In addition to our standard models we provide a lot of special types for special applications.

Construction and Operation

All screw-in resistance thermometers presented in this data sheet are built acc. to DIN 43765 and some are further developments.

Standard features

- Protective tube acc. to DIN 43772
- Connection head acc. to DIN EN 50446
- exchangeable measuring inset acc. to DIN 43762

Specifications

The accuracy classes acc. to DIN EN 60751 are distinguished as follows:

- class B (1/3; 1/10 DIN possible)
- class A (1/2 DIN possible)

All measuring inlets contain a standard measuring resistance acc. to DIN EN 60751 class B.

Please see the end of this data sheet for basic values and deviations of limit values.

The protective tube is designed as screw-in type for this type series.

It protects the measuring insert and consequently the measuring resistance against pressure, flow and possible damages. It remains installed and assures the continuation of process during an exchange of the measuring insert.

The construction of the protective tube depends on the pressure and temperature of the medium on site. See the load diagrams for the necessary specifications.



Main Features

- high accuracy
- easy to exchange
- economic measuring principle
- easy installation of double Pt 100

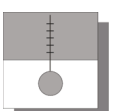
Typical Applications

- process technology
- power plant engineering
- boiler construction
- heating, ventilation and air technology
- furnace construction

The connection head consists mainly of light metal acc. to DIN EN 50446 type B. Other connection heads are indicated at the end of this data sheet.

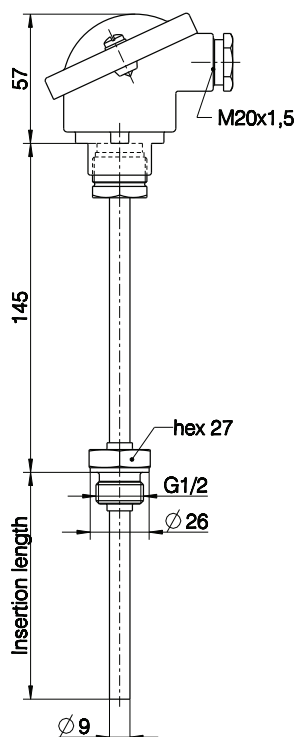
The resistance thermometers are also available with integrated 2-wire transmitter.

See the data sheets TE41 and TE42 for details!



Screw-in Resistance Thermometer TW30

Type B acc. to DIN 43765, for temperature measurement during modest pressure and flow



Measuring element	Measuring insert acc. to DIN 43762 Inset tube of stainless steel 1.4571 Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751
Protective tube	acc. to DIN 43772 type 2G; ø 9 mm; wall thickness 1 mm ; material: 1.4571 Mechanical load acc. to diagram 1
Neck pipe	ø 9 mm; length 145 mm; material: 1.4571
Mounting	G½ male acc. to DIN 3852-2
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	400°C

Ordering Code

Screw-in Resistance Thermometer TW30

			0		0	
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Standard Type

Inset tube with 1x Pt100, 2-wire	> A
Inset tube with 1x Pt100, 3-wire	> B
Inset tube with 1x Pt100, 4-wire	> C
Inset tube with 2x Pt100, 2-wire	> D
Inset tube with 2x Pt100, 3-wire	> E

Connection Head

Type B (standard)	> 1
Type BBK	> 2
Type S79	> 3
Type BUSH	> 4
Type BUS	> 5

Fitting length

100 mm	> 1
160 mm	> 2
250 mm	> 5
400 mm	> 8
Other lengths on request	> 9

Output

Resistance on terminal strip	> K
2-wire transmitter output signal 4..20 mA (only for inset tube with 1x Pt100)	> L

Measuring Range Transmitter (°C)

Without transmitter	> 0	0
-50 .. 0	> 1	0
-50 .. +50	> 2	0
0 .. 50	> 3	0
0 .. 100	> 4	0
0 .. 150	> 5	0
0 .. 200	> 6	0
0 .. 300	> 7	0
0 .. 400	> 8	0
Other ranges on request		

Mechanical and thermal load of protective tube

Type 2G, DIN 43772

Diagram 1

Material 1.4571

(X6CrNiMoTi17122)

Allowable flow rate:

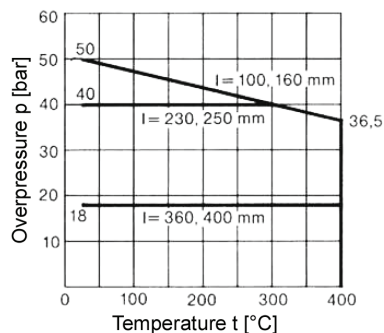
air 25 m/s

water 3 m/s

Allowable clamping torque of
screwed end 50 Nm

Diagram 1

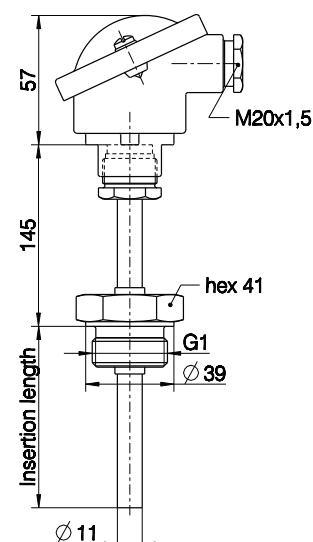
protective tube 9x1 mm



Screw-in Resistance Thermometer TW31

Type C acc. to DIN 43765, for temperature measurement during higher pressure and flow

Measuring element	Measuring insert acc. to 43762 Inset tube of stainless steel 1.4571 Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751
Protective tube	acc. to DIN 43772 type 2G; ø 11 mm; wall thickness 2 mm; material: 1.4571 Mechanical load acc. to diagram 2
Neck pipe	ø 11 mm; length 145; material: 1.4571
Mounting	G1 male acc. to DIN 3852-2
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	400°C



Ordering Code

Screw-in Resistance Thermometer TW31

			0		0	
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Standard Type

Inset tube with 1x Pt100, 2-wire.....	> A
Inset tube with 1x Pt100, 3-wire.....	> B
Inset tube with 1x Pt100, 4-wire.....	> C
Inset tube with 2x Pt100, 2-wire.....	> D
Inset tube with 2x Pt100, 3-wire.....	> E

Connection Head

Type B (standard)	> 1
Type BBK	> 2
Type S79	> 3
Type BUSH	> 4
Type BUS	> 5

Fitting length

100 mm	> 1
160 mm	> 2
250 mm	> 5
400 mm	> 8
Other lengths on request	> 9

Output

Resistance on terminal strip	> K
2-wire transmitter output signal 4..20 mA (only for inset tube with 1x Pt100)	> L

Measuring Range Transmitter (°C)

Without transmitter.....	> 0	0
-50 .. 0	> 1	0
-50 .. +50	> 2	0
0 .. 50	> 3	0
0 .. 100	> 4	0
0 .. 150	> 5	0
0 .. 200	> 6	0
0 .. 300	> 7	0
0 .. 400	> 8	0
Other ranges on request		

Mechanical and thermal load of protective tube

Type 2G, DIN 43772

Diagram 2

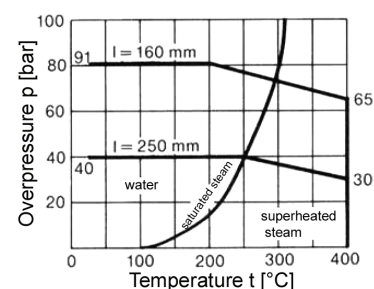
Material 1.4571
(X6CrNiMoTi17122)

Allowable flow rate:

air 40 m/s
water 5 m/s

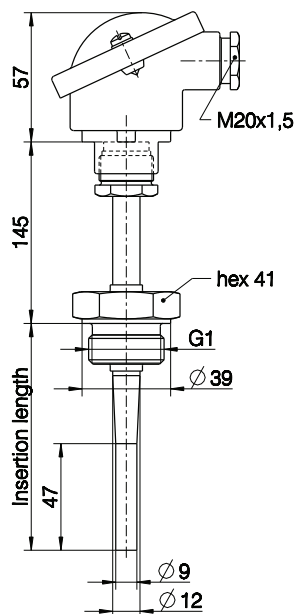
Allowable clamping torque of
screwed end 100 Nm

Diagram 2 protective tube 11x2 mm



Screw-in Resistance Thermometer TW32

Acc. to type G DIN 43766, for temperature measurement during higher pressure and flow



Measuring element	Measuring insert acc. to 43762 Inset tube of stainless steel 1.4571 Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751
Protective tube	Acc. to DIN 43772 type 3G; Ø 12 mm; 2,75 mm wall thickness; measuring point reduced to Ø 9 mm; material: 1.4571 Mechanical load acc. to diagram 3
Neck pipe	Ø 12 mm; length 147 mm; material: 1.4571
Mounting	G1 male acc. to DIN 3852-2
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	400°C

Ordering Code

Screw-in Resistance Thermometer TW32

			0		0	
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Standard Type

Inset tube with 1x Pt100, 2-wire	> A
Inset tube with 1x Pt100, 3-wire	> B
Inset tube with 1x Pt100, 4-wire	> C
Inset tube with 2x Pt100, 2-wire	> D
Inset tube with 2x Pt100, 3-wire	> E

Connection Head

Type B (standard)	> 1
Type BBK	> 2
Type S79	> 3
Type BUSH	> 4
Type BUS	> 5

Fitting length

160 mm	> 2
220 mm	> 5
280 mm	> 8
Other lengths on request	> 9

Output

Resistance on terminal strip	> K
2-wire transmitter output signal 4...20 mA (only for inset tube with 1x Pt100)	> L

Measuring Range Transmitter (°C)

Without transmitter	> 0	0
-50 .. 0	> 1	0
-50 .. +50	> 2	0
0 .. 50	> 3	0
0 .. 100	> 4	0
0 .. 150	> 5	0
0 .. 200	> 6	0
0 .. 300	> 7	0
0 .. 400	> 8	0

Other ranges on request

Mechanical and thermal load of protective tube

acc. to type 3G, DIN 43772)

Diagram 3

Material 1.4571

(X6CrNiMoTi17122)

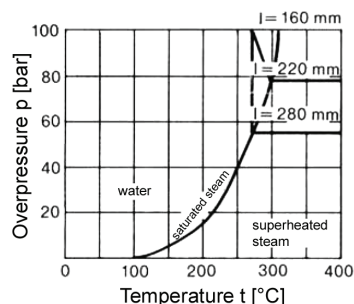
Allowable flow rate:

air 40 m/s

water 5 m/s

Allowable clamping torque of
screwed end 100 Nm

Diagram 3



Screw-in Resistance Thermometer TW35

Quick type, for temperature measurement during pressure up to 10 bar and modest flow

Measuring element	Measuring insert acc. to 43762 Inset tube of stainless steel 1.4571 Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751
Protective tube	ø 11 mm; 1 mm wall thickness; material: 1.4571; Length of measuring point 45 mm, reduced to ø 6mm; Mechanical load at 400°C: 10 bar
Neck pipe	ø 11 mm; length 145 mm; material: 1.4571
Mounting	G½ male acc. to DIN 3852-2
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	400°C

Ordering Code

Screw-in Resistance Thermometer TW35

			0		0	
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Standard Type

Inset tube with 1x Pt100, 2-wire.....	> A
Inset tube with 1x Pt100, 3-wire.....	> B
Inset tube with 1x Pt100, 4-wire.....	> C
Inset tube with 2x Pt100, 2-wire.....	> D
Inset tube with 2x Pt100, 3-wire.....	> E

Connection Head

Type B (standard)	> 1
Type BBK	> 2
Type S79	> 3
Type BUSH	> 4
Type BUS	> 5

Fitting length

100 mm	> 1
200 mm	> 2
300 mm	> 5

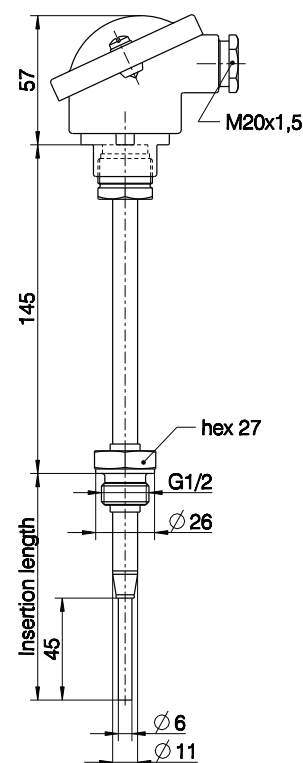
Output

Resistance on terminal strip	> K
2-wire transmitter output signal 4..20 mA (only for inset tube with 1x Pt100)	> L

Measuring Range Transmitter (°C)

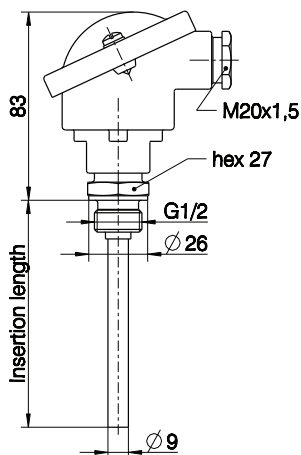
Without transmitter	> 0	0
-50 .. 0	> 1	0
-50 .. +50	> 2	0
0 .. 50	> 3	0
0 .. 100	> 4	0
0 .. 150	> 5	0
0 .. 200	> 6	0
0 .. 300	> 7	0
0 .. 400	> 8	0

Other ranges on request.



Screw-in Resistance Thermometer TW36

for temperature measurement during modest pressure and flow



Measuring element	Measuring insert acc. to 43762 Inset tube of stainless steel 1.4571 Measuring resistance 1 or 2 Pt100 acc. to DIN EN 60751
Protective tube	ø 9 mm; 1 mm wall thickness; material: 1.4571 Mechanical load acc. to diagram 6 comparable to type 2G DIN 43772
Neck pipe	Without
Mounting	G½ male acc. to DIN 3852-2
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	200°C

Ordering Code

Screw-in Resistance Thermometer
TW36

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Standard Type

Inset tube with 1x Pt100, 2-wire	> A
Inset tube with 1x Pt100, 3-wire	> B
Inset tube with 1x Pt100, 4-wire	> C
Inset tube with 2x Pt100, 2-wire	> D
Inset tube with 2x Pt100, 3-wire	> E

Connection Head

Type B (standard)	> 1
Type BBK	> 2
Type S79	> 3
Type BUSH	> 4
Type BUS	> 5

Fitting length

160 mm	> 2
220 mm	> 5
280 mm	> 8
Other lengths on request	> 9

Output

Resistance on terminal strip	> K
2-wire transmitter output signal 4...20 mA (only for inset tube with 1x Pt100)	> L

Measuring Range Transmitter (°C)

Without transmitter	> 0	0
-50 .. 0	> 1	0
-50 .. +50	> 2	0
0 .. 50	> 3	0
0 .. 100	> 4	0
0 .. 150	> 5	0
0 .. 200	> 6	0
Other ranges on request		

Mechanical and thermal load
of protective tube

comparable to type 2G, DIN
43772

Diagram 6

Material 1.4571
(X6CrNiMoTi17122)

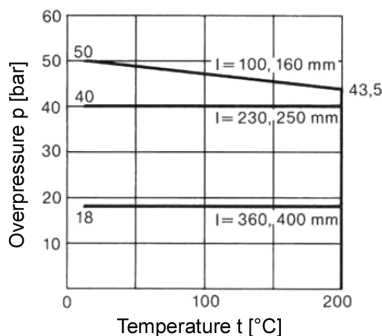
Allowable flow rate:

air 25 m/s

water 3 m/s

Allowable clamping torque of
screwed end 100 Nm

Diagram 6 protective tube
9 x 1 mm



Basic Values and Limit Value Deviation for Pt100 Resistance Thermometers

Calculation equations for the basic values

The following calculation equations apply to the basic value calculation of Pt100 resistance thermometers acc. to DIN EN 60751. In this equation resistance = R in ohm at temperature t and temperature = t in °C.

For Pt100 in temperature ranges of 0 to 850°C:

$$R_t = 100 (1 + 3.90802 \cdot 10^{-3} \cdot t - 0.5802 \cdot 10^{-6} \cdot t^2)$$

For Pt100 in temperature ranges of -200 to 0°C:

$$R_t = 100 (1 + 3.90802 \cdot 10^{-3} \cdot t - 0.5802 \cdot 10^{-6} \cdot t^2 + 0.42735 \cdot 10^{-9} \cdot t^3 - 4.2735 \cdot 10^{-12} \cdot t^4)$$

As simplification we provide the values for the range of -200 to +850°C in the following table.

Basic Values (Ohm) for Pt100 Resistance Thermometers acc. to DIN EN 60751

Temp. °C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90	-100
-200	18.49										
-100	60.25	56.19	52.11	48.00	43.87	39.71	35.53	31.32	27.08	22.80	18.49
0	100.00	96.09	92.16	88.22	84.27	80.31	76.33	72.33	68.33	64.30	60.25
Temp. °C	0	10	20	30	40	50	60	70	80	90	100
0	100.00	103.90	107.79	111.67	115.54	119.40	123.24	127.07	130.89	134.70	138.50
100	138.50	142.29	146.06	149.82	153.58	157.31	161.04	164.76	168.46	172.16	175.84
200	175.84	179.51	183.17	186.82	190.45	194.07	197.69	201.29	204.88	208.45	212.02
300	212.02	215.57	219.12	222.65	226.17	229.67	233.17	236.65	240.13	243.59	247.04
400	247.04	250.48	253.90	257.32	260.72	264.11	267.49	270.86	274.22	277.56	280.90
500	280.90	284.22	287.53	290.83	294.11	297.39	300.65	303.91	307.15	310.38	313.59
600	313.59	316.80	319.99	323.18	326.35	329.51	332.66	335.79	338.92	342.03	345.13
700	345.13	348.22	351.30	354.37	357.42	360.47	363.50	366.52	369.53	372.52	375.51
800	375.51	378.48	381.45	384.40	387.34	390.26					

Limit Value Deviations for Pt100 Resistance Thermometers acc. to DIN EN 60751

Temp.	Kl. B DIN		Kl. B1/2 DIN		Kl. B1/3 DIN		Kl. B1/10 DIN		Kl. A DIN		Kl. A1/2 DIN	
[°C]	[°C]	Ω	[°C]	Ω	[°C]	Ω	[°C]	Ω	[°C]	Ω	[°C]	Ω
-200	1.30	0.56	1.15	0.50	1.10	0.48	1.03	0.45	0.55	0.24	0.48	0.21
-100	0.80	0.32	0.65	0.26	0.60	0.24	0.53	0.21	0.35	0.14	0.28	0.11
-50	0.55	0.21	0.40	0.15	0.35	0.13	0.28	0.10	0.25	0.10	0.18	0.07
0	0.30	0.12	0.15	0.06	0.10	0.04	0.03	0.01	0.15	0.06	0.08	0.03
50	0.55	0.21	0.40	0.15	0.35	0.13	0.28	0.10	0.25	0.10	0.18	0.07
100	0.80	0.30	0.65	0.24	0.60	0.22	0.53	0.19	0.35	0.13	0.28	0.10
150	1.05	0.39	0.90	0.33	0.85	0.31	0.78	0.28	0.45	0.17	0.38	0.14
200	1.30	0.48	1.15	0.42	1.10	0.40	1.03	0.37	0.55	0.20	0.48	0.17
300	1.80	0.64	1.65	0.58	1.60	0.56	1.53	0.53	0.75	0.27	0.68	0.24
400	2.30	0.79	2.15	0.73	2.10	0.71	2.03	0.68	0.95	0.33	0.88	0.30
600	3.30	1.06	3.15	1.00	3.10	0.98	3.03	0.95	1.35	0.43	1.28	0.40
800	4.30	1.28	-	-	-	-	-	-	-	-	-	-

The given limit value deviations for Pt100 resistance thermometers are defined by the following calculation equations:

Limit value deviations in °C

= ± (0.30 + 0.005 * t) for class B DIN

= ± (0.15 + 0.005 * t) for class B1/2 DIN

= ± (0.10 + 0.005 * t) for class B1/3 DIN

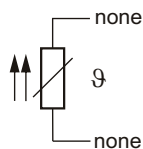
= ± (0.03 + 0.005 * t) for class B1/10 DIN

= ± (0.15 + 0.002 * t) for class A DIN

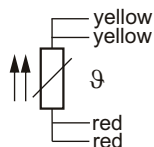
= ± (0.08 + 0.002 * t) for class A1/2 DIN

Connection Diagrams

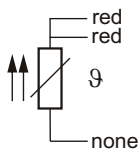
Single Pt100
2-wire circuit



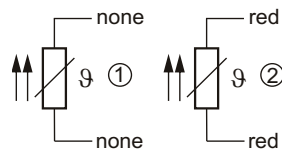
Single Pt100
4-wire circuit



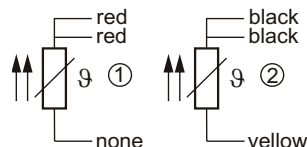
Single Pt100
3-wire circuit



Double Pt100
2-wire circuit



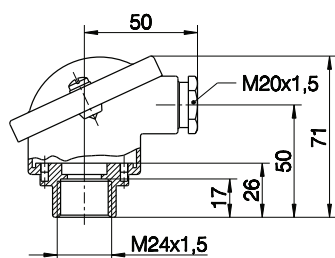
DoublePt100
3-wire circuit



Standard Connecting Heads (Connecting dimensions acc. to DIN EN 50446)

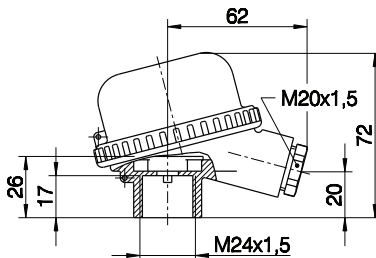
Type B DIN EN 50446

Material: diecast light metal
Protection class: IP54



Type BBK

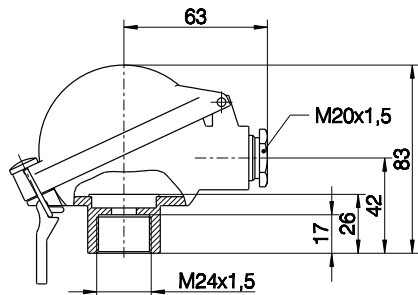
Material: Polyamide (max. 120°C=)
Protection class: IP54



Other Possible Connecting Heads (Connecting dimensions acc. to DIN EN 50446)

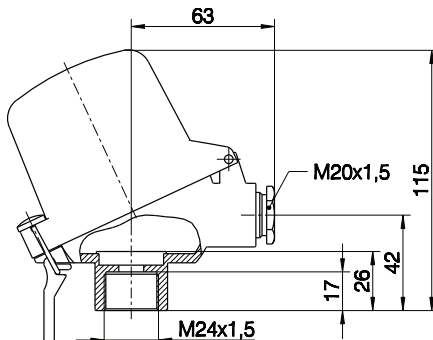
Type BUS

Material: diecast light metal
Protection class: IP65



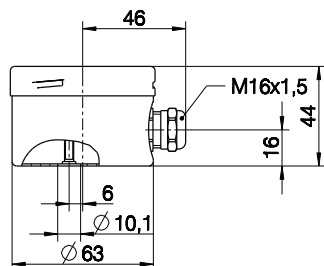
Type BUSH

Material: diecast light metal
Protection class: IP65



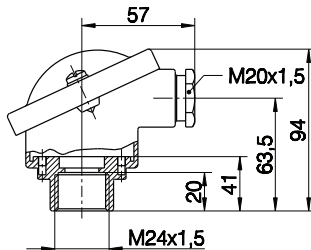
Type S79

Material: stainless steel 1.4301
Protection class: IP65



Type A DIN EN 50446

Material: diecast light metal
Protection class: IP54



Type F

Material: cast light metal
Protection class: IP54

