FISCHER MESS- UND REGELTECHNIK

TW40..49 || Weld-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 stanard models we provide a lot of special types for special applications.

Construction and Operation

All weld-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 inserts 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 weld-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 exchangement 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
- easy data processing
- economic measuring principle
- application possible even for great distance measurement
- easy installation of double Pt 100

Typical Applications

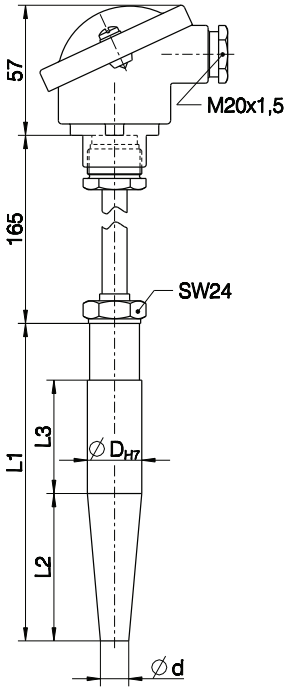
- process technology
- power plant engineering
- boiler construction

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!

Weld-in Resitance Thermometer TW40



Type D DIN 43767, for tempeature measurement during high 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	Type D1..D6 acc. to DIN 43772 form 4; Materials: 1.7335 (13CrMo44) 1.7380 (10CrMo910) 1.4571 (X6CrNiMoTi17122)

Tab.1	Protective tube type					
	D1	D2	D3	D4	D5	D6
ØD (mm)	24	24	30	24	24	30
Ød (mm)	12.5	12.5	16	12.5	12.5	16
L1 (mm)	140	200	200	200	260	255
L2 (mm)	65	125	65	65	125	125
L3 (mm)	50	50	110	110	50	105

	Mechanical load acc. to diagrams 1 to 3
Neckpipe	Ø 11 mm (Ø 14 mm D3, D6); length: 165 mm; material: 1.4571
Mounting	M18x1.5 male thread
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	540°C for 1.7335 (13CrMo44) 570°C for 1.7380 (10CrMo910) 400°C for 1.4571 (X6CrNiMoTi17122)

Mechanical and thermal load of protective tubes type D1 to D6 acc. to DIN 43763 (ungültig!)

Diagram 1

Material1.7335 (13CrMo44)

Allowable flow rate:

for air, superheated steam 60 m/s
for water 5 m/s up to max. 450 bar

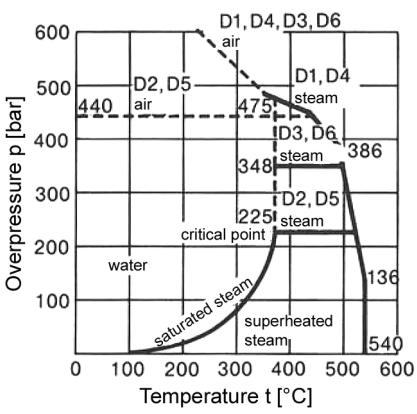


Diagram 2

Material 1.7380 (10CrMo910)

Allowable flow rate:

for air, superheated steam 60 m/s
for water 5 m/s up to max. 450 bar

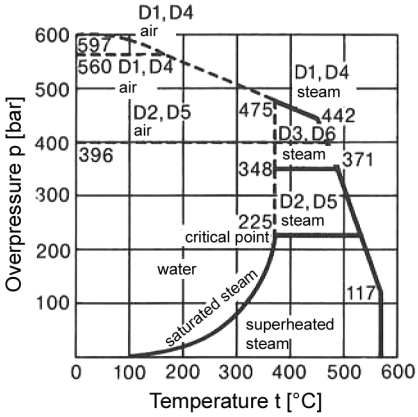


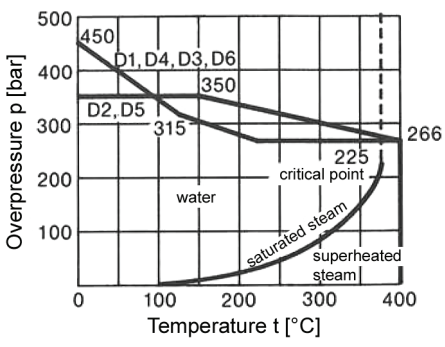
Diagram 3

Material 1.4571 (X6CrNiMoTI17122)

Allowable flow rate:

Protective tubes D1, D3, D4, D6
for air, superheated steam, water 60 m/

Protective tubes D2, D5
for air 60 m/s
for superheated steam, water 30 m/s



Ordering Code

Weld-in Resistance Thermometer TW40

						0		

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

Protective Tube acc. to Table

D1	>	1
D2	>	2
D3	>	3
D4	>	4
D5	>	5
D6	>	6

Material Protective Tube

1.7335 (13CrMo44)	>	1
1.7380 (10CrMo910)	>	2
1.4571 (X6CrNiMoTi17122)	>	3
1.0460 (C22.8)	>	4

Output

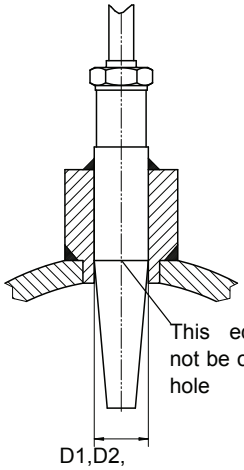
Resistance on terminal strip	>	K
2-wire transmitter output signal 4..20 mA (only for inset tube with 1x Pt100)	>	L

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
0 .. 500	>	9	0

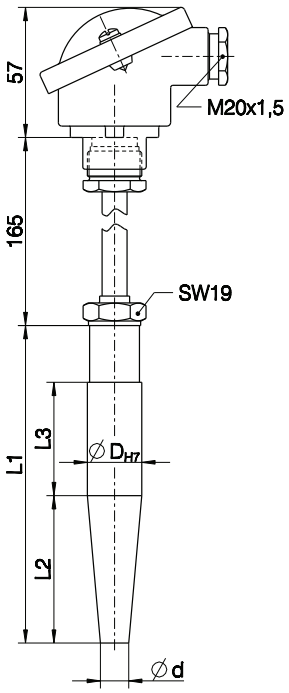
Other ranges on request

Installation requirement



D1,D2,
D4,D5 = ∅24_{G7}
D3,D6 = ∅30_{G7}

Weld-in Resistance Thermometer TW45



like type D DIN 43767, for temperature measurement during high 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	Type 4 acc. to DIN 43772 Materials: 1.7335 (13CrMo44) 1.7380 (10CrMo910) 1.4571 (X6CrNiMoTi17122) 1.0460 (C22.8)

Tab.1	Protective tube type		
	SD1	SD2	SD7
L1 (mm)	140	200	155
L2 (mm)	65	125	40
L3 (mm)	50	50	50

	Mechanical load acc. to diagrams 1 to 3 (for material 1.0460 (C22.8) max. pressure 250 bar)
Neck pipe	Ø 11 mm; length: 165 mm; material: 1.4571
Mounting	M14x1.5 male thread
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	540°C for 1.7335 (13CrMo44) 570°C for 1.7380 (10CrMo910) 400°C for 1.4571 (X6CrNiMoTi17122) 400°C for 1.0460 (C22.8)

Mechanical and thermal load of protective tubes type 4 acc to DIN 43772

Diagram 1

Material 1.7335 (13CrMo44)

Allowable flow rate:

for air, superheated steam 60 m/s
for water 5 m/s up to max. 450 bar

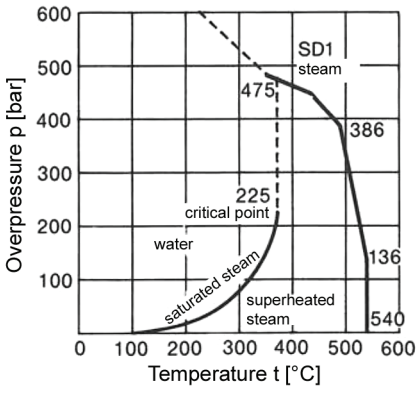


Diagram 2

Material 1.7380 (10CrMo910)

Allowable flow rate:

for air, superheated steam 60 m/s
for water 5 m/s up to max. 450 bar

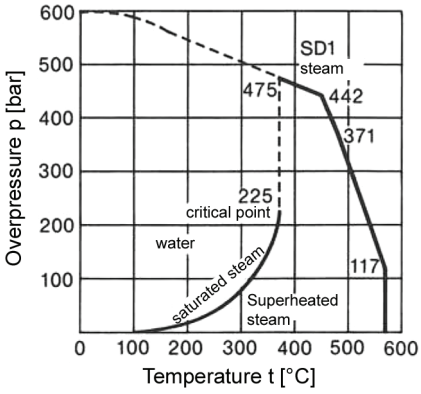
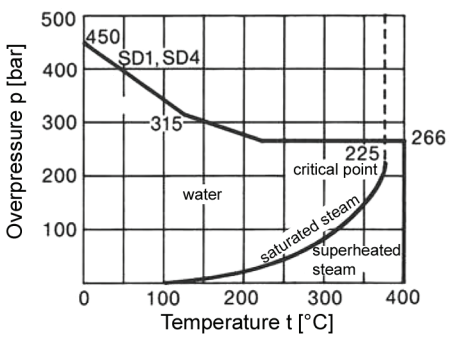


Diagram 3

Material 1.4571 (X6CrNiMoTI17122)

Allowable flow rate:

for air, water, superheated steam 60 m/s



Ordering Code

Weld-in Resistance Thermometer TW45

					0		

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

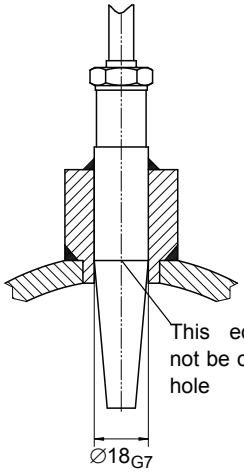
Protective Tube acc. to Table
SD1 ..... > 1
SD2 ..... > 2
SD7 ..... > 7

Material Protective Tube
1.7335 (13CrMo44) ..... > 1
1.7380 (10CrMo910) ..... > 2
1.4571 (X6CrNiMoTi17122) ..... > 3
1.0460 (C22.8) ..... > 4

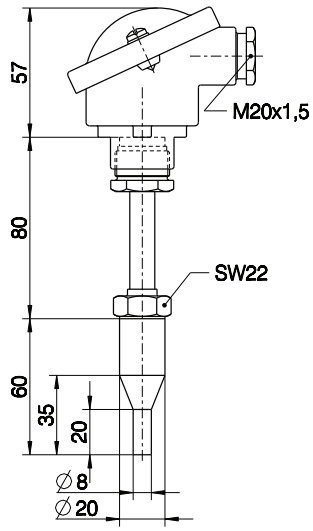
Output
Resistance on terminal strip ..... > K
2-wire transmitter output signal 4..20 mA
(only for inset tube with 1x Pt100) ..... > L

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
0 .. 500 ..... > 9 0
Other ranges on request

Installation requirement



Weld-in Resistance Thermometer TW46



Quick type; for temperature measurement during pressures up to 25 bar and higher 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	Protective tube acc. to dimension; possible materials: 1.4571 (X6CrNiMoTi17122) 1.0460 (C22.8) mechanical load at 400°C: 25 bar
Neck pipe	Ø 11 mm; length: 80 mm; materials: 1.4571
Mounting	G 3/8 male thread
Connection	Standard connection head type B of light metal acc. to DIN EN 50446
max. measuring temp.	400°C

Weld-in Resistance Thermometer TW46

		0			0		

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

Protective Tube Material

1.4571 (X6CrNiMoTi17122)	3
1.0460 (C22.8)	4

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

Basic Values and Limit Value Deviation for Pt100 Resistance Thermometers

Calculation equations for the basic values

The following calculation equations apply ot 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:

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

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

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

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

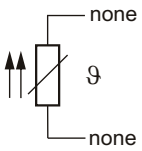
= ± (0.03 + 0.005 * t) for class B1/10 DIN

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

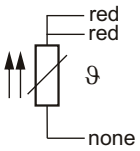
= ± (0.08 + 0.002 * t) for class A1/2 DIN

Connection Diagrams

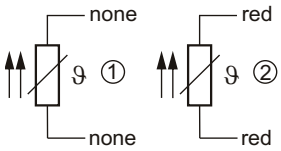
Single Pt100
2-wire circuit



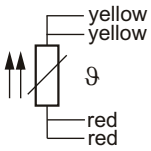
Single Pt100
3-wire circuit



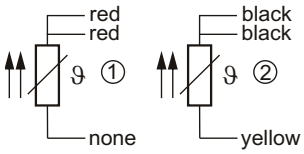
Double Pt100
2-wire circuit



Single Pt100
4-wire circuit

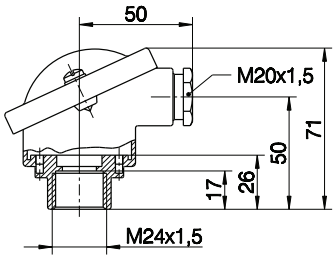


DoublePt100
3-wire circuit

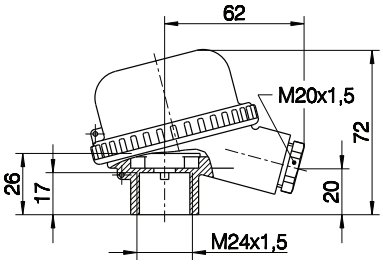


Standard Connecting Heads (Connecting dimensions acc. to DIN EN 50446)

Type B DIN EN 50446
Material: diecast light metal
Protection class: IP54

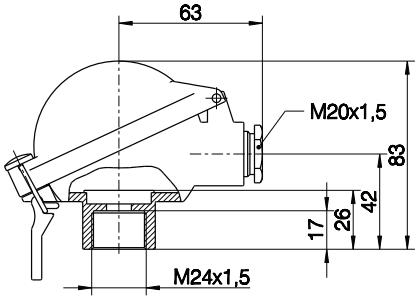


Type BBK
Material: Polyamide (max. 120°C=)
Protection class: IP54

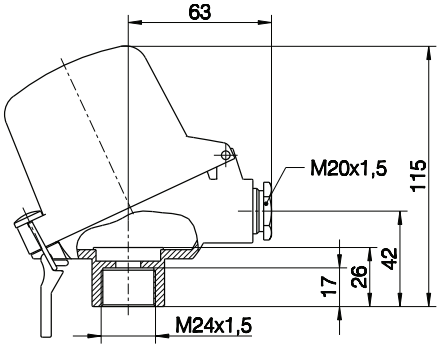


Other Possible Connecting Heads (Connecting dimensions acc. to DIN EN 50446)

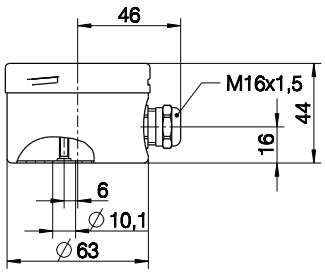
Type BUS
Material: diecast light metal
Protection class: IP65



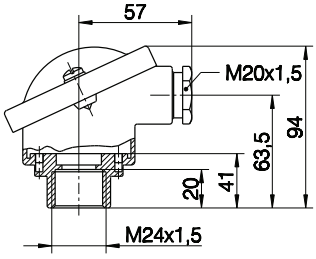
Type BUSH
Material: diecast light metal
Protection class: IP65



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