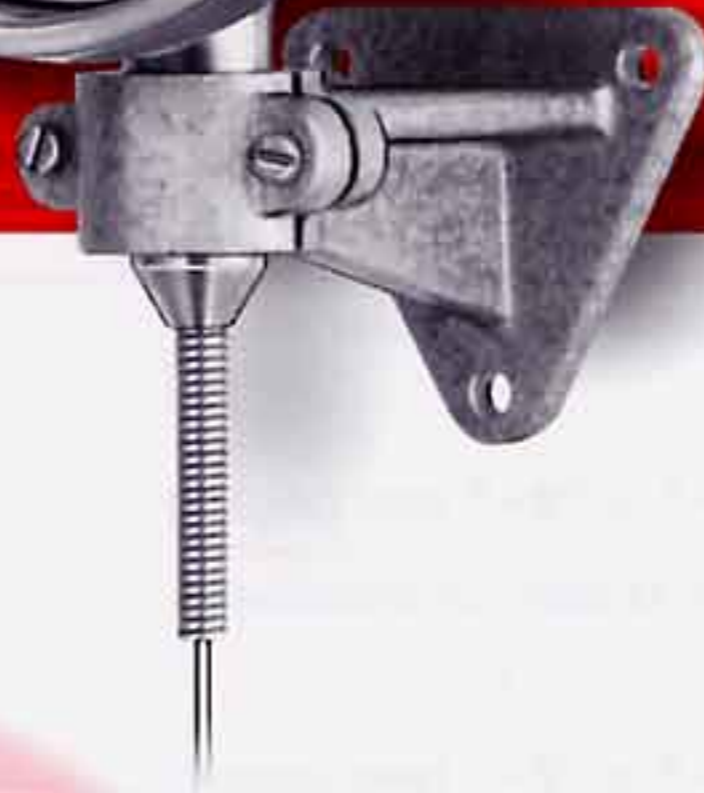
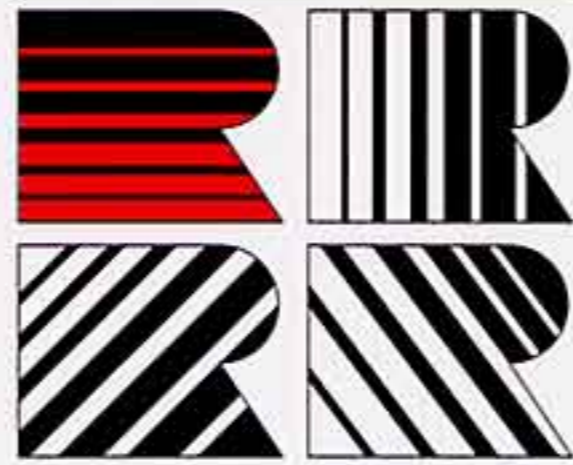


RÜEGER



TIHERMO-Flexible

TF

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**Gas pressure thermometers with capillary tube
"stainless steel" range**

INERT GAS

The "high-performance" category

- Non-polluting
- Temperature range:
from -260°C to $+800^{\circ}\text{C}$
- Remote reading up to 100 m
- Very fast response
- Miniaturized and standardized bulbs
(6, 8, 9 and 13 mm dia.)

Capillary tube thermometers, for industrial use

Gas-filled measuring system

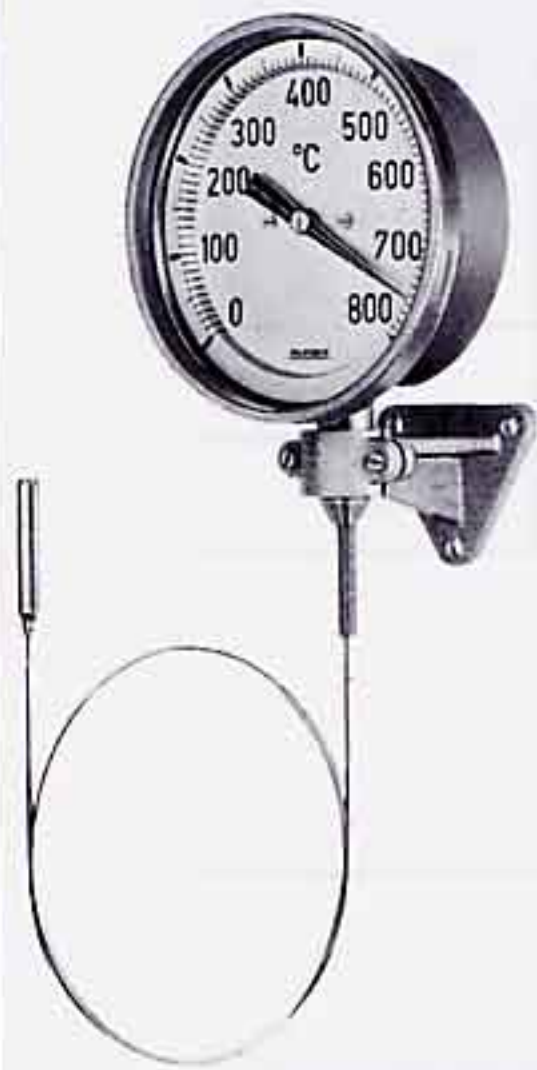
Mineral glass (thickness: 3 mm).
 Head and bezel: stainless steel AISI 304/1.4301.
 Waterproof bezel with bayonet lock
 (EPR seal – ethylene-propylene rubber).
 Adjustment by resetting pointer.

For bracket mounting A Bottom capillary entry	Types dia. 100 mm (4") dia. 130 mm (5") dia. 160 mm (6")	
For panel mounting E with rear fixing clamp Back capillary entry (TFH...) or Bottom capillary entry (TFV...)	Types dia. 100 mm (4") dia. 130 mm (5") dia. 160 mm (6")	
For either bracket or panel mounting X Bottom capillary entry	Types dia. 100 mm (4") dia. 130 mm (5") dia. 160 mm (6")	
For wall mounting with rear fixing lugs B Bottom capillary entry or Back capillary entry (TFH...)	Types dia. 100 mm (4") dia. 130 mm (5") dia. 160 mm (6")	
For mounting with swivelling connection T fitted on shoulder Bottom capillary entry For T connection threads, see page 7 These models supplied with bulbs type "1-" or "2-" (see page 6)	Types dia. 100 mm (4") dia. 130 mm (5") dia. 160 mm (6")	
For mounting with swivelling cap connection U fitted on shoulder Bottom capillary entry For U connection threads, see page 8 These models supplied with bulbs type "1-" or "2-" (see page 6)	Types dia. 100 mm (4") dia. 130 mm (5") dia. 160 mm (6")	

Options

Unbreakable acrylic glass		
Safety glass		
Bright-polished bezel		
Epoxy-coated head and bezel		
With index-pointer (to record maximum or minimum temperature attained)		
Amplifying movement, stainless steel		
Ditto, also resistant to vibrations		
Liquid filled		
Long mounting bracket (projection 90 mm)		No. 041-076
Epoxy-coated mounting bracket		No. 041-077
RÜEGER inspection certificate		
Price list		Reference
With electrical and pneumatic contacts		See notices

- = Standard model, **without** price supplement
- = Standard model, **with** price supplement
- = Optional, **with** price supplement



TFV100AI..
TFV130AI..
TFV160AI..

TFH(V)100EI..
TFH(V)130EI..
TFH(V)160EI..

TFV100XI..
TFV130XI..
TFV160XI..

TFV(H)100BI..
TFV(H)130BI..
TFV(H)160BI..

TFV100TI..
TFV130TI..
TFV160TI..

TFV100UI..
TFV130UI..
TFV160UI..

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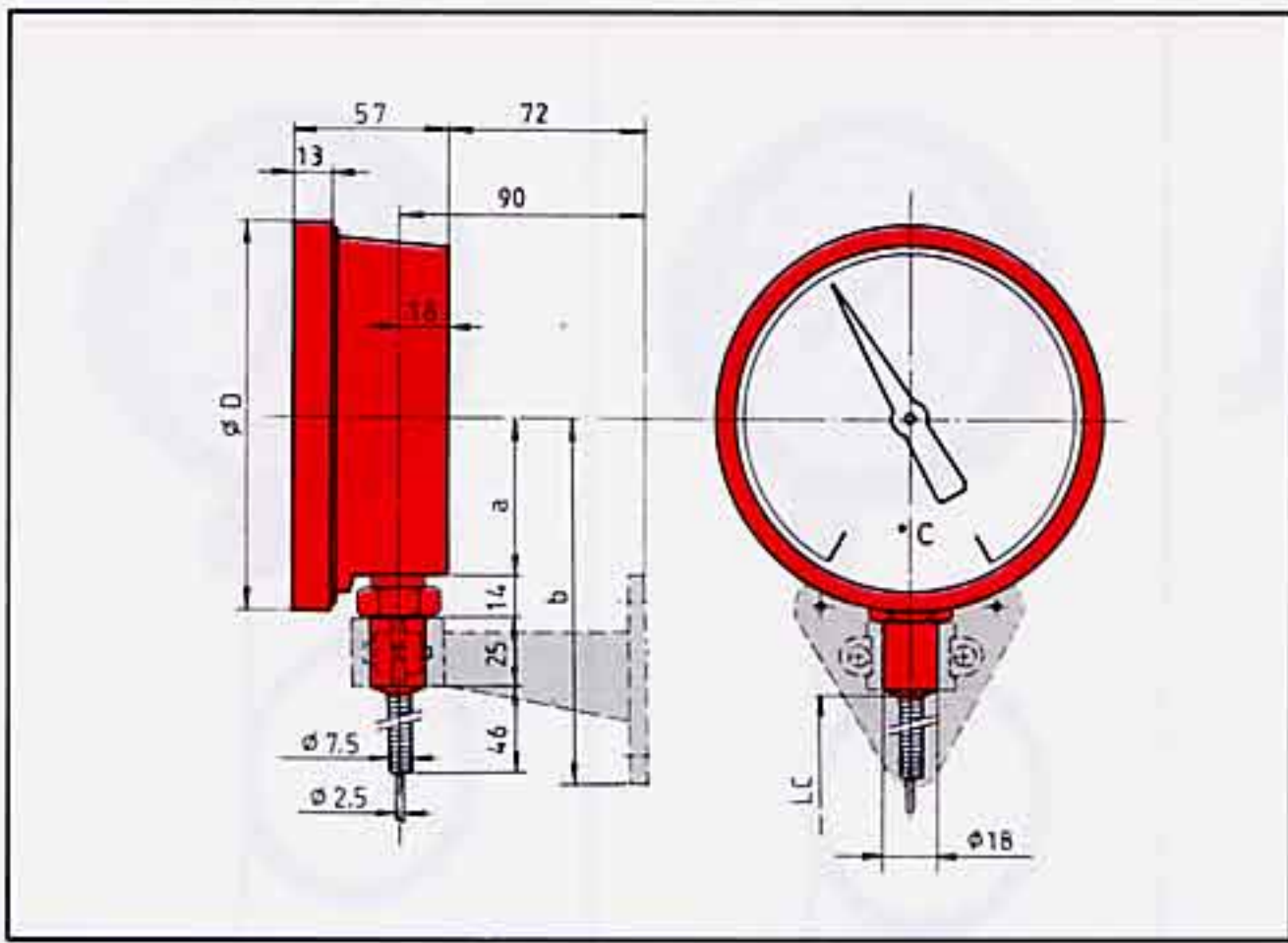
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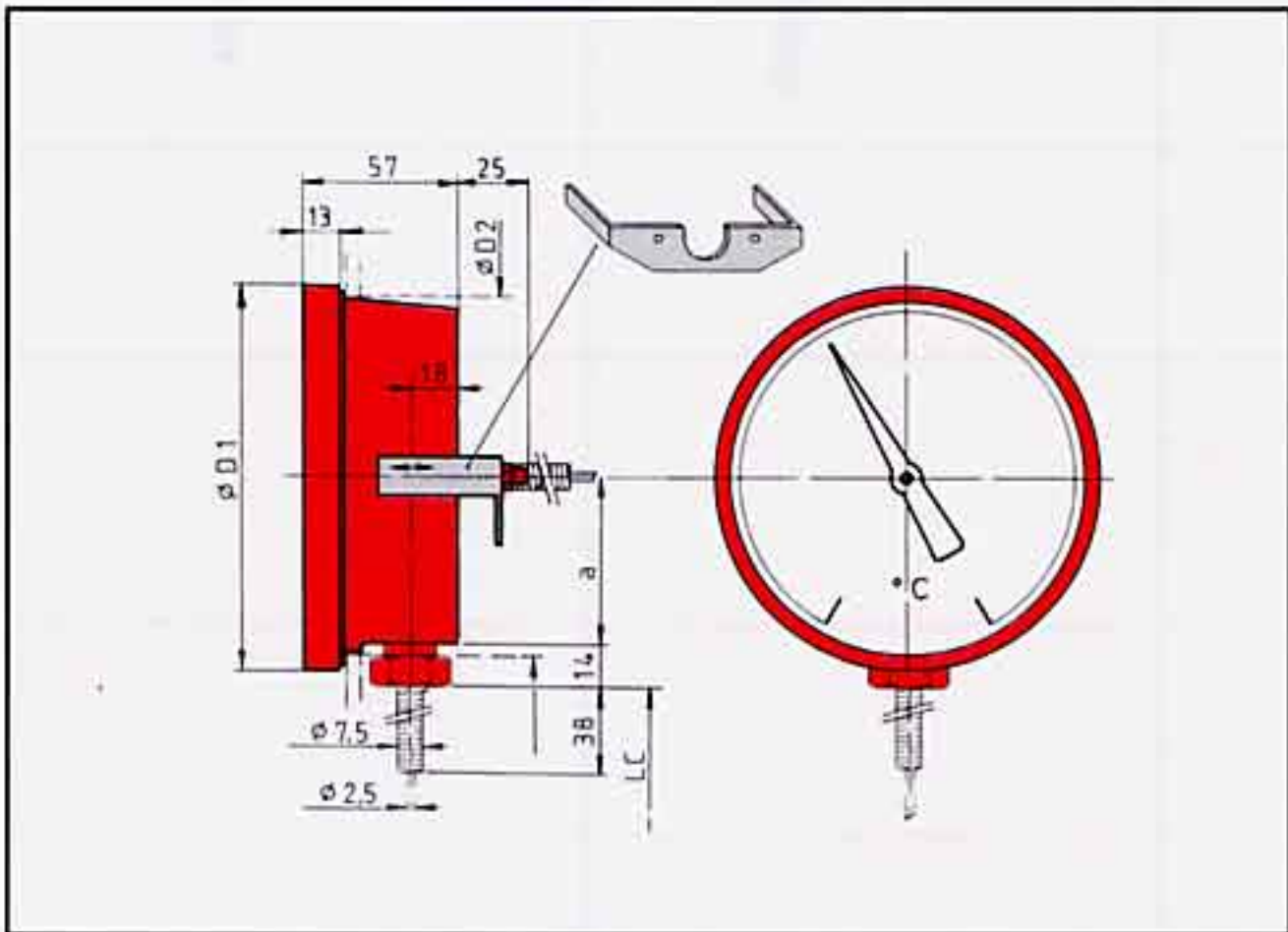
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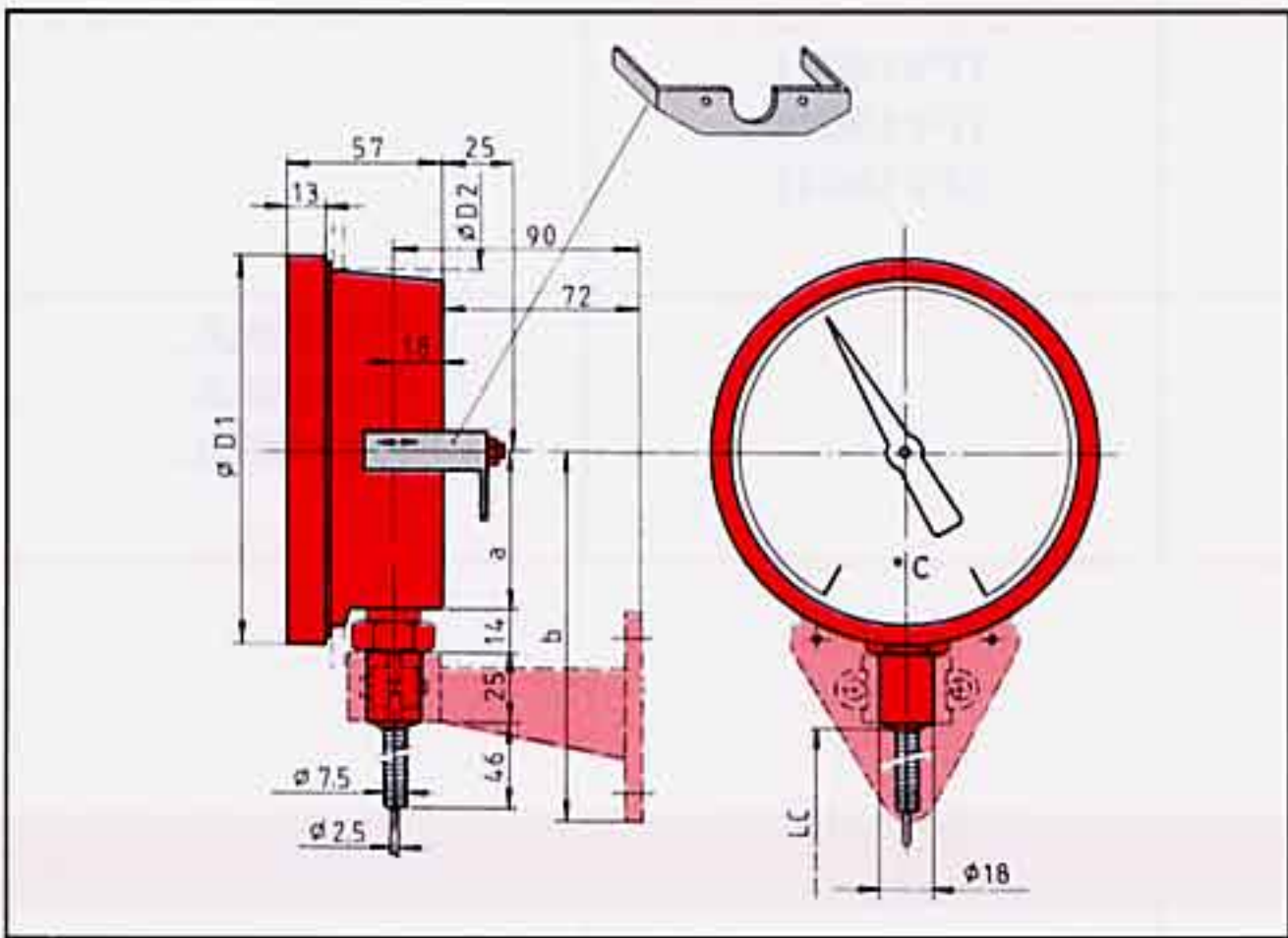
TF 1
TK 1, TK 3



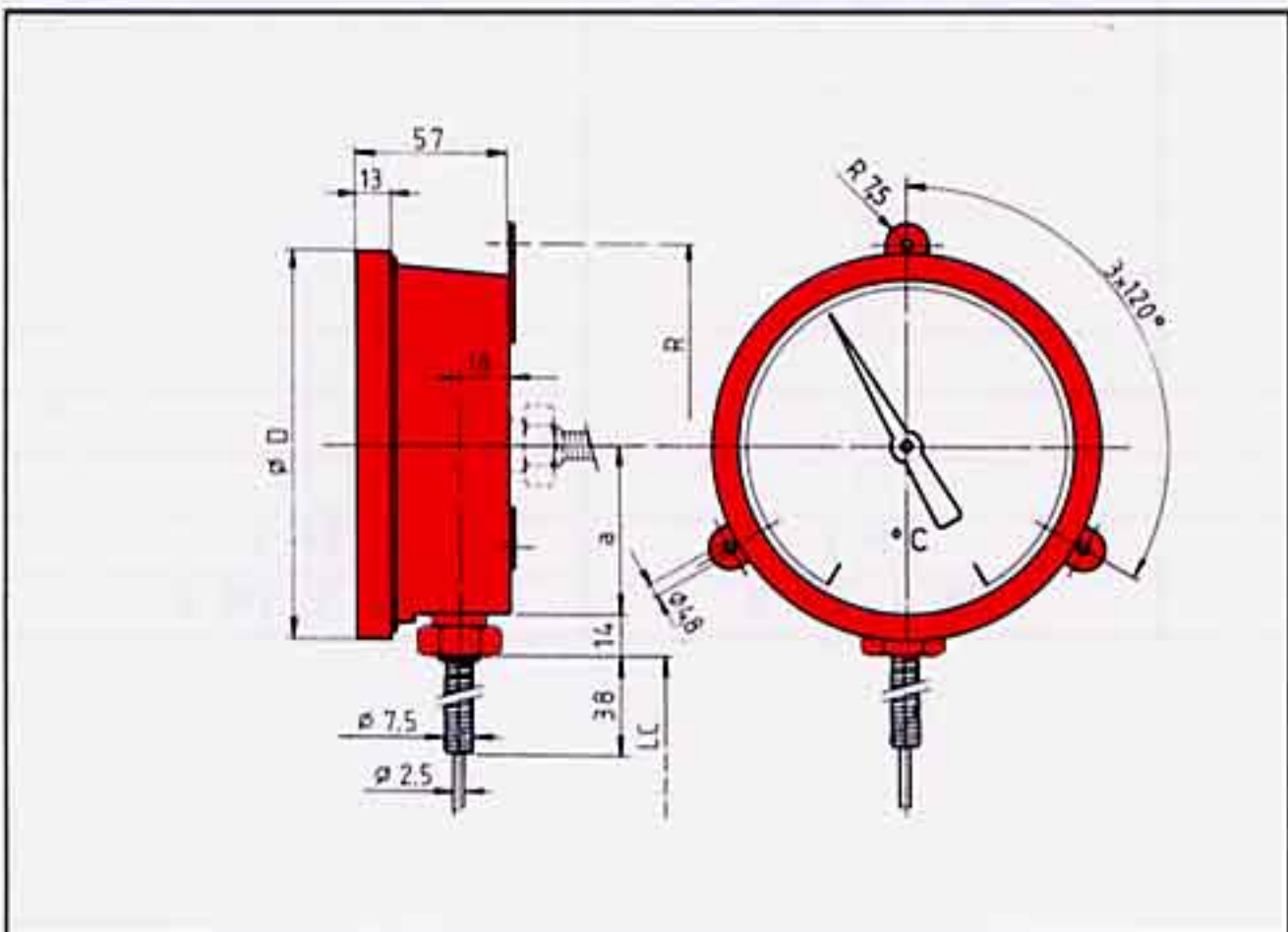
For bracket mounting			
TFV	100Al..	130Al..	160Al..
dia. D	111 (4")	141 (5")	173 (6")
a	43	58	74
b	118	133	149
LC	up to 100 m max.		



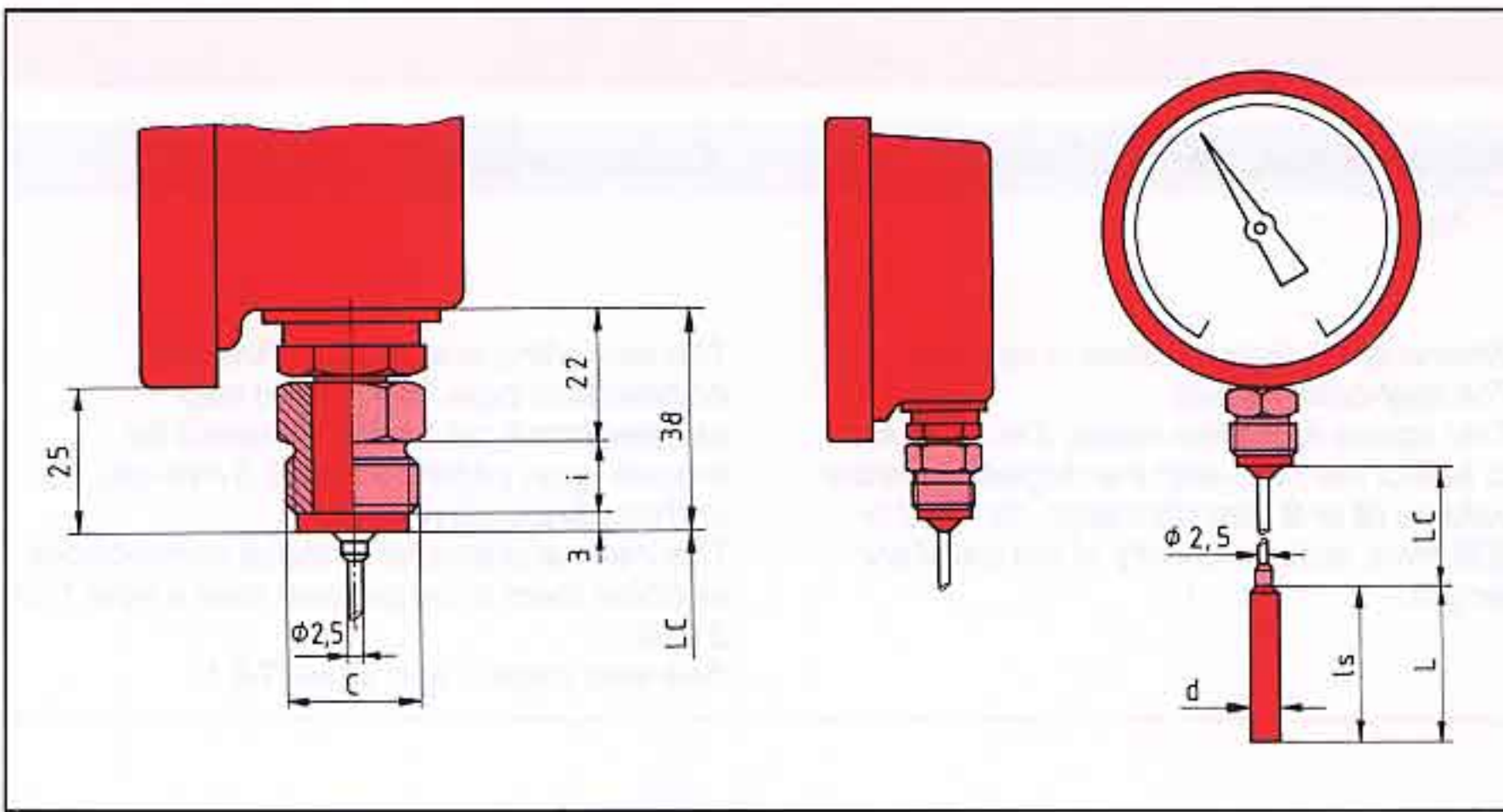
For panel Mounting			
TFH(V)	100EI..	130EI..	160EI..
dia. D1	111 (4")	141 (5")	173 (6")
dia. D2	101	131	161
a	43	58	74
LC	up to 100 m max.		



For either bracket mounting or panel mounting			
TFV	100XI..	130XI..	160XI..
dia. D	111 (4")	141 (5")	173 (6")
a	43	58	74
b	118	133	149
LC	up to 100 m max.		



For wall mounting			
TFV(H)	100BI..	130BI..	160BI..
dia. D	111 (4")	141 (5")	173 (6")
a	43	58	74
R	58	73	92
LC	up to 100 m max		

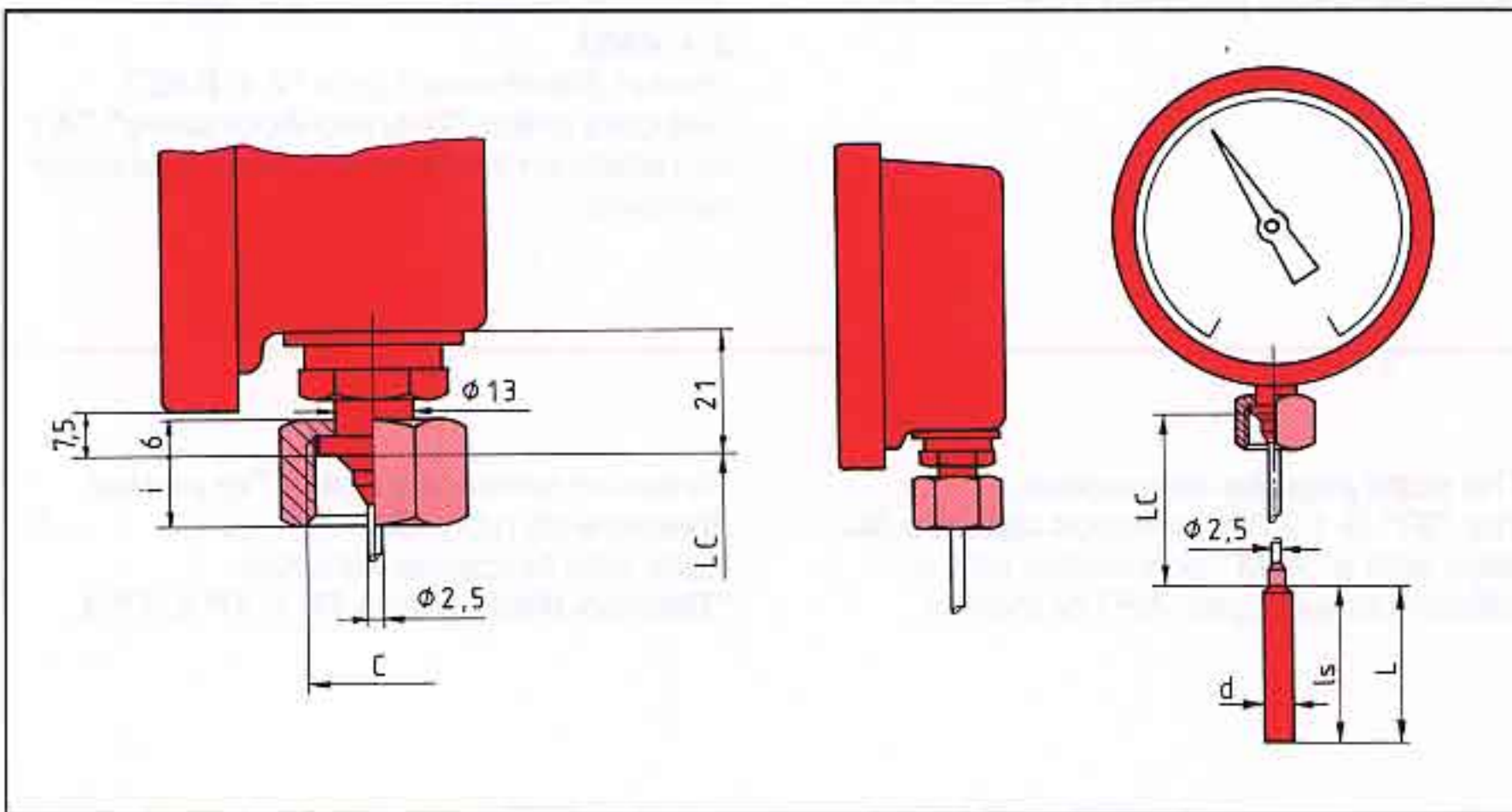


For mounting with swivelling connection "T"

fitted on the shoulder.

Types **TFV100TI..**
TFV130TI..
TFV160TI..

For **T** connection threads: see page 7.
These thermometers are supplied with bulbs type "1" or "2".
Total immersion depth: **L_C + L**.

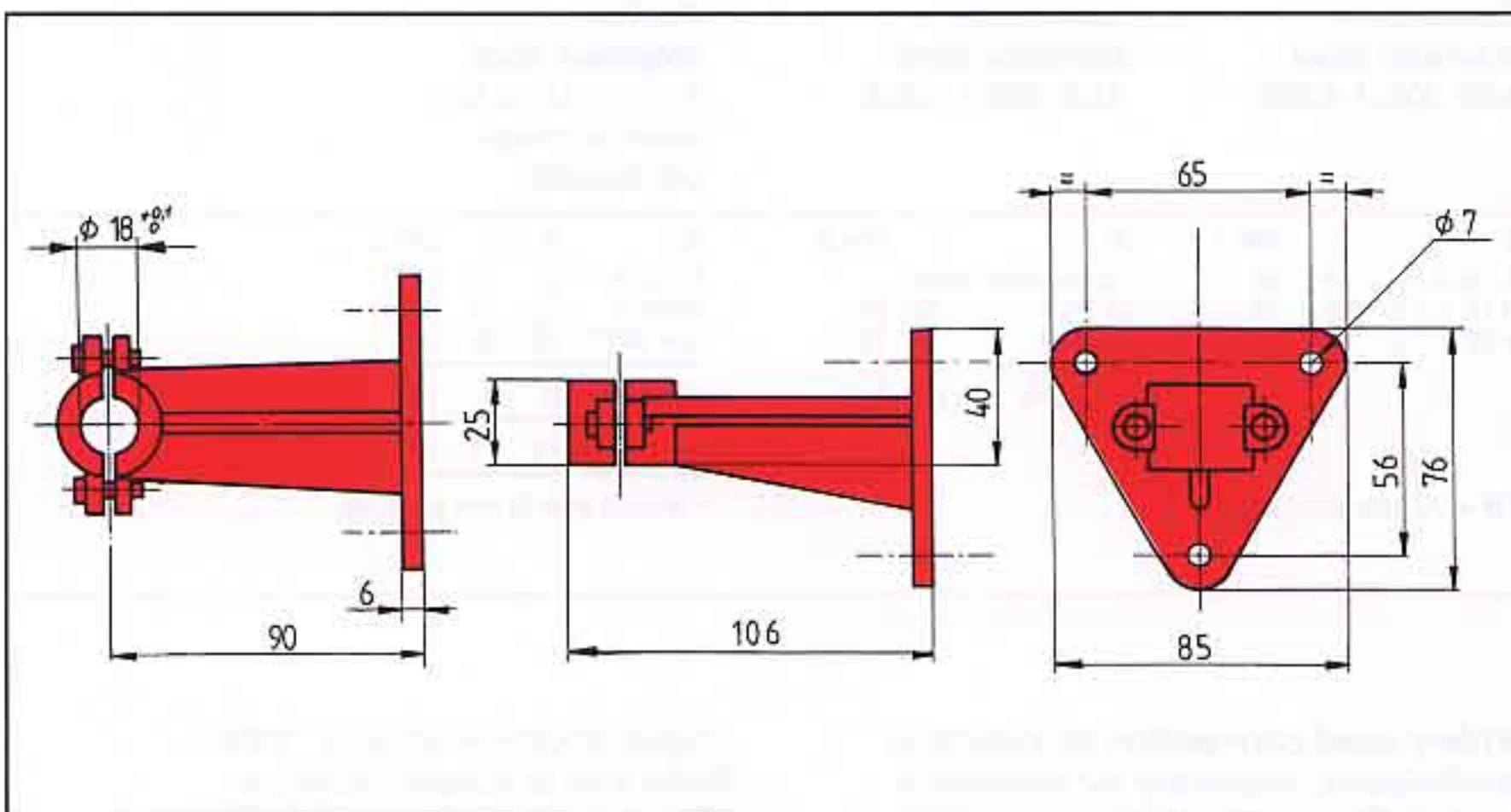


For mounting with swivelling cap connection "U"

fitted on the shoulder.

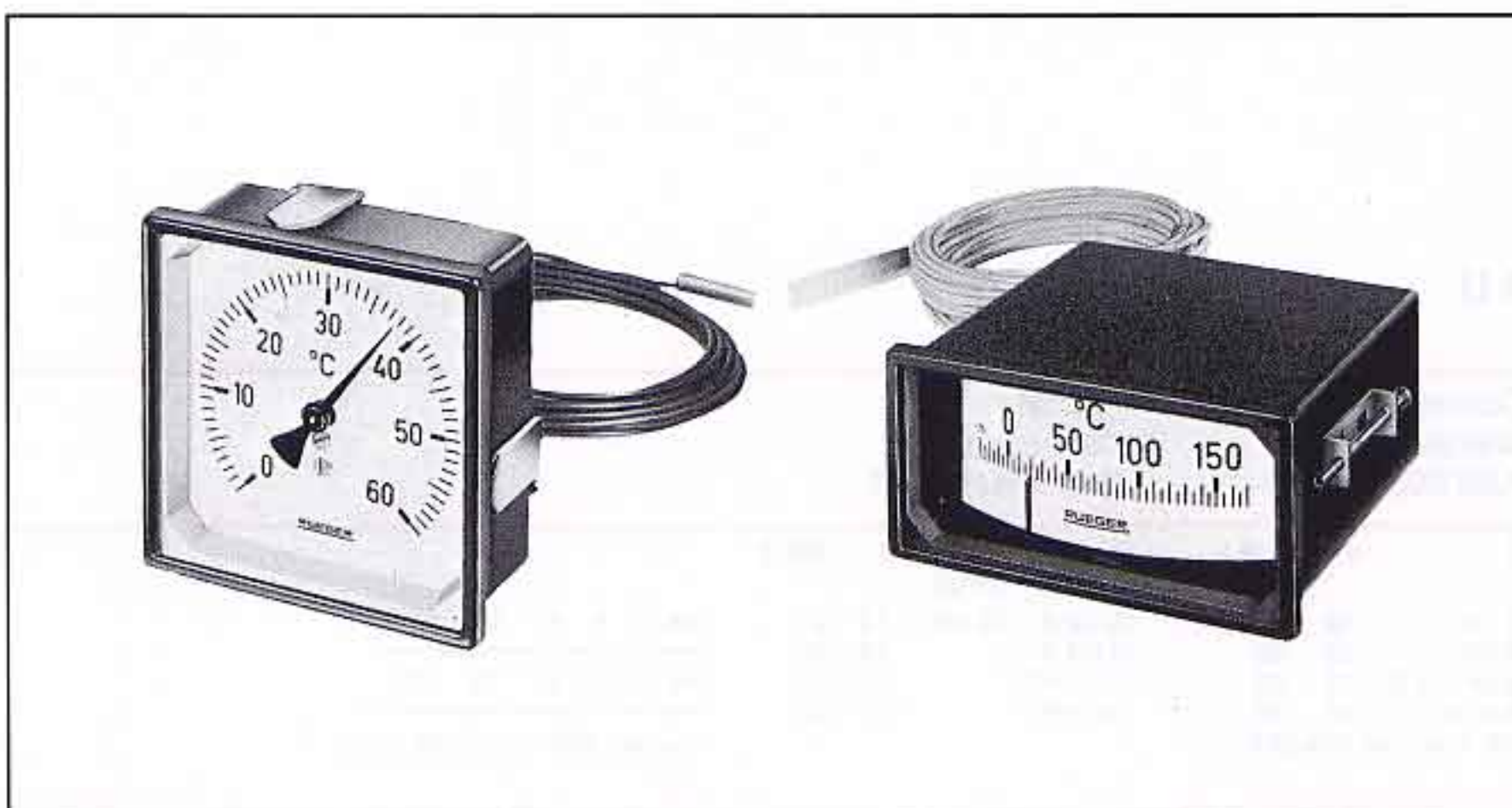
Types **TFV100UI..**
TFV130UI..
TFV160UI..

For **U** connection threads: see page 8.
These thermometers are supplied with bulbs type "1" or "2".
Total immersion depth: **L_C + L**.



Mounting bracket

Light alloy (supplied as an accessory, at extra charge).
Order No.: 041-076.
On request, at extra charge: epoxy coating.
Order No.: 041-077.
Projection: 90 mm.



For control panel mounting

Square case models (DIN standards)
96 × 96 mm
144 × 144 mm
Circular or part-circular scale

Rectangular case models (DIN standards)
144 × 72 mm
72 × 144 mm
Linear scale.
With or without electrical contacts.

Temperature bulbs

Characteristics	Advantages, applications	Accessories																																																							
Type 1 Unthreaded bulb (without fitting). The whole length of the bulb is gas filled, i.e. the bulb is sensitive over all its length.	Wherever no fixing system is needed. The low-cost variant. If no space limitation exists, it is advisable to select the bulb with the largest possible volume (8 or 9 mm diameter, "Is" 100 or 200 mm), independently of the capillary length.	The swivelling and sliding threaded connection type "AMX" and cap connection type "AMU" (sealed) for mounting on capillary with 2.5 mm dia. (or unthreaded bulb type 2). The internal diameter of these connections enables them to be passed over a type 1 or 2 bulb. See also page 9 and sheet TA 1.																																																							
Type 2 Unthreaded bulb (without fitting). A certain length of the bulb is sensitive to temperature, the rest is insensitive and the connection is fitted to this portion. Types 2 + AMX and 2 + AMU: Bulbs with threaded connections swivelling and sliding (sealed).	Useful in cases where thermometers are kept in stock , as the fitting with thread as required can be mounted as necessary.	"AMX" threaded connection and "AMU" swivelling cap connection (sealed) for mounting on type 2 bulb, 2 + AMX, 2 + AMU. Pocket (thermowell) type "2 + DAE". See data sheet "Thermo-Accessory" TA 1 for details on these connections and order numbers.																																																							
Types 3 T Bulbs with swivelling threaded connection .	The most popular connection . The "3T" G 1/2 A connection can also be fitted with a "ANX" connection with a different thread (gas, NPT or metric).	Threaded connection "ANX" or pocket (thermowell) type "DIE". Refer also to special literature "Thermo-Well", group TP 1, TP 2, TP 3.																																																							
Types	3 T	3 T + ANX	3 T + DIE																																																						
	Connection stainless steel AISI 303/1.4305	Connection stainless steel AISI 303/1.4305	Pocket stainless steel AISI 304/1.4301; steel or brass on request.																																																						
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Types 4 U Bulbs with cap connection .	Widely used connection for industrial applications, especially for resistance probes. Substitution of these for the gas filled bulbs is thus easily possible.	Pocket (thermowell) type "DEE". Refer also to special literature "Thermo-Well", TP 1, TP 2, TP 3.																																																							
Types	4 U	4 U + DIE																																																							
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Temperature bulbs

Types	1	2	2 + AMX	2 + AMU
<p>"Is" = sensitive length (only the portion of the bulb within this length is filled with gas).</p> <p>Important! To ensure accurate temperature measurement, the whole of the sensitive length "Is" must be immersed in the medium.</p> <p>The standard insensitive length of 50 mm (2") is empty of gas, and is intended for the mounting of an accessory connection.</p> <p>See above and page 9.</p> <p>Bulb materials: see page 9.</p> <p>Note: Type 1 bulbs have a capillary but neither armoured sheathing nor protective spring.</p>				
	Unthreaded, without connection	Unthreaded, without connection	With swivelling and sliding threaded connection (sealed)	With swivelling and sliding cap connection (sealed)

Types	3 T	3 T + ANX	3 T + DIE
<p>"Is" = sensitive length.</p> <p>See note page 6, under types 1 and 2.</p> <p>Bulb materials: see page 9.</p> <p>Other connections, threads and lengths available on request, at extra cost.</p>			
	Fixing by swivelling threaded connection (sealed)	Fixing by double swivelling threaded connection (sealed)	Fixing by swivelling threaded connection + pocket type DIE (sealed)

Types	4 U	4 U + DEE
<p>"Is" = sensitive length.</p> <p>See note page 6, under types 1 and 2.</p> <p>Bulb materials: see page 9.</p> <p>Other connections, threads and lengths available on request, at extra cost.</p>		
	Fixing by cap connection (sealed)	Fixing by cap connection + pocket type DEE (sealed)

Temperature bulbs

Calculating the sensitive length "Is" and diameter of bulb

The sensitive length "Is" and the diameter of the bulb are determined according to the temperature range and the length of capillary tube "Lc".

We recommend a sensitive length "Is" of at least 100 mm, and a bulb diameter as large as possible.

Temperature	"Lc" max.	bulb diameter	"Is"
≤ 700°	7 m	6 mm	100 mm
≤ 700°	15 m	6 mm	150 mm
≤ 700°	20 m	6 mm	200 mm
≤ 700°	7 m	8 mm	* 50 mm
≤ 700°	15 m	8 mm	* 75 mm
≤ 700°	20 m	8 mm	100 mm
≤ 700°	50 m	8 mm	200 mm
≤ 700°	7 m	9 mm	* 50 mm
≤ 700°	15 m	9 mm	* 75 mm
≤ 700°	20 m	9 mm	100 mm
≤ 700°	50 m	9 mm	200 mm
≤ 700°	20 m	13 mm	* 50 mm
≤ 700°	50 m	13 mm	100 mm
≤ 700°	100 m	13 mm	200 mm
≤ 800°	10 m	9 mm	100 mm
≤ 800°	10 m	13 mm	50 mm
≤ 800°	10 m	13 mm	100 mm
≤ 800°	25 m	13 mm	150 mm

Choice of bulb

First determine the sensitive length "Is" and the bulb diameter, then define the other minimum values "L", "L1", "A".

Bulbs	1	2	2 + AMX*	2 + AMU*
"Is"	L	L mini	L mini	L mini
50 mm	50 mm	100 mm	62 mm	70 mm
75 mm	75 mm	125 mm	87 mm	95 mm
100 mm	100 mm	150 mm	112 mm	120 mm
150 mm	150 mm	200 mm	162 mm	170 mm
200 mm	200 mm	250 mm	212 mm	220 mm

Bulbs	3T	3T + ANX*	3T + DIE
"Is"	L1 mini	L1 mini	A mini
50 mm	70 mm	70 mm	72 mm
75 mm	95 mm	95 mm	97 mm
100 mm	120 mm	120 mm	122 mm
150 mm	170 mm	170 mm	172 mm
200 mm	220 mm	220 mm	222 mm

Bulbs	4U	4U + DEE
"Is"	L1 mini	L1 mini
50 mm	95 mm	72 mm
75 mm	120 mm	97 mm
100 mm	145 mm	122 mm
150 mm	195 mm	172 mm
200 mm	245 mm	222 mm

* On connections with NPT threads, increase these values by 10 mm.

Temperature bulbs

Characteristics

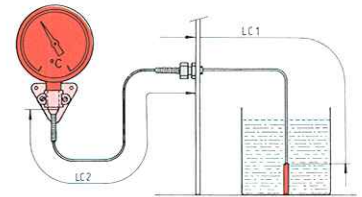
Types 5 AMX and 5 AMU

Bulbs with swivelling and sliding threaded connection mounted directly on the capillary during manufacture.

For fitting to the capillary subsequently, see types "ACX" and "ACU" below.

Advantages, applications

With this solution the bulb need not be too long. As the connection can be slid along the capillary, the distance between the bulb and the connection can be adjusted as required.



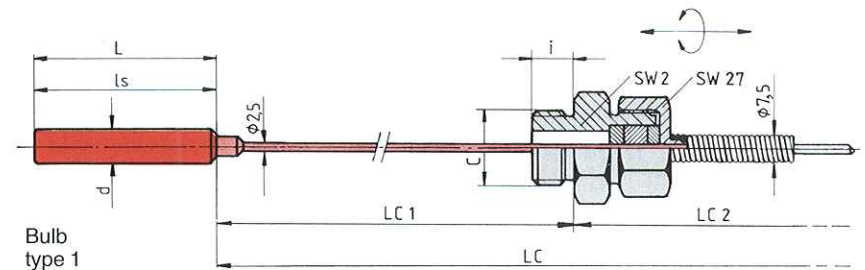
Type

5 AMX

Fixing by swivelling and sliding threaded connection mounted directly on the capillary (2.5 mm dia.). In stainless steel AISI 303/1.4305. PTFE (Teflon) sealing ring, for working temperatures from -70 to +250°C (-90... +480°F).

C	i	SW 2
G 1/2 A	12	27
G 3/4 A	12	32
1/2" NPT	22	27
M 20 x 1.5	12	27

SW = Across flats (AF)



LC = Total length of capillary between thermometer head and bulb.

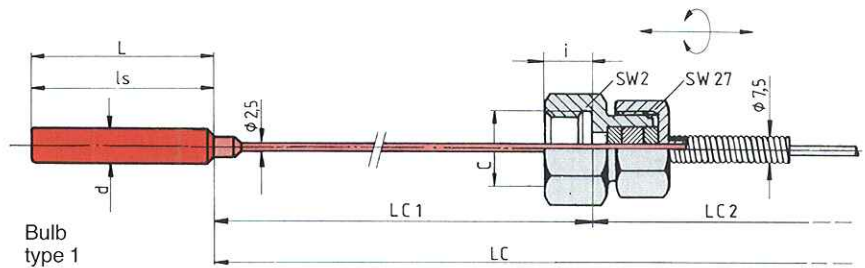
Type

5 AMU

Fixing by swivelling and sliding cap connection, mounted directly on the capillary (2.5 mm dia.). In stainless steel AISI 303/1.4305. PTFE (Teflon) sealing ring, for working temperatures from -70 to +250°C (-90... +480°F).

C	i	SW 2
G 1/2	12	27
G 3/4	12	32
M 24 x 1.5	12	32
M 27 x 2	12	32

SW = Across flats (AF)



LC = Total length of capillary between thermometer head and bulb.

Accessories

Types

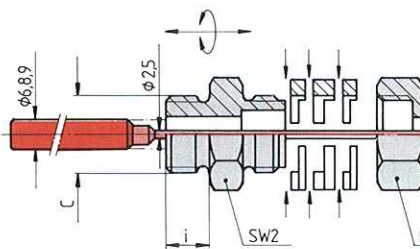
Swivelling and sliding threaded "ACX" and cap "ACU" connections (sealed), for fitting to the capillary subsequently (2.5 mm dia.).

In stainless steel AISI 303/1.4305.

Sealing rings:

- PTFE (Teflon), for working temperatures from -70 to +250°C (-90... +480°F).
- Copper, for working temperatures up to +800°C (1470°F) (6, 8 and 9 mm dias. only).

ACX

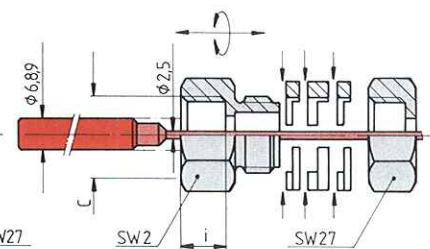


Connection "ACX"

C	i	SW 2
G 1/2 A	12	27
G 3/4 A	12	32
1/2" NPT	22	27
3/4" NPT	22	32
M 18 x 1.5	12	27
M 20 x 1.5	12	27

SW = Across flats (AF)

ACU



Connection "ACU"

C	i	SW 2
G 1/2	12	27
G 3/4	12	32
1/2" NPT	18	27
M 24 x 1.5	12	32
M 27 x 2	12	32

SW = Across flats (AF)

Unsealed connections for bulbs 6, 8 and 9 mm dias.: see «Accessories» for bulbs types 1 and 2, page 6.

Bulb materials

For ranges from -260°C to +700°C
Stainless steel AISI 316 L/1.4404

For range 0... +800°C
Nimonic – drilled from bar stock

Thermometers for industry

Standard temperature ranges

Range °C	°Div.	Range °C	°Div.	Range °C	°Div.	Range °C	°Div.
- 260... + 50*	5	- 30... + 170	2	0... + 120**	1	0... + 400	5
- 200... + 50*	2	- 30... + 270	5	0... + 160**	2	0... + 500*/**	10
- 120... + 40*	2	0... + 60**	1/2	0... + 200**	2	0... + 600*/**	10
- 70... + 40	1	0... + 80***	1	0... + 250**	2	0... + 700*	10
- 40... + 40	1	0... + 100	1	0... + 320	5	0... + 800*	10
- 30... + 70	1						

* = with extra cost. ** = conform to DIN. *** = for dia. 100 mm (4") only.

Other **special ranges** (°C, °F, Kelvin, or double °C/°F scales) available on request, with extra cost.

The **average scale angle** is 270° (260-280°). The **scale length** on the dial is about 190 mm for 100 mm dia., 250 mm for 130 mm dia. and 300 mm for 160 mm dia. The dial **diameters**, the printing of the **figures**, and the **divisions**, conform to **DIN standards**. The antiparallax dial is made of printed or anodized aluminium. On request, DIN and KI.1 indications can be printed on the dial. Pointer aluminium alloy, black.

Capillary tubes

Capillary tubes (int. dia. 0.1 ± 0.03 mm)	Material	Ext. dia. mm	Temperature range
Minimum bending radius of capillary: 40 mm	Stainless steel	2.5	- 260... + 800°C (- 328... + 1470°F)
Protective springs	Stainless steel	6.5 7.5	with bulbs types 2, 6 mm dia. for all other bulbs
Armoured sheathings*	Material	Ext. dia. mm	Service temperature
Anti-corrosive protection and electrical insulation (approx. 10 kV):	PVC	3.5	- 20... + 80°C (0... + 180°F)
	PTFE	3.5	- 70... + 250°C (- 90... + 480°F)
Mechanical protection	Stainless steel		
	AISI 304/1.4301	6	- 260... + 400°C (- 430... + 750°F)
	AISI 316/1.4401	6	- 260... + 400°C (- 430... + 750°F)
* = available on bulbs types 2 -, 3 T to 4 U	Galvanized steel	6	- 260... + 160°C (- 430... + 320°F)

Technical specification

Characteristics	Units	Value	Characteristics	Units	Value
Range lower limit	°C	≥ - 260	Hysteresis	% FS	0.5
Range upper limit	°C	≤ + 800	Threshold	% FS	≤ ± 0.3
Minimum span* Δ T	K	60	Stability	% FS/a	≤ ± 0.3
Maximum span* Δ T	K	800	Ambient temperature error (- 10... + 50°C)	% FS	≤ ± 1
Overload for range < 600°C	% FS	20	Ambient pressure error (0.7... 1.1 bar _{abs})	% FS	≤ ± 0.2
Overload for range ≥ 600°C	% FS	10	Calibration at ≈ +20°C and ≈ 1 bar _{abs}		
Accuracy (class 1)	% FS	≤ ± 1			
Repeatability	% FS	≤ ± 0.3			
* = Full scale (FS)			Degree of protection	IP	65

These thermometers may be in **vibration-resistant execution** according to the **service conditions** expected (e.g. liquid filled). Please specify when ordering.

How gas-filled thermometers work

The idea of devising thermometers which work according to the gas laws — where a temperature change produces a proportional pressure change — is nothing new. It was applied industrially, using gas at high pressure, almost 20 years ago for the manufacture of SECUTHERM capillary thermometers.

RÜEGER has mastered this technology for 15 years now, and working closely with the inventors of the SECUTHERM gas-pressure thermometer, has made many improvements. RÜEGER has thus retained its place as indisputable leader in the field of these precision instruments.

The measuring system of the RÜEGER gas-filled thermometers comprises a capillary, and a tubular coil.

The coil, made in a special spring steel, unrolls as the pressure inside it increases, and rolls tighter as the pressure decreases. These pressure-induced movements are proportional to the changes in temperature which cause them. As the coil is linked to a pointer by an

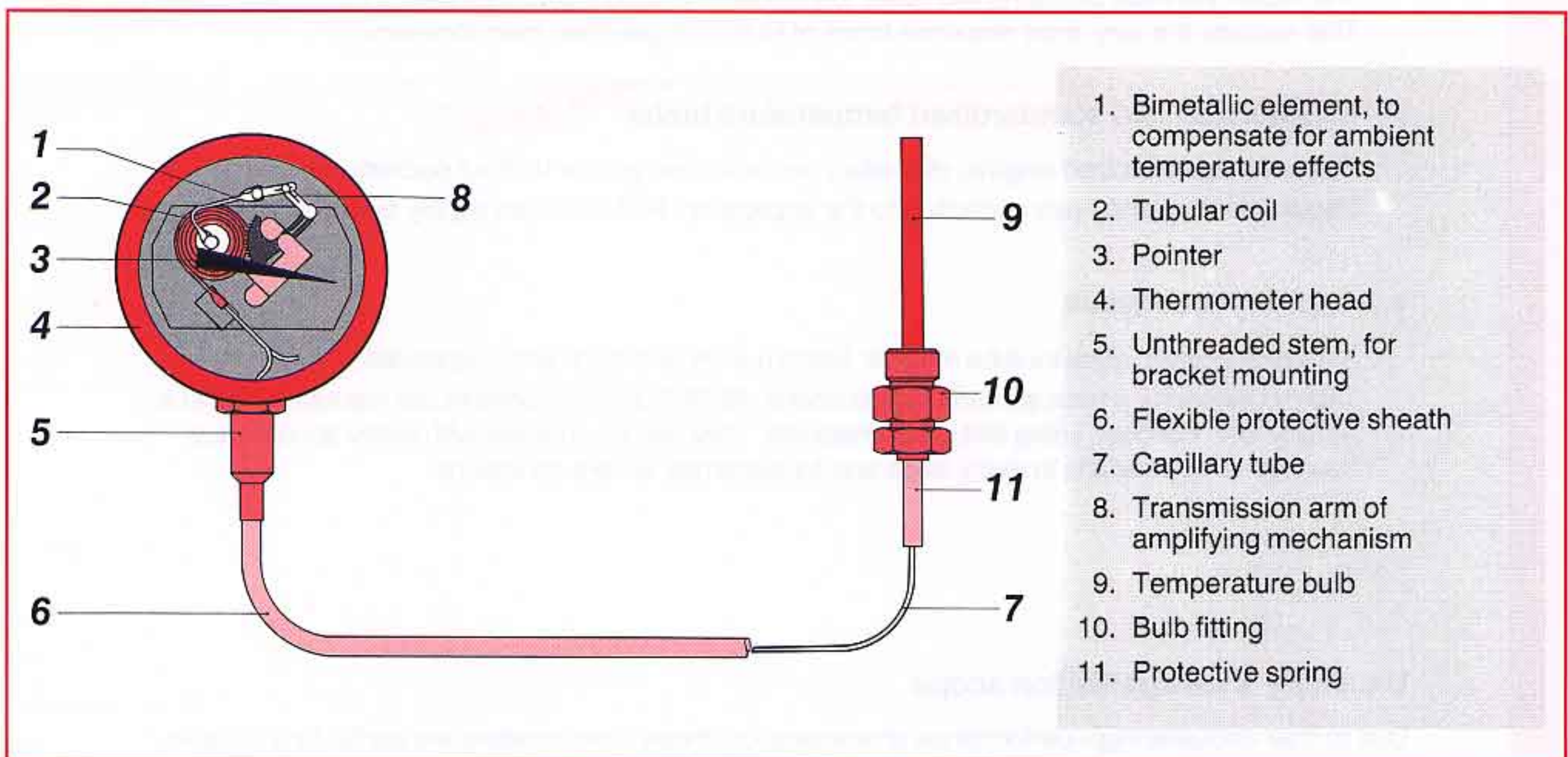
amplifying mechanism, the displacement of the pointer against a scale gives an accurate indication of the temperature change.

To compensate for the ambient temperature acting on the thermometer head, the coil and the capillary, a bimetallic element is incorporated between the coil and the amplifying mechanism.

Non-polluting, non-contaminating

The inert gases such as helium, which RÜEGER uses to fill its capillary tube thermometers, represent no hazard to the medium being measured or to the environment, in case of accident. This is a very positive feature when one realizes how, every year, large quantities of goods are spoiled, and damage to the environment and to health is caused, by substances such as mercury, ethylene, toluene, freon, etc.

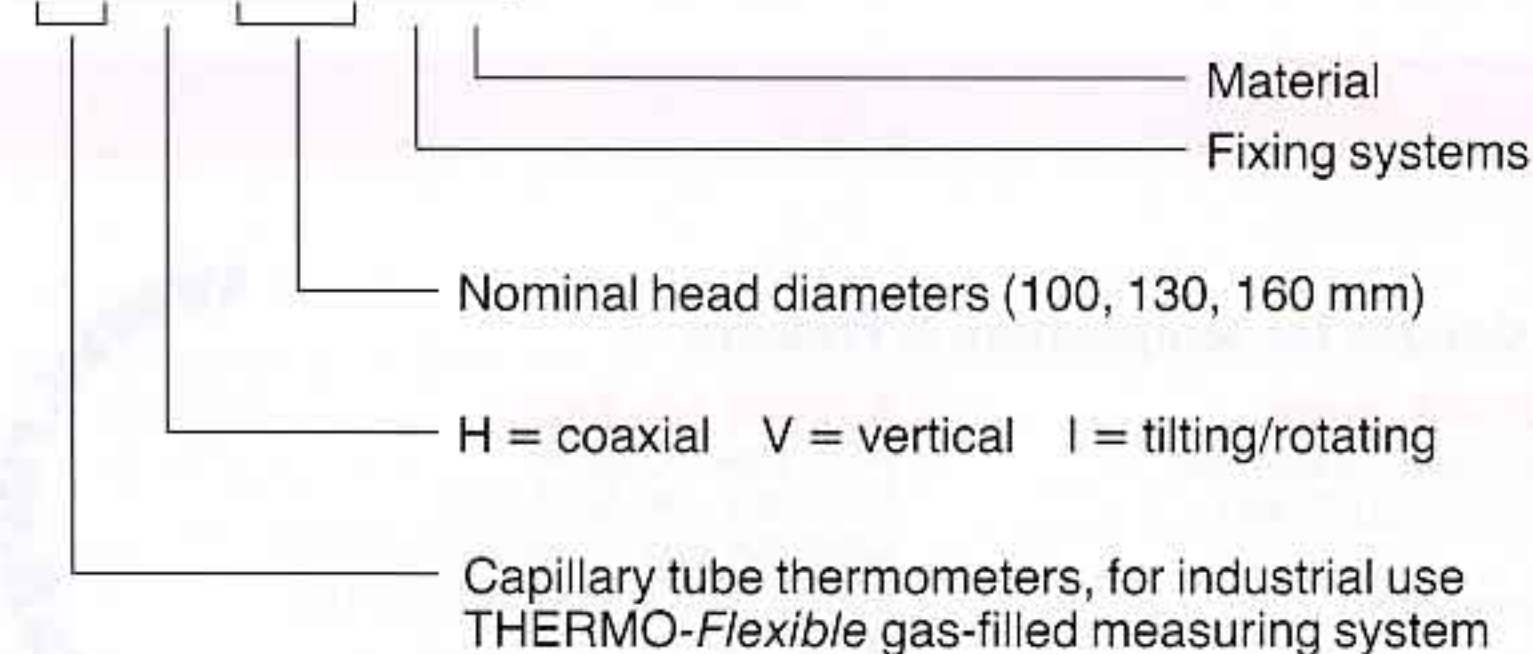
RÜEGER thermometers are *safe*, and offer the advantage of a technology which is both advanced and non-polluting.



Ordering code structure

Type

T F V 1 0 0 A I



- A = steel I = stainless steel
 A = unthreaded shoulder for bracket mounting **A**
 B = wall mounting with rear fixing lugs **B**
 E = panel mounting **E** with rear fixing clamp
 T = mounting with swivelling connection **T**
 U = mounting with swivelling cap connection **U**
 X = mounting **A** or **E** possible
 F = panel mounting with back flange
 C = panel mounting with front flange

Additional information

- Temperature range
- Sensitive length "Is", "L" and "L1"
- Length of capillary tube "Lc"
- Connection threads, material
- Typ and bulb diameter
- Connection types and options

Extreme performance and decisive advantages

- **Low temperatures down to - 260°C**

Non-toxic gas filling (helium), and accurate calibration at 3 points

Specially suitable for cryogenics. Accurate measurement, sturdy construction, faultless reliability.

- **High temperatures up to + 800°C**

Bulbs in special stainless steel, to resist extreme temperatures and very high pressures

Example: monitoring of diesel engine exhaust gas temperatures. An application where instruments must resist temperatures up to + 750°C and higher, as well as severe vibration.

- **Remote reading up to 100 m**

- **Very fast response**

Pressurized, inert gas filling

The higher the initial pressure, the faster the modified pressure stabilizes after a temperature change. This explains the very short response times of RÜEGER gas-filled thermometers.

- **Miniaturized and standardized temperature bulbs**

Bulbs with standardized lengths, diameters and volumes, with or without pockets and fittings

Requirements usually vary according to the application: RÜEGER can supply bulbs for any situation.

- **Capillary tube types**

Standard models, capillary tube models: Bottom entry and back entry capillaries.

Thermometers for a wide spread of applications. All RÜEGER instruments are manufactured to a "quality first" concept, using first-class materials. They can be supplied with many accessories, opening up applications in many fields and for extremely severe conditions.

Unusually wide application scope

Due to their exclusive high-performance characteristics, these thermometers are particularly suitable for applications in:

- the food, pharmaceutical, chemical and petro-chemical industries
- cryogenics, refrigeration, heating, sterilization
- industrial plant, e.g. compressors, engines, machines, apparatus, etc.

RÜEGER

Manufacturers of Sensors and Gauges for Temperature & Pressure



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