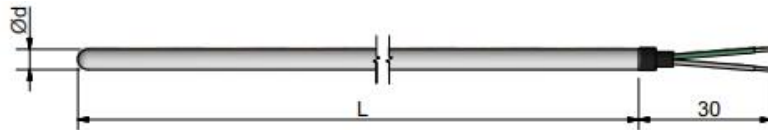


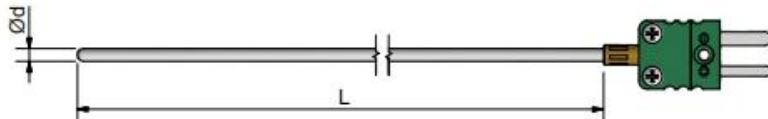
**Sheathed Mineral Insulated Type TTP Thermocouple** is a fine thermocouple, because the back-end wiring structure is different, there are junction box type, aviation plug type, compensation wire type, plug and socket type. It is suitable for applications with fast response time and narrow temperature measurement occasions. The temperature is measured from -40-1300 degrees Celsius. The outer diameter of stainless steel armor wire can be produced from 0.25mm-10mm.

**Sheathed Mineral Insulated Type TTP Thermocouple Common structure**

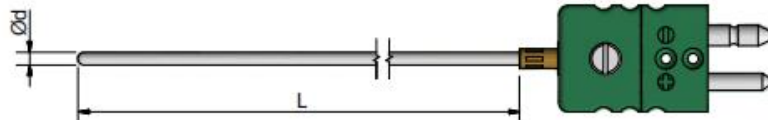
**Type BT**  
 with free unisolated wires 30 mm long



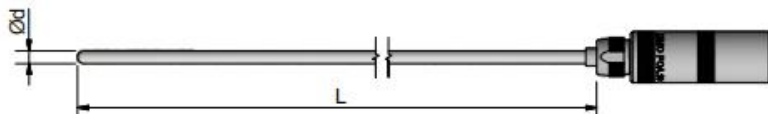
**Type BTW**  
 with miniature size plug



**Type BTWs**  
 with standard size plug



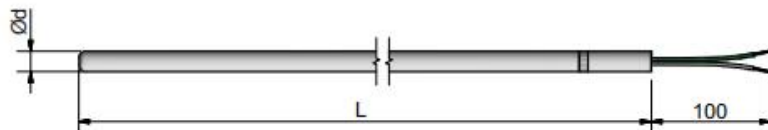
**Type WL**  
 with LEMO® plug PCA 1.S



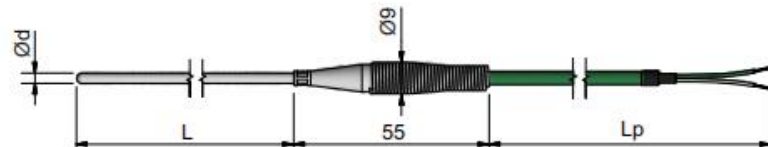
**Type T**  
 with pot seal and flying leads



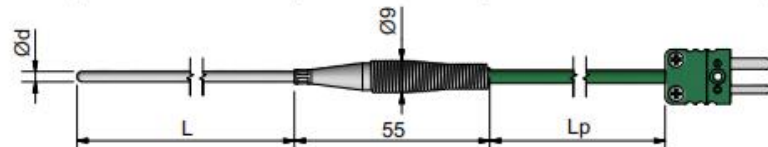
**Typ TS**  
 with pot seal with the same diameter like sheath and flying leads  
 For Ød=4.5, 4.76, 6.0, 6.4 mm



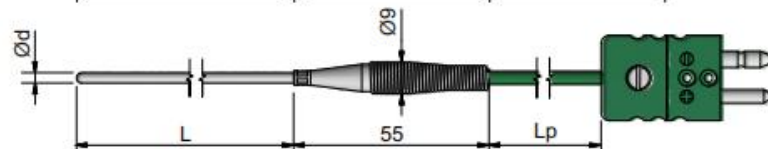
**Type TKb**  
 with pot seal and compensating cable



**Type TKbW**  
 TKb + miniature size plug



**Type TKbWs**  
 TKb + standard size plug



**Type TTP Thermocouple Common dimensions of armored outer diameter**

No. of sensors	Sheath diameter [ mm ]									
	Ø 0.25	Ø 0.5	Ø 1.0	Ø 1.5	Ø 2.0	Ø 3.0	Ø 4.5	Ø 6.0	Ø 6.4	Ø 8.0
Single (1xP)	✓	✓	✓	✓	✓	✓	✓	✓	✓*	✓
Double (2xP)					✓	✓	✓	✓	✓*	✓
Triple (3xP)						✓	✓	✓		

**Sheathed Mineral Insulated Type TTP Thermocouple Temperature error**

Basic values of Thermocouples type J, K, N according to PN-EN 60584 / IEC 584

Temperature		°C	100	200	300	400	500	600	700
Basic value	Type J	mV	5.27	10.78	16.33	21.85	27.39	33.10	39.13
	Type K	mV	4.10	8.14	12.21	16.40	20.64	24.91	29.13
	Type N	mV	2.77	5.91	9.34	12.97	16.75	20.61	24.53
Tolerance	Class 1	°C	±1.5	±1.5	±1.5	±1.6	±2.0	±2.4	±2.8
	Class 2	°C	±2.5	±2.5	±2.5	±3.0	±3.7	±4.5	±5.2

**Tolerances**

Basic values and limiting errors for the thermocouple sensors are laid down in PN-EN 60 584-2.

Type J ( Fe-CuNi )

Class	Temperature range	Tolerance
1	-40°C .. +375°C	± 1.5°C
	+375°C .. +750°C	± 0.0040 x   t
2	-40°C .. +333°C	± 2.5 °C
	+333°C .. +750°C	± 0.0075 x   t

Type K ( NiCr-Ni ), Type N ( NiCrSi-NiSi )

Class	Temperature range	Tolerance
1	-40°C .. +375°C	± 1.5°C
	+375°C .. +1000°C	± 0.0040 x   t
2	-40°C .. +333°C	± 2.5 °C
	+333°C .. +1200°C	± 0.0075 x   t

Type E ( NiCr-CuNi )

Class	Temperature range	Tolerance
1	-40°C .. +375°C	± 1.5°C
	+375°C .. +800°C	± 0.0040 x   t
2	-40°C .. +333°C	± 2.5 °C
	+333°C .. +900°C	± 0.0075 x   t

Type T ( Cu-CuNi )

Class	Temperature range	Tolerance
1	-40°C .. +125°C	± 0.5°C
	+125°C .. +350°C	± 0.0040 x   t
2	-40°C .. +133°C	± 1.0 °C
	+133°C .. +350°C	± 0.0075 x   t

Type S ( PtRh10-Pt ), Type R ( PtRh13-Pt )

Class	Temperature range	Tolerance
1	0°C .. +1100°C	± 1.0°C
	+1100°C .. +1600°C	± [ 1+0.003 (t-1100) ]
2	0°C .. +600°C	± 1.5 °C
	+600°C .. +1600°C	± 0.0025 x   t

**Sheathed Mineral Insulated Type TTP Thermocouple Response time**

Diameter [ mm ]	Junction type	water 0.4 m/s		air 2 m/s	
		$t_{90}$	$t_{90}$	$t_{90}$	$t_{90}$
Ø 0.5	isolated	0.06	0.15	1.80	6.00
	grounded	0.03	0.10	1.80	6.00
Ø 1.0	isolated	0.15	0.50	3.00	10.00
	grounded	0.06	0.20	3.00	10.00
Ø 1.5	isolated	0.21	0.60	8.00	25.00
	grounded	0.13	0.40	8.00	25.00
Ø 3.0	isolated	2.50	2.90	26.00	88.00
	grounded	0.45	0.75	23.00	80.00
Ø 4.5	isolated	4.00	6.00	37.00	120.00
	grounded	0.55	1.60	33.00	110.00
Ø 6.0	isolated	7.00	9.50	60.00	200.00
	grounded	0.75	2.60	55.00	185.00
Ø 8.0	isolated	7.00	14.00	100.00	290.00
	grounded	0.75	3.90	87.00	250.00

The structure of the front section of the temperature measurement

**Measuring junction types**

Resistance of isolation at ambient temperature, according to wg PN-EN 61515:

$\varnothing < 1.5 \text{ mm}$	75 Vdc	> 1000 MOhm
$\varnothing > 1.5 \text{ mm}$	500 Vdc	> 1000 MOhm

JUNCTION ISOLATED



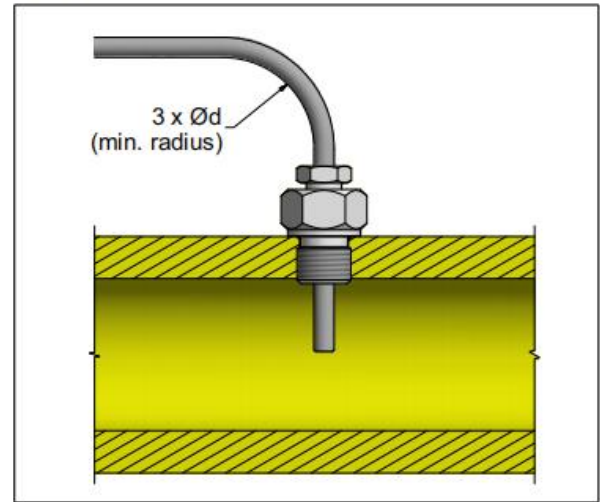
A junction of the thermocouple is fully insulated from sheath that is tightly welded. It is a standard type of thermocouples due to the fact that they can be applied close to devices that may produce electromagnetic fields that are a source of interference at other types of measuring junctions.

JUNCTION EXPOSED



A junction of thermocouple is fully exposed that that will ensure short response times with varying temperature. Wires of the thermocouple are not protected against gases and liquids.

**Example of installation**



JUNCTION GROUNDED



A junction of thermocouple is connected to a lid that is tightly welded with the sheath. It will produce short response times when temperature varies; the junction is protected against the environment (gases, liquids) in the same time.

**Sheathed Mineral Insulated Type TTP Thermocouple Order notice**

1	2	3	4	5	6	7	8	9	10	11	12	13
□	□	□	□	□	□	□	□	□	□	□	□	□

	<b>Temperature transmitter</b>														
1	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>without transmitter</td></tr> <tr><td>AP with installed transmitter 4..20 mA</td></tr> <tr><td>APW with installed transmitter 4..20 mA and local LED display*</td></tr> <tr><td>2AP with two installed transmitters 4..20 mA</td></tr> </table>	without transmitter	AP with installed transmitter 4..20 mA	APW with installed transmitter 4..20 mA and local LED display*	2AP with two installed transmitters 4..20 mA									
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APW with installed transmitter 4..20 mA and local LED display*															
2AP with two installed transmitters 4..20 mA															
<small>* available only with connection head DANWdie and PR7501</small>															
<b>Thermocouple type</b>															
2	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>J Type J ( Fe-CuNi )</td></tr> <tr><td>K Type K ( NiCr-Ni )</td></tr> <tr><td>xxx other, please specify</td></tr> </table>	J Type J ( Fe-CuNi )	K Type K ( NiCr-Ni )	xxx other, please specify										
J Type J ( Fe-CuNi )															
K Type K ( NiCr-Ni )															
xxx other, please specify															
<b>Design</b>															
3	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>BT without pot seal</td></tr> <tr><td>BTW without pot seal, with miniature size plug</td></tr> <tr><td>BTWs without pot seal, with standard size plug</td></tr> <tr><td>WL without pot seal, with LEMO® PCA socket</td></tr> <tr><td>T with pot seal, teflon insulated flying leads</td></tr> <tr><td>TS with pot seal with the same diameter like sheath and flying leads</td></tr> <tr><td>TKb with pot seal and compensating cable</td></tr> <tr><td>TKbW with pot seal, compensating cable and miniature size plug</td></tr> <tr><td>TKbWs with pot seal, compensating cable and standard size plug</td></tr> <tr><td>TKbWL with pot seal, compensating cable and LEMO® PCA socket</td></tr> <tr><td>NA with aluminum connection head NA type ( other types, see page 5 )</td></tr> <tr><td>DANWdie with connection head equipped with local LED display</td></tr> <tr><td>PR7501 with field mounted PR7501 temperature transmitter 4..20mA with HART® and local LED display</td></tr> </table>	BT without pot seal	BTW without pot seal, with miniature size plug	BTWs without pot seal, with standard size plug	WL without pot seal, with LEMO® PCA socket	T with pot seal, teflon insulated flying leads	TS with pot seal with the same diameter like sheath and flying leads	TKb with pot seal and compensating cable	TKbW with pot seal, compensating cable and miniature size plug	TKbWs with pot seal, compensating cable and standard size plug	TKbWL with pot seal, compensating cable and LEMO® PCA socket	NA with aluminum connection head NA type ( other types, see page 5 )	DANWdie with connection head equipped with local LED display	PR7501 with field mounted PR7501 temperature transmitter 4..20mA with HART® and local LED display
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TS with pot seal with the same diameter like sheath and flying leads															
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DANWdie with connection head equipped with local LED display															
PR7501 with field mounted PR7501 temperature transmitter 4..20mA with HART® and local LED display															
<b>Multiplicity</b>															
4	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>I Single</td></tr> <tr><td>II Double</td></tr> <tr><td>III Triple</td></tr> </table>	I Single	II Double	III Triple										
I Single															
II Double															
III Triple															
<b>Sheath material</b>															
5	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>H stainless steel 1.4306 ( AISI 304L )</td></tr> <tr><td>Y stainless steel 1.4404 ( AISI 316L )</td></tr> <tr><td>V stainless steel 1.4541 ( AISI 321 )</td></tr> <tr><td>Z heat-resistant steel 1.4749 ( AISI 446 )</td></tr> <tr><td>J heat resistant steel 2.4816 ( INCONEL® 600 )</td></tr> <tr><td>XL heat-resistant steel XL-SUPERCLAD</td></tr> <tr><td>P heat-resistant steel Pyrosil® D</td></tr> </table>	H stainless steel 1.4306 ( AISI 304L )	Y stainless steel 1.4404 ( AISI 316L )	V stainless steel 1.4541 ( AISI 321 )	Z heat-resistant steel 1.4749 ( AISI 446 )	J heat resistant steel 2.4816 ( INCONEL® 600 )	XL heat-resistant steel XL-SUPERCLAD	P heat-resistant steel Pyrosil® D						
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<b>Sheath diameter</b>															
6	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>05 Ø 0.5 mm</td></tr> <tr><td>10 Ø 1.0 mm</td></tr> <tr><td>15 Ø 1.5 mm</td></tr> <tr><td>20 Ø 2.0 mm</td></tr> <tr><td>30 Ø 3.0 mm</td></tr> <tr><td>45 Ø 4.5 mm</td></tr> <tr><td>60 Ø 6.0 mm</td></tr> <tr><td>xxx other, please specify</td></tr> </table>	05 Ø 0.5 mm	10 Ø 1.0 mm	15 Ø 1.5 mm	20 Ø 2.0 mm	30 Ø 3.0 mm	45 Ø 4.5 mm	60 Ø 6.0 mm	xxx other, please specify					
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xxx other, please specify															
<b>Tolerance</b>															
7	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>1 Class 1 acc. to PN-EN 60584-2</td></tr> <tr><td>2 Class 2 acc. to PN-EN 60584-2</td></tr> </table>	1 Class 1 acc. to PN-EN 60584-2	2 Class 2 acc. to PN-EN 60584-2											
1 Class 1 acc. to PN-EN 60584-2															
2 Class 2 acc. to PN-EN 60584-2															
<b>Measuring junction type</b>															
8	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>SO junction isolated</td></tr> <tr><td>SOB junctions isolated ( double and triple thermocouples )</td></tr> <tr><td>SP junction / junctions grounded to sheath</td></tr> <tr><td>SW junction exposed</td></tr> </table>	SO junction isolated	SOB junctions isolated ( double and triple thermocouples )	SP junction / junctions grounded to sheath	SW junction exposed									
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<b>Length L</b>															
9	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>150 150 mm</td></tr> <tr><td>300 300 mm</td></tr> <tr><td>500 500 mm</td></tr> <tr><td>1000 1000 mm</td></tr> <tr><td>xxx other, please specify</td></tr> </table>	150 150 mm	300 300 mm	500 500 mm	1000 1000 mm	xxx other, please specify								
150 150 mm															
300 300 mm															
500 500 mm															
1000 1000 mm															
xxx other, please specify															
<b>Cable length L<sub>p</sub></b>															
10	<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>1000 1000 mm</td></tr> <tr><td>1500 1500 mm</td></tr> <tr><td>xxx other, please specify</td></tr> </table>	1000 1000 mm	1500 1500 mm	xxx other, please specify										
1000 1000 mm															
1500 1500 mm															
xxx other, please specify															

**Sheathed Mineral Insulated Type TTP Thermocouple Example**

TTP-K-TKbWs-I-Y30-1-SO-1000-3000-SLSL

Mineral Insulated Thermocouple 1xK, with pot seal, compensating cable and standard size plug, sheath material AISI316, sheath diameter  $\varnothing 3.0$  mm, class 1 acc. to PN-EN 60584-2, junction isolated, length L=1000mm, cable length Lp=3000 mm, cable insulation silicone/silicone.