

Applications

- Measuring range: $-40 \dots +1200^{\circ}\text{C}$
- Temperature measurement of tube wall in industrial furnaces
- Energy industry
- Petrochemical industry

Features

- Made of mineral insulated cable
- Adapted to individual customer requirements
- Sheath materials:
INCONEL® 600 (2.4816), AISI316 (1.4401),
AISI446 (1.4762)
- Spiral expansion loops*
- Vibration-proof

Termoaparatura manufactures wide range of thermocouples, including sensors for temperature measurement of tube skins in industrial furnaces which are used primarily in refining worldwide. Tube Skin Thermocouples are designed to minimize problems with temperature measurement in order to accurately measure a very demanding application.

ATEX versions

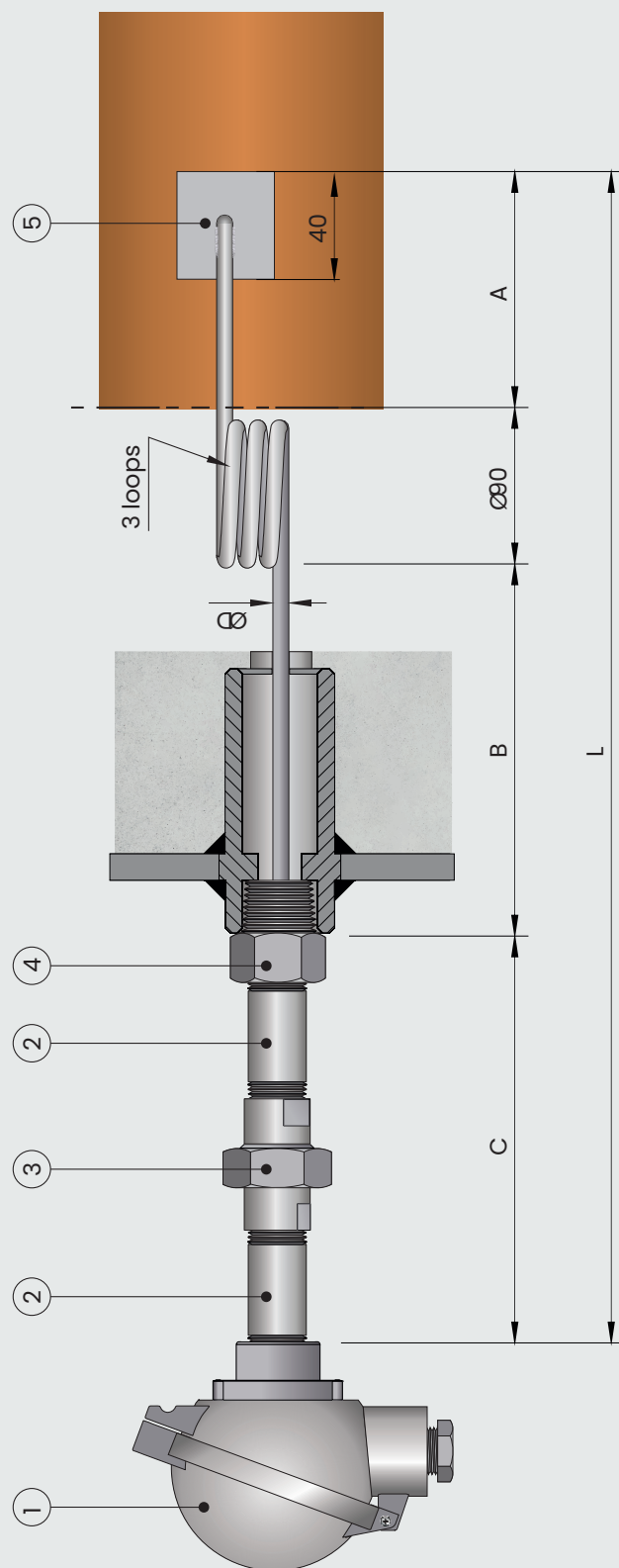
Intrinsically safe and Flameproof designs are available for applications in hazardous areas. These models are provided with certificate for „intrinsically safe“ type of protection according to Directive 2014/34/UE (ATEX).

Other versions

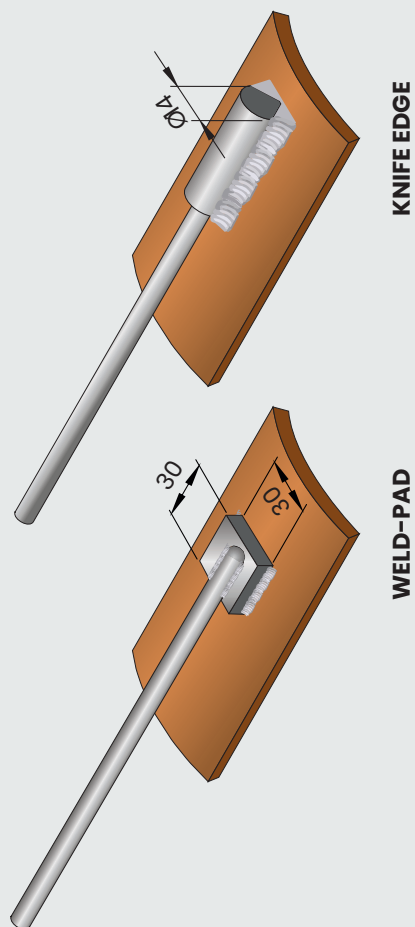
This data sheet contains only small part of our supplies program of mineral insulated thermocouples. Upon the customer's request, other versions can also be delivered.

* Expansion loops shape „S“ are available upon request

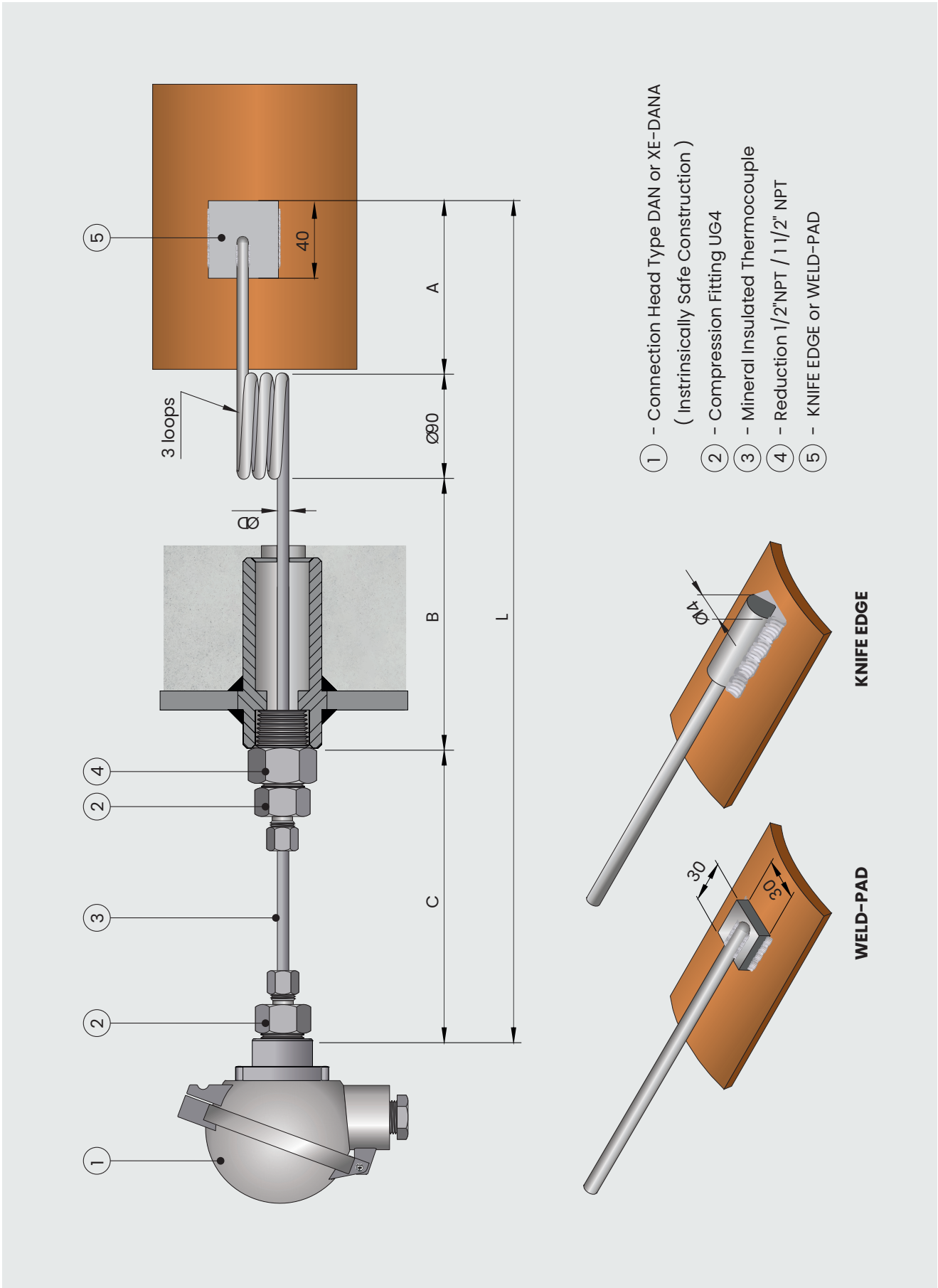
Design TTP-320



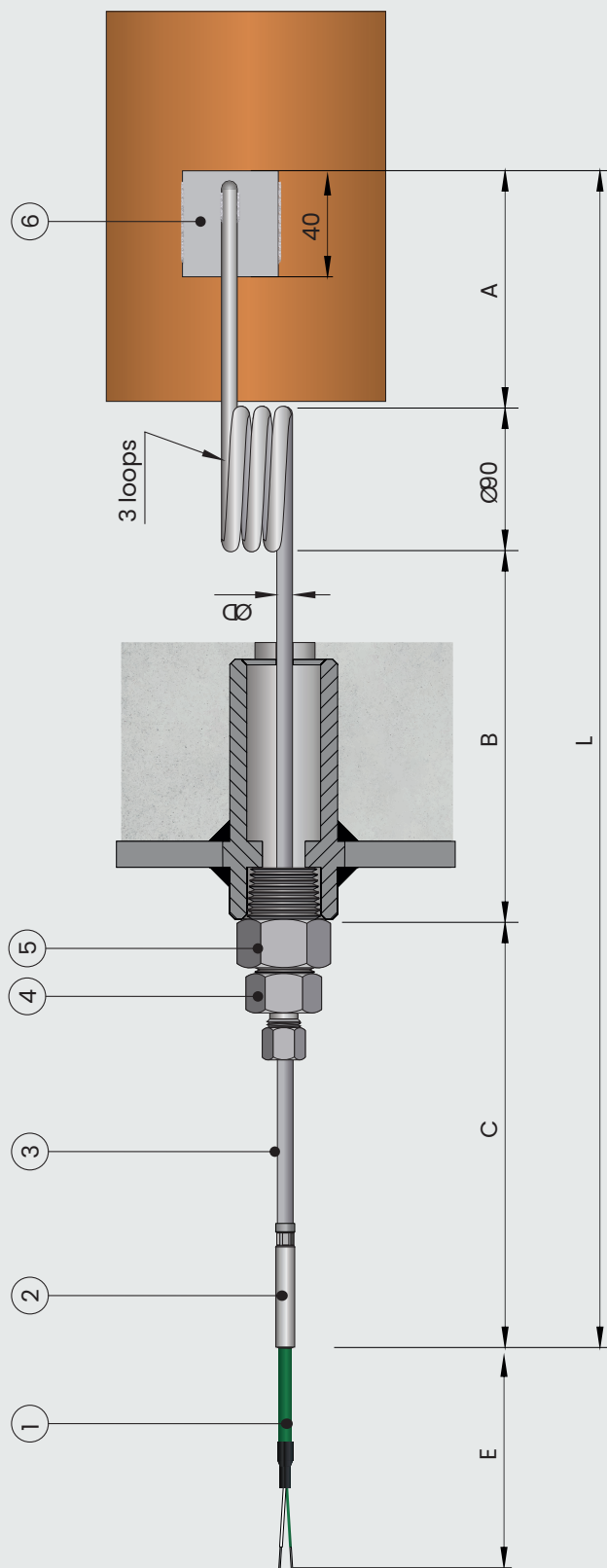
- ① - Connection Head Type DAN or XE-DANA (Intrinsically Safe Construction)
- ② - Nipple
- ③ - Union
- ④ - Reduction 1/2"NPT / 1 1/2" NPT
- ⑤ - KNIFE EDGE or WELD-PAD



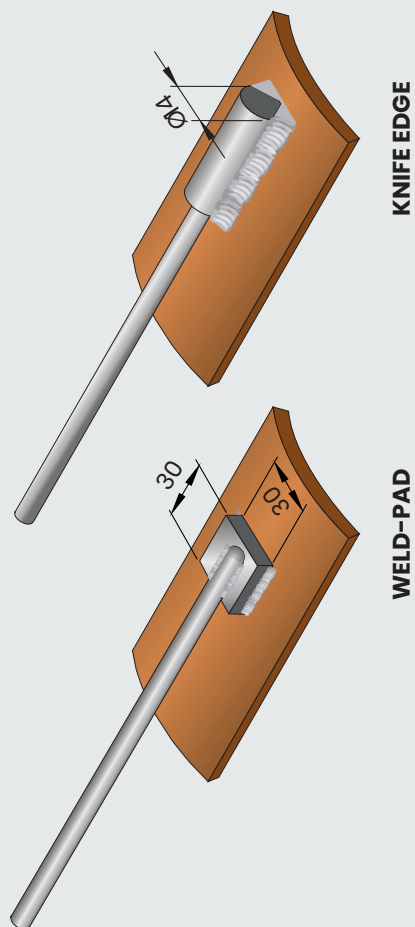
Design TTP-321



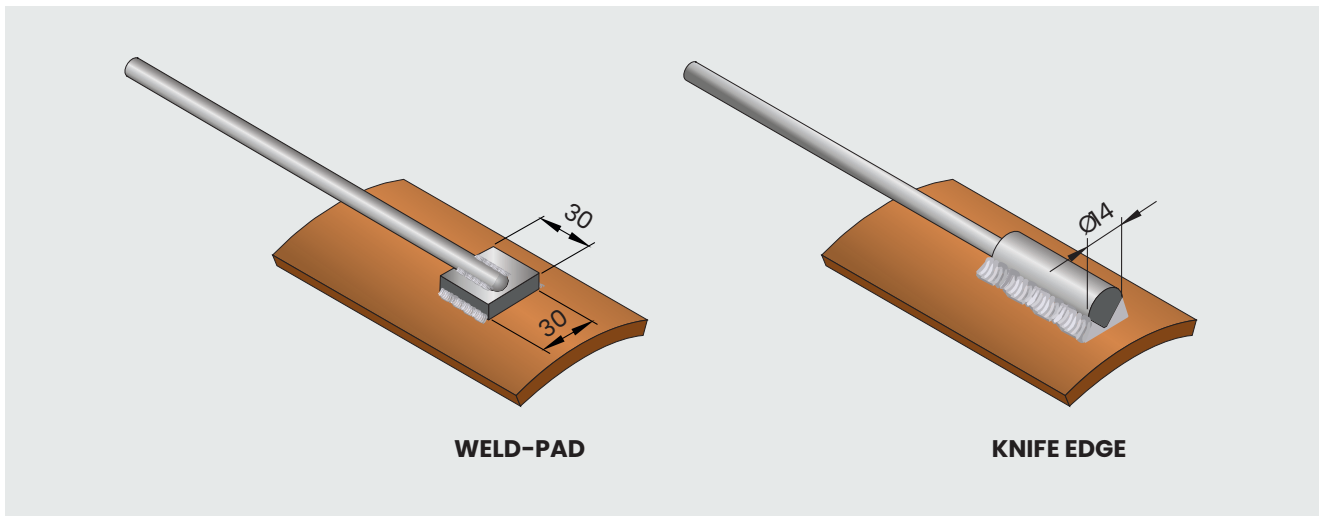
Design TTP-322



- ① - Compensating Cable
- ② - Pot Seal
- ③ - Mineral Insulated Thermocouple
- ④ - Compression Fitting UG4
- ⑤ - Reduction 1/2"NPT / 1 1/2"NPT
- ⑥ - KNIFE EDGE or WELD-PAD



End Tips of Skin Tube Thermocouples



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	33.10
	Type K	mV	4.10	8.14	12.21	16.40	20.64	24.91	24.91
	Type N	mV	2.77	5.91	9.34	12.97	16.75	20.61	20.61
Tolerance	Class 1	°C	±1.5	±1.5	±1.5	±1.6	±2.0	±2.4	±2.4
	Class 2	°C	±2.5	±2.5	±2.5	±3.0	±3.7	±4.5	±4.5

Tolerances

Basic values and limiting errors for the thermocouple sensors are laid down in PN-EN 60584.

Type K (NiCr-Ni), Typ 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

Possible combinations of sheath diameter and number of sensors







No. of sensors	Sheath diameter [mm]					
	Ø 4.5	Ø 6.0	Ø 6.4	Ø 8.0	Ø 10.0	Ø 12.7
Single (1xTC)	✓	✓	✓	✓	✓	✓
Double (2xTC)	✓	✓	✓	✓	✓	✓
Triple (3xTC)	✓	✓				

✓ : available

Sheath materials

Maximal temperature	Material	Material properties	Applications
800°C	1.4404 AISI 316 L	As a result of the addition of molybdenum, this material has higher corrosion resistance in non-oxidizing acids such as ethanolic acid, tartaric acid, phosphoric acid, sulphuric acid and others. Increased pitting resistance. Good welding properties. Heat treatment is generally not necessary.	Sulphite, pulp, textile, dyeing, fatty acid, soap and pharmaceutical industries.
1200°C	1.4749 1.4762 AISI 446	Extremely good resistance to reducing, sulphurous atmospheres. Very good resistance to oxidation and air. Good resistance to corrosion caused by incinerator slag and copper, lead and tin smelts. Good welding properties in arc welding and WIG welding. Preheating to 200 - 400 °C is recommended. Retreatment is not necessary.	Petrochemical industry, metallurgy, power technology, recuperators, heat treatment kilns, vortex firing installations, waste incinerators.
1150°C	2.4816 Inconel 600™ *	Good general resistance to corrosion, resistant to tension crack corrosion. Excellent resistance to oxidation. Not recommended with gases containing CO ₂ and sulphur above 550 °C and sodium above 750 °C. In air, resistant up to 1100 °C. Good welding properties for all types of welding processes. Excellent ductility even after long-term use.	PWR, nuclear power, furnace construction, plastics industry, heat treatment, paper and food processing industries, boilers, aircraft engines.

Insulation material for compensation cables

Designation	No. of cores / cross section	Outer dia.	Maximal temp.	Construction	Applications
 JJ	2 x 0.22 mm ² 2 x 1.50 mm ² 4 x 1.50 mm ²	Ø 3.6 Ø 7.3 Ø 7.8	105°C	insulat.: PVC sheath: PVC	humid rooms, weak acids, resistant for oils, gasoline, permanent installation.
 SLSL	2 x 0.22 mm ² 4 x 0.22 mm ²	Ø 3.8 Ø 4.3	180°C	insulat.: Silicone sheath: Silicone	humid rooms, weak acids, resistant for oils, gasoline, mobile installation.
 TPSL	4 x 0.22 mm ²	Ø 4.5	180°C	insulat.: FEP screen: Cu braid sheath: Silicone	humid rooms, weak acids, resistant for oils, gasoline, mobile installation, suitable for computer systems, resistant to electromagnetic disturbances
 TT	2 x 0.22 mm ² 2 x 0.50 mm ² 2 x 0.75 mm ² 4 x 0.75 mm ²	1.9 x 2.3 2.0 x 3.5 2.4 x 4.2 Ø 5.1	200°C	insulat.: FEP sheath: FEP	humid rooms, acids and alkalines, resistant for oils, gasoline, partially mobile installation.
 TCuT	4 x 0.22 mm ² 4 x 0.50 mm ² 6 x 0.50 mm ² 6 x 0.75 mm ²	Ø 3.5 Ø 4.2 Ø 5.1 Ø 6.0	200°C	insulat.: FEP screen: Cu braid sheath: FEP	humid rooms, acids, resistant for oils, gasoline, mobile installation, suitable for computer systems, resistant to electromagnetic disturbances.
 GLGLP	2 x 0.22 mm ²	Ø 3.8	400°C	insulat.: fibreglass sheath: fibreglass braid: steel	dry rooms, resistant for high temperatures and mechanical duty

Ordering code

1 2 3 4 5 6 7 8 9 10 11 12 13
 - **TTP** - - - - - - - - - - -

1	<input type="text"/>	Version		
		Standard		
		XI	Intrinsically Safe Exi - ATEX	
2	<input type="text"/>	Design		
		320	with connection head, nipple-union-nipple construction	
		321	with connection head, compression fitting and reduction	
3	<input type="text"/>	Thermocouple type		
		J	Type J (Fe-CuNi)	
		K	Type K (NiCr-Ni)	
		xxx	other, please specify	
4	<input type="text"/>	Connection head		
		DAN	Type DAN	Aluminum IP65 Cable gland: M20x1.5
		G1	Type XE-DANA	Aluminum IP65 Cable gland: M20x1.5
		xxx	other, please specify	
5	<input type="text"/>	Multiplicity		
		I	Single	
		II	Double	
		III	Triple	
6	<input type="text"/>	Sheath material		
		Y	Stainless Steel 1.4401 (AISI316)	
		J	Heat-Resistant Steel 2.4816 (INCONEL® 600)	
		Z	Heat-Resistant Steel 1.4749 / 1.4762 (AISI446)	
		xxx	other, please specify	
7	<input type="text"/>	Sheath diameter D		
		8	Ø8.0 mm	
		10	Ø10.0 mm	
		12.7	Ø12.7 mm	
8	<input type="text"/>	Length L		
		4050	4050 mm	
		10500	10500 mm	
		xxx	other, please specify	
9	<input type="text"/>	Length A		
		3700	3700 mm	
		4500	4500 mm	
		10150	10150 mm	
		xxx	other, please specify	
10	<input type="text"/>	Length B		
		200	200 mm	
		xxx	other, please specify	
11	<input type="text"/>	Length C		
		150	150 mm	
		xxx	other, please specify	
12	<input type="text"/>	Tolerance		
		1	Class 1 acc. to PN-EN 60584-2	
		2	Class 2 acc. to PN-EN 60584-2	
13	<input type="text"/>	Tip for weld		
		KNIFE	Type KNIFE EDGE	
		PAD	Type PAD	

Example

TTP-320-K-DAN-I-J80-4050-3700-200-150-1-KNIFE

Thermocouple 1xK, with nipple-union-nipple construction, sheath material INCONEL® 600, sheath diameter Ø8.0 mm, class 1 acc. to PN-EN 60584-2, junction grounded, length L=4050mm, connection head type DAN.

Ordering code

1 2 3 4 5 6 7 8 9 10 11 12 13 14
 - **TTP-322** - - - - - - - - - - - - -

1	<input type="text"/>	Version	
		Standard	
		XI	Intrinsically Safe Exi - ATEX
2	<input type="text"/>	Thermocouple type	
		J	Type J (Fe-CuNi)
		K	Type K (NiCr-Ni)
		xxx	other, please specify
4	<input type="text"/>	Multiplicity	
		I	Single
		II	Double
		III	Triple
5	<input type="text"/>	Sheath material	
		Y	Stainless Steel 1.4401 (AISI316)
		J	Heat-Resistant Steel 2.4816 (INCONEL® 600)
		Z	Heat-Resistant Steel 1.4749 / 1.4762 (AISI446)
		xxx	other, please specify
6	<input type="text"/>	Sheath diameter D	
		8	Ø8.0 mm
		10	Ø10.0 mm
		12.7	Ø12.7 mm
7	<input type="text"/>	Length L	
		4050	4050 mm
		10500	10500 mm
		xxx	other, please specify
8	<input type="text"/>	Length A	
		3700	3700 mm
		4500	4500 mm
		10150	10150 mm
		xxx	other, please specify
9	<input type="text"/>	Length B	
		200	200 mm
		xxx	other, please specify
10	<input type="text"/>	Length C	
		150	150 mm
		xxx	other, please specify
11	<input type="text"/>	Compensation cable length E	
		5000	5000 mm
		xxx	other, please specify
12	<input type="text"/>	Tolerance	
		1	Class 1 acc. to PN-EN 60584-2
		2	Class 2 acc. to PN-EN 60584-2
13	<input type="text"/>	Tip for weld	
		KNIFE	Type KNIFE EDGE
		PAD	Type PAD
14	<input type="text"/>	Cable insulation	
		JJ	PVC / PVC (up to +105°C)
		SLSL	Silicone / Silicone (up to +180°C)
		TPSL	Teflon® FEP / Cu braid / Silicone (up to +180°C)
		TT	Teflon® FEP / Teflon® FEP (up to +200°C)
		TCuT	Teflon® FEP / Cu braid / Teflon® FEP (up to +200°C)
		GLGLP	Fiberglass / Fiberglass / Steel braid (up to +400°C)

Example

TTP-322-K-I-J80-4050-3700-200-150-5000-1-KNIFE-TCuT

Thermocouple 1xK, with compression fitting and reduction, sheath material INCONEL® 600, sheath material Ø8.0 mm, class 1 acc. to PN-EN 60584-2, junction grounded, length L=4050mm, compensation cable in teflon / Cu braid / teflon insulation and 5000 mm long.