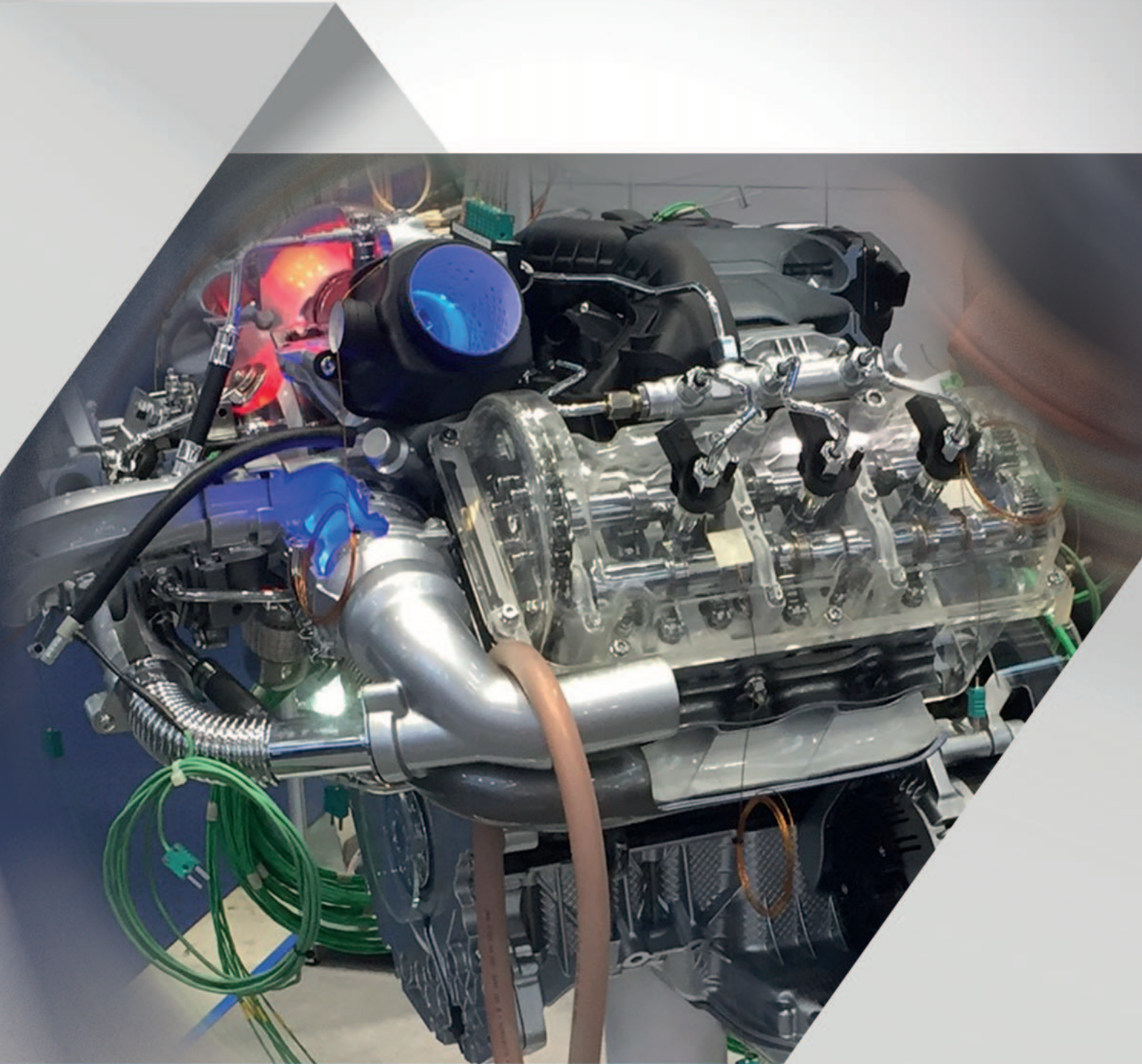


# TEMPERATURE MEASUREMENT IN TEST VEHICLES AND TEST BENCHES



[www.sab-cable.com](http://www.sab-cable.com)





TRADITIONAL  
FAMILY BUSINESS  
SINCE 1947



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## FAMILY BUSINESS IN THE THIRD GENERATION

**75** years of experience in cable and wire manufacturing as well as in temperature measurement technology turned a one-man business into a company with more than 550 employees. We prove our strength every year with more than 1500 special products according to customers' requirements. Each product is a new challenge for our creative technical team. We at **SAB** see ourselves as a manufacturer and a service provider – in the sense of true partnership and the greatest possible customer orientation.

Today, the quality of our products is known and appreciated in more than 100 countries around the world. In all product ranges, we are certified according to DIN EN ISO 9001. Furthermore, we have implemented an environmental management system for our company according to DIN EN ISO 14001, an occupational health and safety management system according to NLF/ILO-OSH and DIN ISO 45001, and an energy management system according to DIN EN ISO 50001.

And also for the future, our slogan is: **"WE GO FORWARD!"**

FOUNDED:	1947 by Peter Bröckskes sen. an independent, medium-sized company.
CEO:	Peter Bröckskes and Sabine Bröckskes-Wetten
PLANT/LOCATION:	In Viersen (Lower Rhine) 110.000 m <sup>2</sup> company site.  Own manufacturing from copper conductor to outer sheath.  VDE proved burnchamber and laboratory within the company.
EMPLOYEES/WORKERS:	Approx. 430 at the plant in Viersen, 550 worldwide
YEARLY SALES:	Approx. 134 Mio. € worldwide
PRODUCTS:	Special Cables  Measurement Technology  Cable Harnessing
CERTIFICATES AND APPROVALS:	Quality management system acc. to DIN EN ISO 9001 for every manufacturing field  Environmental management system acc. to DIN EN ISO 14001  Occupational health and safety management acc. to NLF/ILO-OSH and DIN ISO 45001  Energy management system acc. to DIN EN ISO 50001



# REFERENCES

## VEHICLE INDUSTRY

customer	branch	our products
Audi AG	automobile industry	thermocouples, resistance thermometers, HV thermo-sensors, harnessing
BMW AG	automobile industry	thermocouples, harnessing
Daimler AG	automobile industry	HV thermo-sensors, harnessing
Porsche AG	automobile industry	thermocouples, resistance thermometers, HV thermo-sensors, harnessing
Skoda SA	automobile industry	thermocouples, resistance thermometers, HV thermo-sensors, harnessing
Volkswagen AG	automobile industry	thermocouples, resistance thermometers, HV thermo-sensors, harnessing
Volvo AB	automobile industry	thermocouples
Deutz AG	commercial vehicle industry	thermocouples
Kässbohrer GmbH	commercial vehicle industry	thermocouples
MAN AG	commercial vehicle industry	thermocouples, resistance thermometers, HV thermo-sensors, harnessing
APL GmbH	automotive supplier industry	harnessing
AVL	automotive supplier industry	HV thermo-sensors, thermocouples
Bertrandt	automotive supplier industry	HV thermo-sensors
BorgWarner	automotive supplier industry	thermocouples
Bosch AG	automotive supplier industry	HV thermo-sensors, thermocouples
BPW	automotive supplier industry	HV thermo-sensors, thermocouples
Chassis Brakes	automotive supplier industry	thermocouples, harnessing
FEV	automotive supplier industry	harnessing
Finoba Automotiv	automotive supplier industry	thermocouples
Horiba	automotive supplier industry	thermocouples
IAV	automotive supplier industry	thermocouples, harnessing
Knott GmbH	automotive supplier industry	thermocouples
Magna	automotive supplier industry	thermocouples, resistance thermometers, HV thermo-sensors, harnessing
PBS Turbo	automotive supplier industry	thermocouples
Tectos GmbH	automotive supplier industry	harnessing
ZF Friedrichshafen AG	automotive supplier industry	HV thermo-sensors, thermocouples

# OUR TEMPERATURE MEASUREMENT

## AT A GLANCE

WITH US YOU GET **TEMPERATURE MEASUREMENT**  
AND **ACCESSORIES** FOR A WIDE VARIETY OF REQUIREMENTS AND INDUSTRIES.

### Protecting armatures and gauge slides

- Immersion protecting armatures
- Screwed protecting armatures
- Welding protecting armatures, etc.

### Temperature measurement in test vehicles

- Thermo 8-plug connector
- Dipstick thermocouples
- Thermocouples for cooling water tube applications, etc.

### Mineral insulated thermocouples/ Mineral insulated resistance thermometers

- with fixed connecting cable
- with bare connection ends
- with thermo-plug/miniature plug, etc.

### Temperature measurement in plastics processing industry/Hot runner technique

- Hot runner mineral insulated thermocouples
- Plug-in thermocouples
- Molten mass thermocouples, etc.

### Probe with stainless steel sleeve

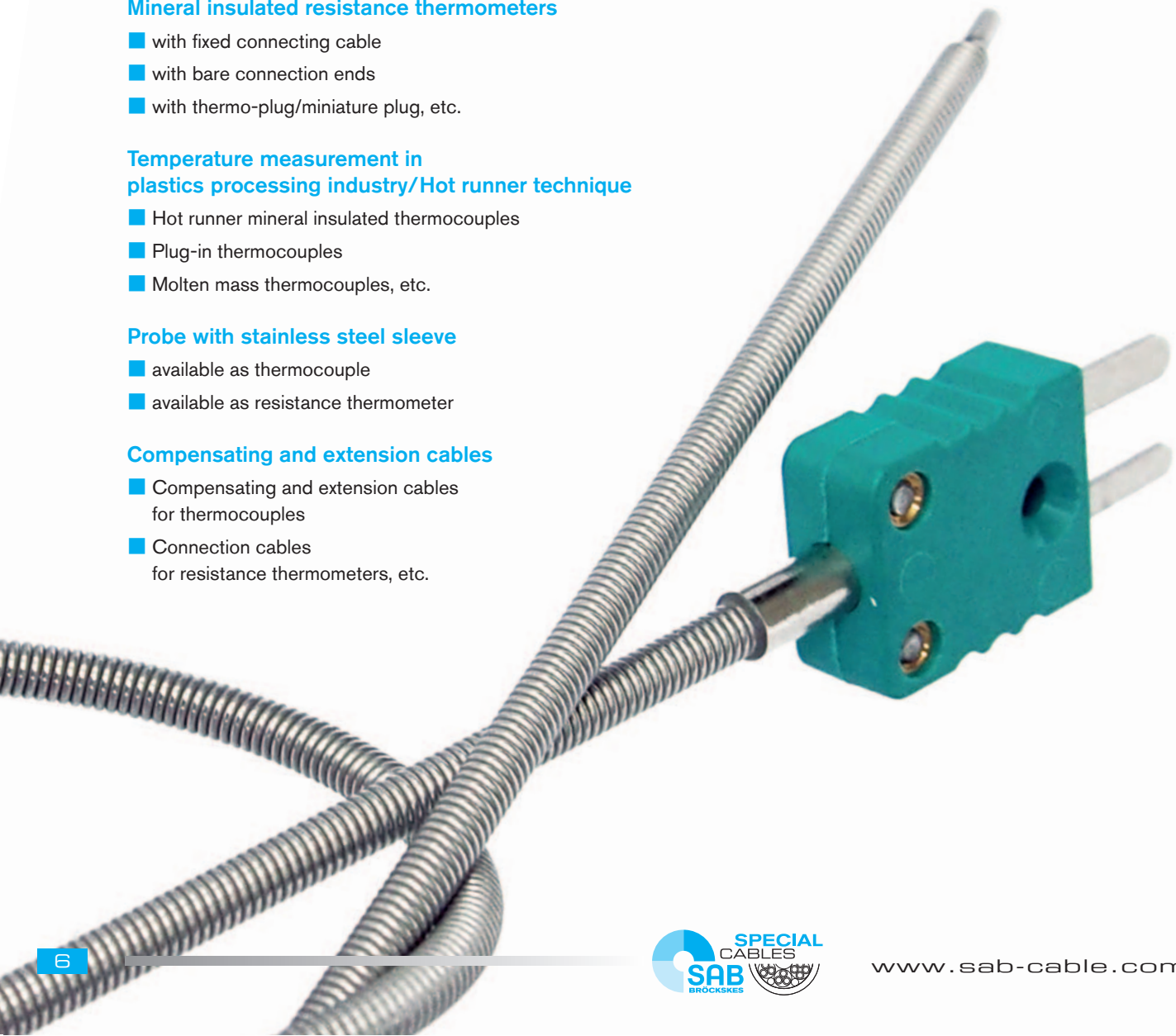
- available as thermocouple
- available as resistance thermometer

### Compensating and extension cables

- Compensating and extension cables for thermocouples
- Connection cables for resistance thermometers, etc.

### Accessories

- Clamping screw connections
- Flanges
- Screw sockets
- Connection heads
- Welding protecting tubes
- Transmitters
- Thermo-plugs/sockets
- Screw-in nipples
- Miniature plugs/sockets



# OUR CABLE HARNESSING

## AT A GLANCE

### WE SUPPLY **HARNESSED CABLES AND WIRES**

FROM A SINGLE SOURCE.

- helix cables
- harnessed cables acc. to customers' specification
- cable harnesses
- harnessed motor and transmission cables for Siemens and Indramat drives
- harnessed track cable
- various combinations of connector types and terminals
- many application of various materials and sheath materials
- complete solutions
- high quality standard by continuous quality control



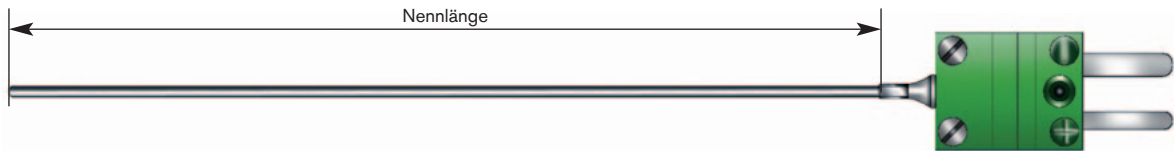


# TEMPERATURE MEASUREMENT

## IN UNIVERSAL USE

mineral insulated thermocouple with plug / plug-in mineral insulated thermocouple with plug

### ■ mineral insulated thermocouple with plug



■ This temperature probe is versatile due to its design and high temperature resistance. With its slim design and flexible sheath material, the probe can even be installed in hardly reachable positions. Easy installation is ensured in conjunction with a clamping screw connection.

### ■ plug-in mineral insulated thermocouple with plug



■ Especially appropriate to collect temperatures in test vehicles in the vehicle interior. By slight pressure, the plunge-in thermocouple can be placed for example in the seats or neck-rests to collect the temperature.

#### Thermocouple:

- 1 x type J
- 1 x type K
- 2 x type J } from Ø 1,5 mm
- 2 x type K }
- other thermocouples \_\_\_\_\_

#### Sheath-Ø:

- 0,25 mm
- 0,50 mm
- 0,64 mm
- 0,75 mm
- 1,00 mm
- 1,50 mm
- 2,00 mm
- 3,00 mm
- 4,50 mm
- 6,00 mm
- other sheath-Ø \_\_\_\_\_

#### Sheath material:

- 1.4541 (+800°C)
- 2.4816 (+1100°C)
- other sheath materials \_\_\_\_\_

#### Connection ends:

- miniature thermoplug     miniature socket
- standard plug             standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

#### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

Nominal length: \_\_\_\_\_ mm

- with batch certificate and identification
- Dakks calibration on request
- accessories (fix): \_\_\_\_\_

#### CONFIGURATION EXAMPLES

item no.	type	Ø mm	nominal length mm	material	connection ends	feature
T302-051-218	K	0,50	100	2.4816	miniature thermoplug	without tip
T302-046-275	K	1,00	100	2.4816	miniature thermoplug	without tip
T302-043-185	K	1,50	100	1.4541	miniature thermoplug	with tip



# TEMPERATURE MEASUREMENT

## IN UNIVERSAL USE

mineral insulated resistance thermometer with Lemo connection end



■ This temperature probe is versatile due to its design and high temperature resistance. With its slim design and flexible sheath material, the probe can even be installed in hardly reachable positions. Easy installation is ensured in conjunction with a clamping screw connection.

### RTD:

- 1 x PT100 class B
- 1 x PT100 class A
- 2 x PT100 class B
- 2 x PT100 class A

### Connection types of inner wire:

- 2-wire circuit
- 3-wire circuit
- 4-wire circuit

### Sheath-Ø:

- 1,5 mm     3,0 mm     4,5 mm
- other sheath-Ø \_\_\_\_\_

### Connection element:

- socket size 0     plug size 0
- socket size 1     plug size 1
- socket size 2     plug size 2
- other connection elements \_\_\_\_\_

### Accessories (fix):

- without socket/plug housing
- with socket/plug housing
- other accessories \_\_\_\_\_

### Measuring ranges:

- 50 up to +400°
- 50 up to +600°
- other measuring ranges

Nominal length: \_\_\_\_\_ mm

- with batch certificate and identification
- Dakks calibration on request
- accessories (fix): \_\_\_\_\_

RTD:	PT100 acc. to DIN EN 60751
sheath material:	mat. no. 1.4541
measuring range:	-50 up to +400°C and -50 up to +600°C
plug/ socket size:	size 0 with sheath-Ø 1,5 mm size 1 with sheath-Ø 1,5 mm – 4,5 mm size 2 with sheath-Ø 6,00 mm

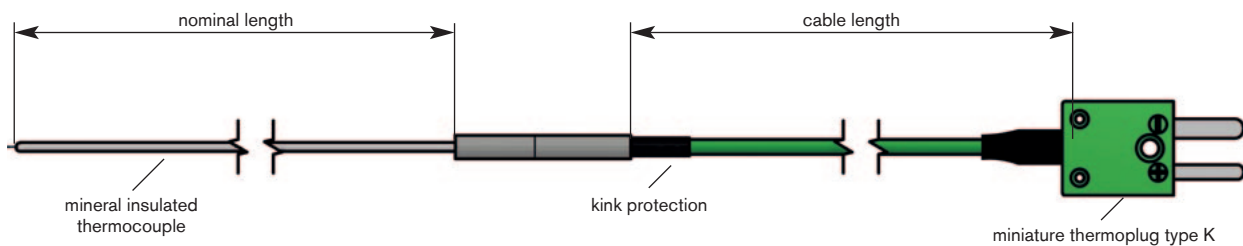
### CONFIGURATION EXAMPLES

item no.	RTD	Ø mm	nominal length mm	connection types	connection ends
T603-046-327	1 x PT100 class A	1,5	100	4-wire circuit	Lemo plug size 0, 4 pole
T603-040-028	1 x PT100 class A	3,0	100	4-wire circuit	Lemo plug size 1, 4 pole

# TEMPERATURE MEASUREMENT

## IN UNIVERSAL USE

mineral insulated thermocouple with cable



■ This temperature probe is versatile due to its design and high temperature resistance. With its slim design and flexible sheath material, the probe can even be installed in hardly reachable positions. Easy installation is ensured in conjunction with a clamping screw connection.

### Thermocouple:

- 1 x type J
- 1 x type K
- 2 x type J } from Ø 1,5 mm
- 2 x type K }
- other thermocouples \_\_\_\_\_

### Sheath-Ø:

- 0,25 mm
- 0,50 mm
- 1,00 mm
- 1,50 mm
- 2,00 mm
- 3,00 mm
- 4,50 mm
- 6,00 mm
- other sheath-Ø \_\_\_\_\_

### Sheath material:

- 1.4541 (+800°C)
- 2.4816 (+1100°C)
- other sheath materials \_\_\_\_\_

### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

Nominal length: \_\_\_\_\_ mm

- with batch certificate and identification
- Dakks calibration on request
- accessories (fix): \_\_\_\_\_

### Type:

- with kink protection
- without kink protection

### Connection cable:

- Thermocouple extension cable 2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable 2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

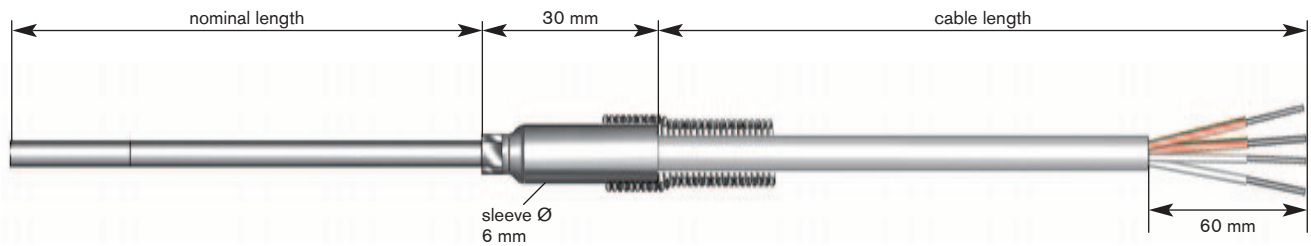
### CONFIGURATION EXAMPLES

item no.	type	Ø mm	nominal length mm	material	cable	cable length mm	connection ends
T207-058-738	K	0,25	100	1.4541	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	miniature thermoplug
T207-058-674	K	0,50	300	1.4541	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T207-053-625	K	0,50	150	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	miniature thermoplug
T207-059-165	K	0,64	200	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T207-035-153	K	1,00	100	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2000	miniature thermoplug
T207-055-557	K	1,00	500	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	miniature thermoplug
T207-058-740	K	1,50 (double wall thickness)	150	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	Lemo plug size 0, 2 pole
T207-037-493	K	1,50	150	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	miniature thermoplug
T207-056-787	K	3,00	150	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2000	miniature thermoplug
T207-056-830	K	3,00 (double wall thickness)	150	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	250	miniature thermoplug

# TEMPERATURE MEASUREMENT

## IN UNIVERSAL USE

mineral insulated resistance thermometer with connection cable



■ This temperature probe is versatile due to its design and high temperature resistance. With its slim design and flexible sheath material, the probe can even be installed in hardly reachable positions. Easy installation is ensured in conjunction with a clamping screw connection.

### RTD:

- 1 x PT100
- 2 x PT100

### Limiting deviation:

- class A     -30°C/+300°C     -100°C/+450°C
- class B     -50°C/+500°C     -196°C/+600°C

### Connection types of inner wire:

- 2-wire circuit
- 3-wire circuit
- 4-wire circuit

### Sheath-Ø:

- 1,5 mm     3,0 mm     4,5 mm
- other sheath-Ø \_\_\_\_\_

Nominal length: \_\_\_\_\_ mm



available on request:

- ▶ class AA
- ▶ class DIN 1/10

### Type:

- with kink protection
- without kink protection

### Connection cable:

- RTD cable (FEP / FEP)
- other connection cables (see page 40)

### Connection cable length:

- 0,50 m     1,00 m
- 1,50 m     2,00 m
- 3,00 m     5,00 m
- 10,0 m     other length \_\_\_\_\_ m

### Connection ends:

- bare ends
- endsleeves
- cable lugs M4
- tinned
- other cable ends \_\_\_\_\_
- with batch certificate and identification
- Dakks calibration on request
- accessories (fix): \_\_\_\_\_

### general information

With a 2-wire circuit only one class accuracy class B accuracy can be confirmed.

material 1.4541: +800°C

Please note that the temperature stability of the sensor is determined by the weakest parameters.

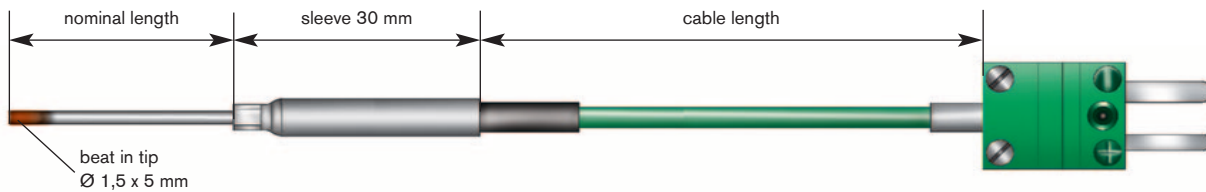
### CONFIGURATION EXAMPLES

item no.	RTD	ø mm	nominal length mm	connection types	cable	cable length mm	connection ends
T507-059-257	1 x PT100	1,5	100	4-wire circuit	FEP/FEP	1000	Lemo FGA.0B.306
T505-053-490	1 x PT100	1,5	100	4-wire circuit	FEP/FEP	1000	bare ends

# TEMPERATURE MEASUREMENT

## ON SURFACES

beat in mineral insulated thermocouple with cable



■ This item is used, for example in automobile industry and is particularly appropriate for surface temperature measurement. With the help of an appropriate groove, the element can be fixed by beating in. The measuring point is situated behind the copper tip and can easily be identified by the colour difference.

### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

Nominal length: \_\_\_\_\_ mm

### Type:

- with kink protection (shrinkable sleeve)
- without kink protection (shrinkable sleeve)

### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends
  
- with batch certificate and identification

### general information

type J	class 1 -40°C / +750°C
type K	class 1 -40°C / +1000°C
limit deviation	class 1
material 1.4541	+800°C
material 2.4816	+1100°C

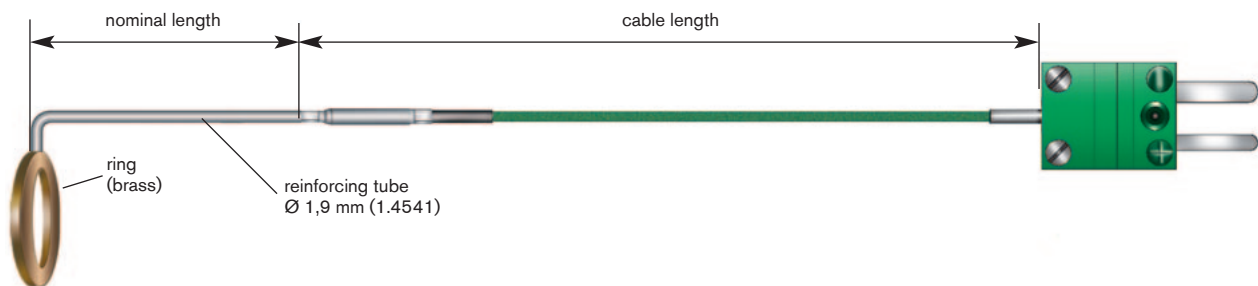
Please note  
that the temperature stability  
of the sensor is determined  
by the weakest parameters.



# TEMPERATURE MEASUREMENT

## ON SURFACES

### spark plug surface sensor



■ This item is used for the easy measurement at the sealing ring of spark plugs, for example in automobile industry. Working with spark plug spanner isn't impeded.

#### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

#### Ring-Ø:

- Ø 19 x 13,1 x 2,5 mm Ms  
(standard version for spark plugs)
- other type of ring \_\_\_\_\_

Nominal length: \_\_\_\_\_ mm

#### Type:

- with kink protection (shrinkable sleeve)
- without kink protection (shrinkable sleeve)

#### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

#### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

#### Connection ends:

- miniature thermoplug
- miniature socket
- standard plug
- standard socket
- free ends \_\_\_\_\_ mm
- other connection ends
- with batch certificate and identification

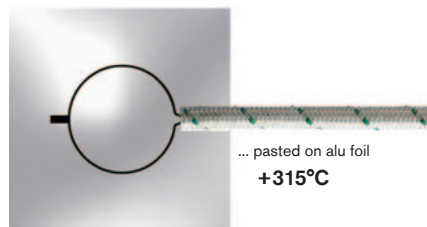
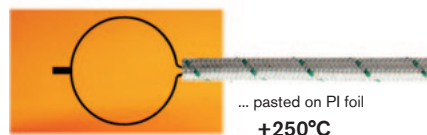
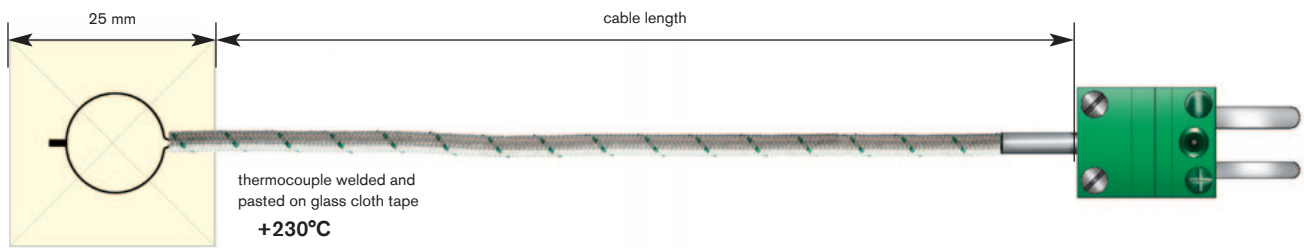
#### CONFIGURATION EXAMPLE

item no.	type	dimension mm	nominal length mm	material	cable	cable length mm	connection ends
T207-044-579	K	19 x 13,1 x 2,5	52	1.4541	FEP/C/FEP	300	miniature thermoplug

also available as  
**Type J and T**

## ON SURFACES

self-adhesive surface thermocouple



■ This item is used, for example in automobile industry, especially everywhere quick and uncomplicated temperatures must be measured. Advantage: No special preparation necessary at the measuring points. It only has to be paid attention to the fact that the surface is free of dust, grease and oils.

### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

### Pad size:

- glass cloth tape +230°C
- PI foil +250°C
- HT max. +315°C

### Connection cable:

- single wire / fibre-glass / fibre-glass
- single wire / FEP / FEP
- single wire / polyimide / polyimide
- other connection cable \_\_\_\_\_

Cable length: \_\_\_\_\_ mm

### Connection ends:

- miniature thermoplug     miniature socket
- standard plug             standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

- with batch certificate and identification

### self-adhesive thermocouple in practical application

Self-adhesive thermocouples to measure the temperature at the sleeves of the drive shaft.

The data transmission is done by a telemetric device. Several self-adhesive thermocouples can be mounted in a space saving way without any problem.



Spare adhesive pads in cut-outs and a packaging unit of 100 pieces are available on one roll! (see page 37)

### CONFIGURATION EXAMPLES

item no.	type	adhesive pad	cable	cable length mm	connection ends
T130-031-950	K	glass cloth	2 x 0,20 mm GL/GL	1000	miniature thermoplug
T130-058-997	K	alu foil	2 x 0,20 mm GL/GL	1000	miniature thermoplug

### general information

Temperature range of the sensor is dependent of the temperature resistance of the cable e.g. FEP +180°C

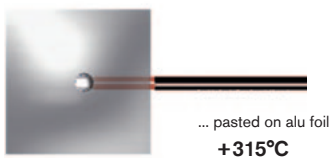
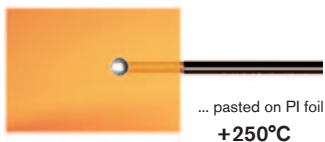
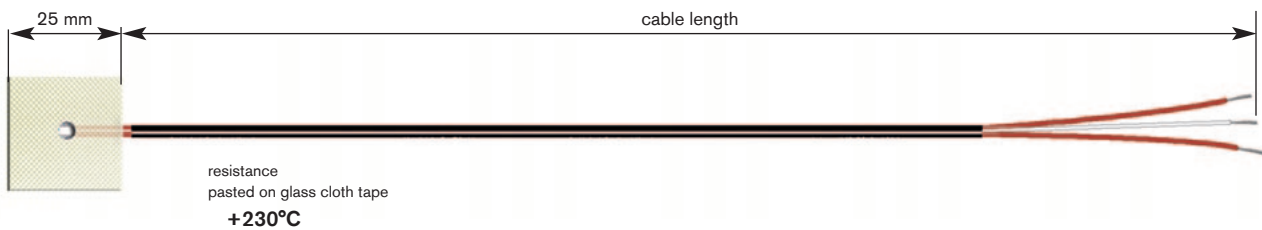
limit deviation:  
class 1

Please note that the temperature stability of the sensor is determined by the weakest parameters.

# TEMPERATURE MEASUREMENT

## ON SURFACES

self-adhesive surface resistance thermometer



■ Especially appropriate where quick and uncomplicated temperatures must be measured. Advantage: No special preparation necessary at the measuring points. It only has to be paid attention to the fact that the surface is free of dust, grease and oils.

### RTD:

- 1 x PT100

### Connection types of inner wire:

- 2-wire circuit  
 3-wire circuit  
 4-wire circuit

### Connection cable:

- RTD cable (FEP / FEP)  
 other connection cables (see page 40)

Cable length: \_\_\_\_\_ mm

(only for type with gas tight tub)

### Connection ends:

- bare ends  
 endsleeves  
 cable lugs M4  
 tinned  
 other cable ends \_\_\_\_\_



Spare adhesive pads in cut-outs and a packaging unit of 100 pieces are available on one roll! (see page 37)

### general information

Please note that the temperature stability of the sensor is determined by the weakest parameters.

### CONFIGURATION EXAMPLES

item no.	RTD	connection types	adhesive pad	cable	cable length mm	connection ends
T630-058-570	1 x PT100	3-wire circuit	glass cloth	FEP/FEP	5000	bare ends
T630-057-291	1 x PT100 (AA)	4-wire circuit	glass cloth	GL/GL	500	Lemo socket size 0, 4 pole

# TEMPERATURE MEASUREMENT

## ON SURFACES

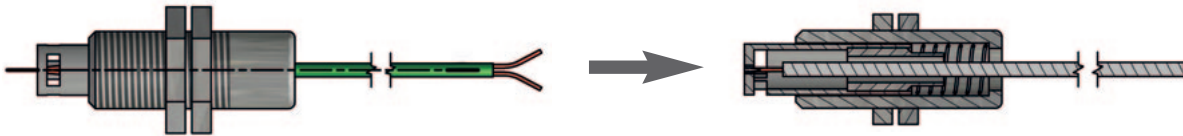
### surface thermocouple for brake discs

■ For the quick temperature collection on flat and rotating surfaces, such as brake discs.

■ The fixing is done by a screw on the holding plate. With the help of a setting screw the initial spring pre-load can be adjusted. The fixing is done by a metal sheet with through-hole or threaded hole.



■ The fixing is done by a metal sheet with through-hole or threaded hole. By counter nuts the slackening of the thread insert can be avoided. Depending on the screw-in depth the spring pre-load can be modified.



■ The fixing is done by a metal sheet with through-hole or threaded hole. By counter nuts the slackening of the thread insert can be avoided. Via bayonet the sensor can be mounted and removed easily. Depending on the screw-in depth the spring pre-load can be modified.



#### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

#### Sheath material:

- Ø 0,5 with variable holding plate  
11 x 17 mm (E-Cu)

#### Length:

(sheath material with stainless steel wire armouring (VA))

- 0,5 m     1,0 m     1,5 m     2,0 m
- other length \_\_\_\_\_ m

#### Connection ends:

- miniature thermoplug
- miniature socket
- standard plug
- standard socket
- free ends \_\_\_\_\_ mm
- other connection ends
- with batch certificate and identification

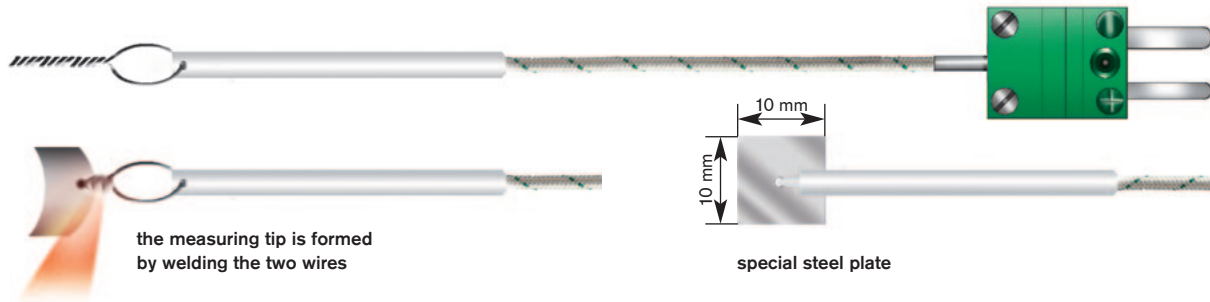
#### CONFIGURATION EXAMPLES

item no.	type	thermocouple	cable	cable length mm	connection ends	dimension
T895-050-687	with holding plate	type K	Ø0,5er min.t/c with special steel protecting tube	1000	miniature thermoplug	85 x 10mm
T055-057-737 + T999-057-738	bayonet M12	type K	2 x 0,22 mm <sup>2</sup> GL/ Besilen®	1000	miniature thermoplug	M12
T999-040-282	screw-in sensor M12	type K	2 x 0,22 mm <sup>2</sup> FEP/FEP	500	miniature thermoplug	M12



## ON SURFACES

surface thermocouple with ceramic housing



■ This surface thermocouple is applied in the exhaust gas area. It is especially appropriate for a quick and uncomplicated measurement. By welding the measuring tip the sensor can be easily positioned at the required measuring point.

### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

### Connection cable:

- fibre-glass insulated thermo-cable  
2 x 0,50 mmØ +400°C
- other connection cables (see page 39)

### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends
- with batch certificate and identification



The ceramic insulation is also available separately!

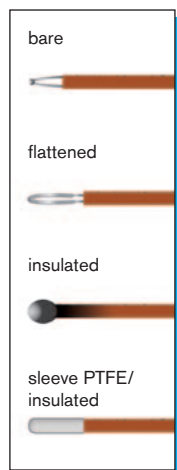
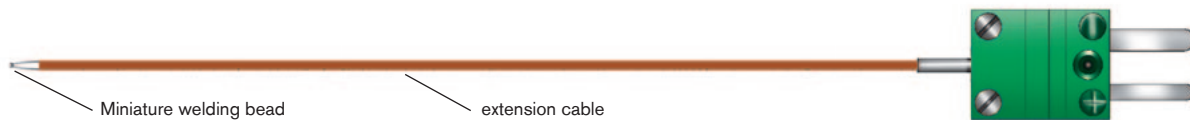
### CONFIGURATION EXAMPLES

item no.	note	type	cable	cable length mm	connection ends
T100-053-130	without fitting panel	K	2 x 0,50 mm GL	3000	miniature thermoplug
T999-056-584	with special steel fitting panel	K	2 x 0,50 mm GL	2000	miniature thermoplug

**NEW:**  
with stranded  
and shielded  
thermo cables

## ON SURFACES

surface thermocouple with welding bead



### possible measuring tips

■ This surface thermocouple with polyimide cable is used for example in coil windings, electronic parts and narrow spaces. Batch certificate and identification can be delivered on request.

#### Thermocouple:

- 1 x type J
- 1 x type N
- 1 x type K
- 1 x type T
- other thermocouples \_\_\_\_\_

#### Connection cable:

- thermocouple cable 2 x 0,20 mmØ polyimide +250°C approx. 0,7 mmØ
- thermocouple cable 2 x 0,20 mmØ polyimide +250°C type K stranded approx. 0,8 mmØ
- thermocouple cable 2 x 0,20 mmØ polyimide +250°C type K stranded and braided, approx. 1,0 mmØ
- other connection cables (see page 39)

#### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

#### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

- with batch certificate and identification

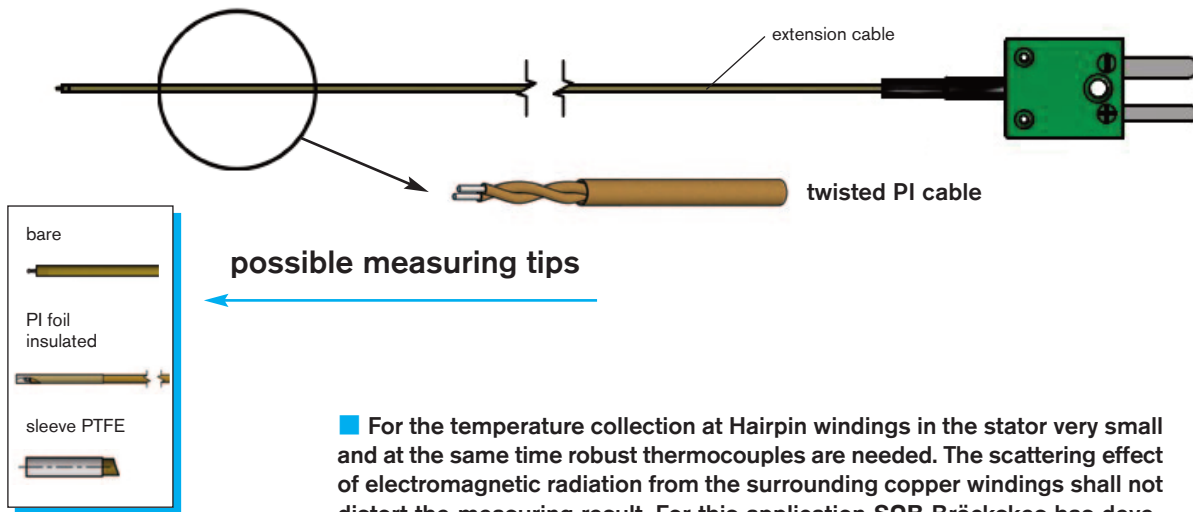
#### CONFIGURATION EXAMPLES

item no.	type	measuring tip	cable	cable length mm	connection ends
T100-054-316	K	bare	2 x 0,20 mm PI	1000	miniature thermoplug
T100-048-288	K	bare	2 x 0,20 mm PI/PFA	1000	miniature thermoplug
T100-053-628	K	bare (insulated with PI foil)	2 x 0,20 mm PI	1000	miniature thermoplug
T100-049-178	K	insulated	2 x 0,20 mm PI	1000	miniature thermoplug
T100-057-499	K	bare	2 x 0,20 mm PI	1000	miniature thermoplug
T100-060-215	K	bare	2 x 0,20 mm PI (braided)	1000	miniature thermoplug 3 pole
T100-060-214	K	bare	2 x 0,20 mm PI (stranded)	1000	miniature thermoplug
T100-061-046	K	sleeve PTFE approx. 1,2 x 5 mmØ	2 x 0,20 mm PI (stranded)	1500	miniature thermoplug

# TEMPERATURE MEASUREMENT

## ON SURFACES

Surface thermocouple with twisted cores / screened cable  
for measurements in EMC critical areas as for example rotor / stator



■ For the temperature collection at Hairpin windings in the stator very small and at the same time robust thermocouples are needed. The scattering effect of electromagnetic radiation from the surrounding copper windings shall not distort the measuring result. For this application SAB Bröckskes has developed different surface thermocouples. The necessary cables have been optimised in our own cable works with regard to screening and twisting.

### Thermocouple:

- 1 x type N
- 1 x type K
- other thermocouples \_\_\_\_\_

### Connection cable:

- L0433-9138, 2 x 0,20 mm Ø, cores next to each other, PI foil insulation KN/KP bare/PI sheath, type K, -40...+ 250°C, outer-Ø approx. 0,7 mm
- L0433-9262, 2 x 0,20 mm Ø, twisted cores, PTFE foil NP/NN bare/PI-sheath, type N, -40...+ 250°C, outer-Ø approx. 0,8 mm
- L0433-9279, 2 x 0,20 mm Ø, twisted cores, PI foil insulation/sheath, type K, -40...+ 250°C, outer-Ø, approx. 0,85 mm
- L0433-9280, 2 x 0,20 mm Ø twisted cores, PI foil insulation/nickel-plated copper braid/PI-sheath, type K, -40...+ 250°C, outer-Ø approx. 1,05 mm

### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

### Connection ends:

- miniature thermoplug  miniature socket
- free ends \_\_\_\_\_ mm
- other connection ends
- with batch certificate and identification

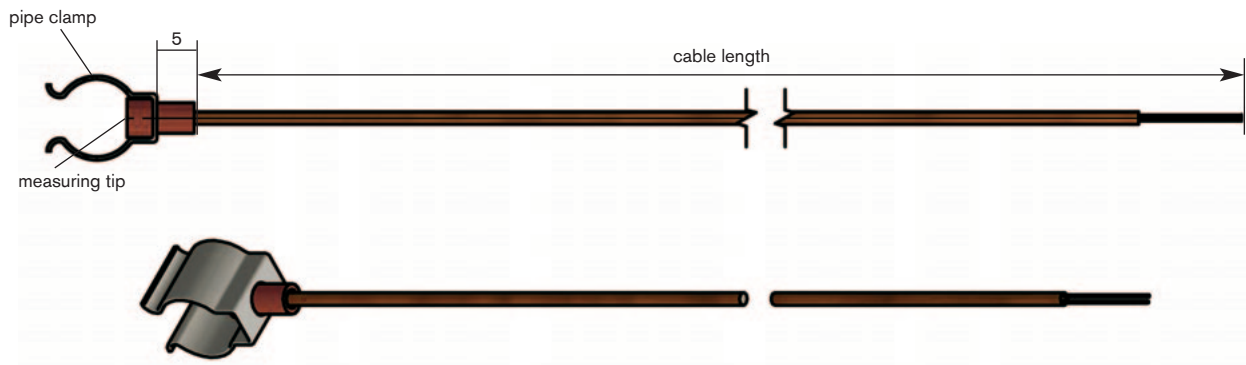
### CONFIGURATION EXAMPLES

item no.	type	measuring tip	cable	cable length mm	connection ends
T100-061-046	K	sleeve PTFE	2 x 0,20 mm PI stranded	1500	miniature thermoplug
T100-061-998	K	PI foil	2 x 0,20 mm PI stranded	2000	bare
T100-060-628	K	bare	2 x 0,20 mm PI stranded	2000	miniature thermoplug
T100-060-629	K	bare	2 x 0,20 mm PI stranded	3000	miniature thermoplug
T100-061-276	K	bare	2 x 0,20 mm PI stranded	1000	bare
T100-062-000	K	PI foil	2 x 0,20 mm PI stranded	2000	bare

# TEMPERATURE MEASUREMENT

## ON SURFACES

### surface thermocouple with pipe clamp



■ This surface thermocouple with pipe clamp is especially appropriate to collect temperatures on pipe connections, as for example air conditioning and water cooling systems.

#### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

#### Connection cable:

- PI foil insulated thermo-cable  
2 x 0,20 mm $\varnothing$  +250°C
- other connection cables (see page 39)

#### Pipe clamp:

- $\varnothing$  6 - 7
- $\varnothing$  10 - 12
- $\varnothing$  13 - 14
- $\varnothing$  16 - 19
- other nominal  $\varnothing$  \_\_\_\_\_

#### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

#### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends
- with batch certificate and identification



Also available  
with other clamp types  
and sizes!

#### CONFIGURATION EXAMPLES

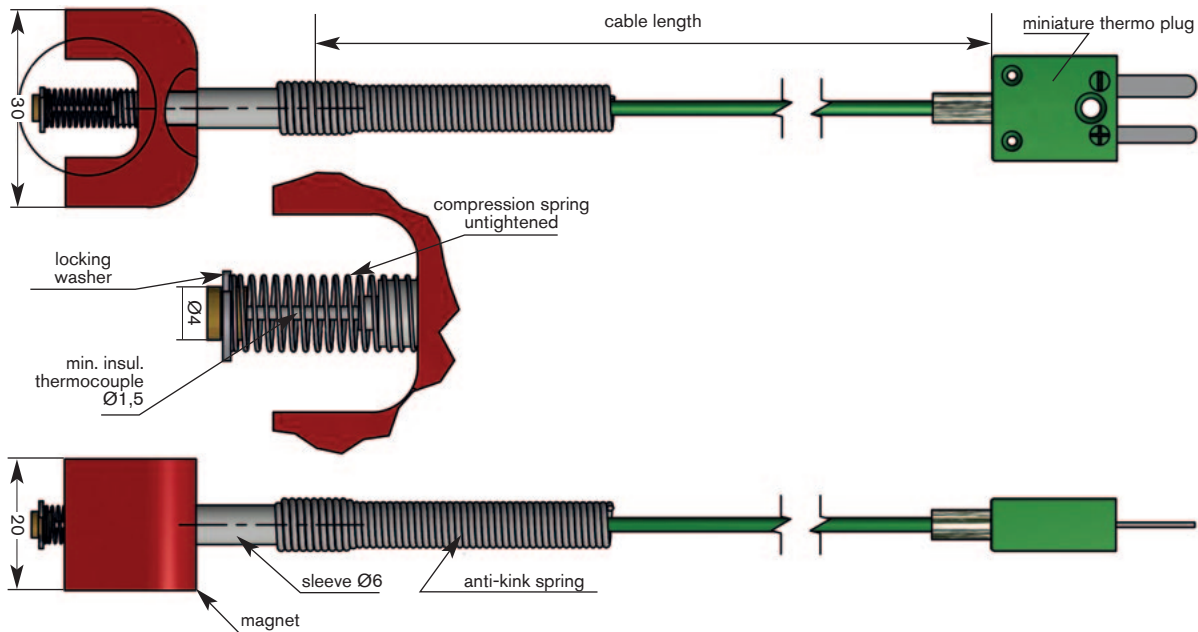
item no.	type	pipe clamp nominal $\varnothing$ mm	cable	cable length mm	connection ends
T999-056-952	K	6-7	2 x 0,20 mm PI	1000	free ends
T999-056-953	K	10-12	2 x 0,20 mm PI	1000	free ends
T999-056-954	K	13-14	2 x 0,20 mm PI	1000	free ends
T999-056-955	K	16-19	2 x 0,20 mm PI	1000	free ends



# TEMPERATURE MEASUREMENT

## ON SURFACES

magnetic sensor



■ Thermocouple for surface measurements on magnetic materials. The flat measuring tip enables a direct surface measurement. Thanks to the compression spring, it fits closely even when there is vibration.

### Thermocouple:

- 1 x type K
- other thermocouples \_\_\_\_\_

### Class accuracy:

- class 1

### Types of measuring tip:

- form A, insulated measuring tip
- form B, welded measuring tip

### Jacket material:

- 1.4571

### Kink protection:

- spring

### Length:

- 1000 mm
- other lengths: \_\_\_\_\_ mm

### End of cable:

- miniature thermo plug
- other connection end: \_\_\_\_\_ mm

### Note:

- magnet: AlNiCO, 45 N, 450 °C, red provided with protective cap (remove before use)

### Special features:

- measuring tip Ø 4x3 mm, brass



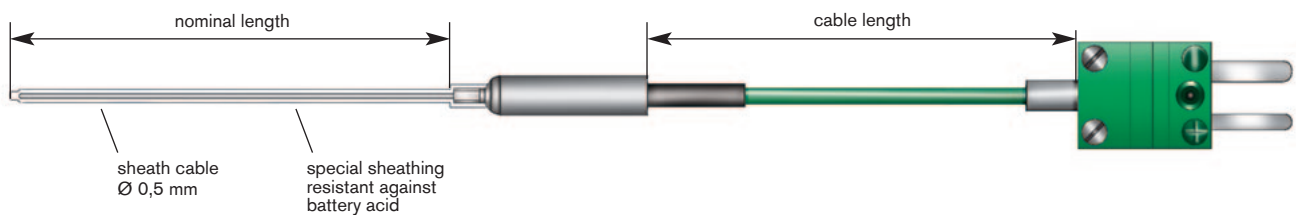
Allows surface measurement up to 450°C without mechanically processing or destroying the component. Minimal installation effort.

### CONFIGURATION EXAMPLE

item no.	cable	measuring point	cable length mm	cable end
T999-060-863	FEP/C/FEP	form A, insulated	1000	miniature thermo plug

## IN LIQUIDS

### battery thermocouple



■ This item is used, for example in automobile industry. The special thermocouple is especially appropriate to collect temperatures in batteries. Considerable advantage is the special sheathing resistant against battery acids that enables a temperature measurement directly in the acid without any harm to the thermocouple itself.

#### Thermocouple:

- 1 x type J
- 1 x type K
- 2 x type J
- 2 x type K
- other thermocouples \_\_\_\_\_

#### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

#### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

#### Sheath material:

- 1.4541
- other sheath materials \_\_\_\_\_

#### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

#### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

#### Nominal length: \_\_\_\_\_ mm

#### Type:

- with kink protection (shrinkable sleeve)
- without kink protection (shrinkable sleeve)
- with batch certificate and identification
- Dakks calibration on request
- accessories (fix): \_\_\_\_\_

#### CONFIGURATION EXAMPLES

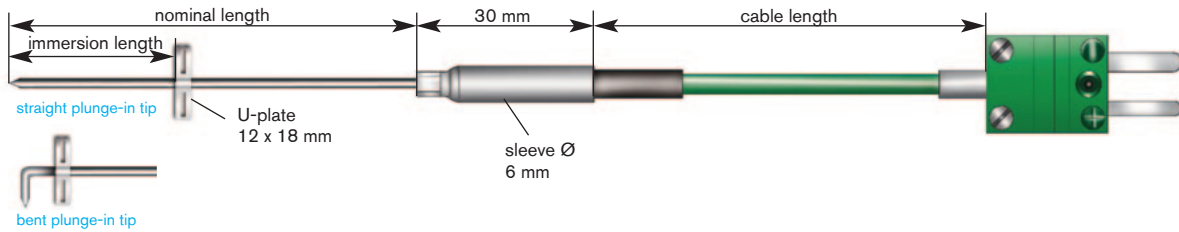
item no.	type	Ø mm	nominal length mm	material	cable	cable length mm	connection ends
T841-041-336	K	0,50	200	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	500	end sleeves
T841-049-891	K	0,50	100	2.4816	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	300	miniature thermoplug

# TEMPERATURE MEASUREMENT

## IN LIQUIDS

### cooling water tube thermocouple

#### ■ with U-plate for two cable ties T844



■ Especially appropriate to collect the temperature of the cooling liquid in the cooling tubes at the engine. If temperature collection is no longer required, the sheath can be simply cut behind the high temperature cable tie. Considerable advantage is the achieved time saving, as it is no longer necessary to let off the cooling liquid. The system of cooling tubes remains tight.

#### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

#### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

#### Sheath-Ø:

- 1,5 mm

#### Plunge-in tip:

- straight
- bent

#### Sheath material:

- 1.4541
- other sheath materials \_\_\_\_\_

Nominal length: \_\_\_\_\_ mm

Immersion length: \_\_\_\_\_ mm

#### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

#### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

#### Connection ends:

- miniature thermoplug
- miniature socket
- standard plug
- standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

- with batch certificate and identification

#### general information

limit deviation:  
class 1

Please note  
that the temperature  
stability of the sensor  
is determined by the  
weakest parameters.



In order to reuse the cooling water tube sensor, the opening can be closed permanently by the blind plug.

▶ item no.: T061-041-908

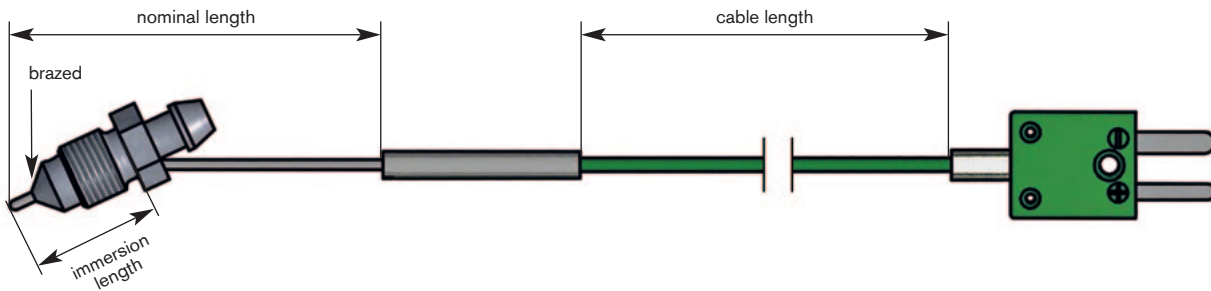
#### CONFIGURATION EXAMPLES

item no.	type	nominal length mm	immersion length mm	plunge-in tip	cable	cable length mm	connection ends
T844-041-357	K	70	20	straight	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1500	miniature thermoplug
T844-056-135	K	80	10	straight	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2000	miniature thermoplug
T844-057-278	K	40	20	straight	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2000	miniature thermoplug
T844-059-310	K	80	14	straight	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2000	miniature thermoplug

# TEMPERATURE MEASUREMENT

## IN LIQUIDS

mineral insulated thermocouple with breather nipple



■ This mineral insulated thermocouple with breather nipple is especially designed for the use at brake callipers or clutch slave cylinders. The existing breather nipple is replaced by the breather with thermocouple and thus the temperature of the brake and clutch fluid can be measured.

### Thermocouple:

- 1 x type J
- 1 x type K
- 2 x type J
- 2 x type K
- other thermocouples \_\_\_\_\_

### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

### Connection cable length:

- 1,00 m
- 1,50 m
- 2,00 m
- 2,50 m
- 3,00 m
- 4,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

### Sheath material:

- 1.4541
- other sheath materials \_\_\_\_\_

### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

Nominal length: \_\_\_\_\_ mm

Immersion length: \_\_\_\_\_ mm

Thread \_\_\_\_\_ mm

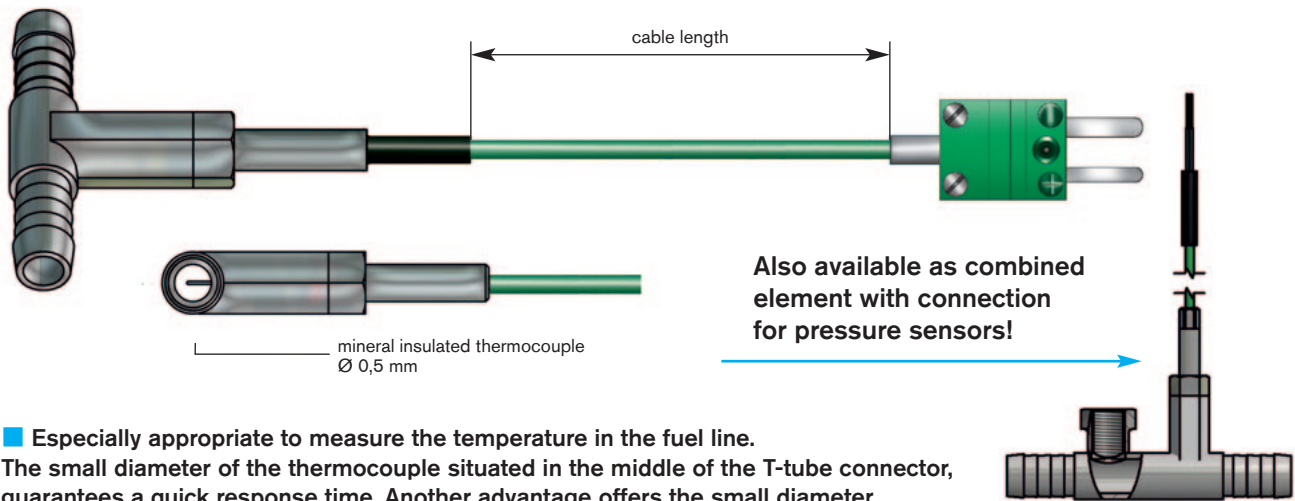
### CONFIGURATION EXAMPLES

item no.	type	nominal length mm	nipple size	cable	cable length mm	connection ends
T209-056-683	K	200	M10x1x30	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	250	miniature thermoplug
T209-059-283	K	200	M10x1x22	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug

Especially appropriate for temperature measurement in engine oil!

## IN LIQUIDS

### fuel thermocouple



Also available as combined element with connection for pressure sensors!

Especially appropriate to measure the temperature in the fuel line. The small diameter of the thermocouple situated in the middle of the T-tube connector, guarantees a quick response time. Another advantage offers the small diameter of the mineral insulated thermocouple so that neither the flow velocity nor the flow quantity are affected. The screening of the cable offers at the same time mechanical protection as well as protection against electromagnetic interference.

#### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

#### Sheath-Ø:

- 0,5 mm (1.4404)
- other sheath-Ø (on request) \_\_\_\_\_

#### Inner tube-Ø:

- 4 - 5 mm (tube connector NW 3)
- 5 - 6 mm (tube connector NW 4)
- 7 - 8 mm (tube connector NW 6)
- 9 - 10 mm (tube connector NW 8)
- 11 - 12 mm (tube connector NW 10)
- 13 - 14 mm (tube connector NW 12)
- other tube inner-Ø (on request) \_\_\_\_\_

#### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

#### Connection cable length:

- 0,50 m     1,00 m     1,50 m
- 2,00 m     3,00 m     5,00 m
- 10,0 m     other length \_\_\_\_\_ m

#### Connection ends:

- miniature thermoplug     miniature socket
- standard plug     standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

- with batch certificate and identification

#### Pressure sensor:

- thread \_\_\_\_\_

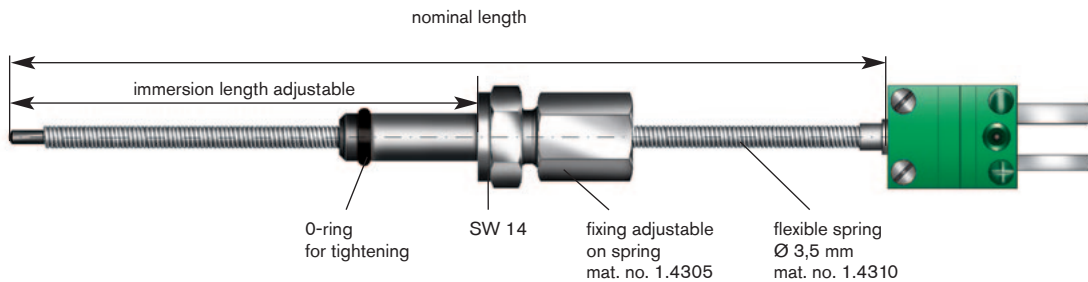
#### CONFIGURATION EXAMPLES

item no.	type	tube NW	additional connection pressure sensor	cable	cable length mm	connection ends
T850-058-533	K	4	no	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	7000	miniature thermoplug
T850-056-956	K	6	no	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T850-050-374	K	8	no	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	500	miniature thermoplug
T850-058-418	K	2,5	yes	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T850-058-509	K	4	yes	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T850-058-426	K	6	yes	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T850-057-580	K	8	yes	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T850-057-251	K	10	yes	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug
T850-059-012	K	12	yes	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	10000	miniature thermoplug

Also available as PT100!

## IN LIQUIDS

dip-stick thermocouple



■ This dipstick thermocouple is especially appropriate to collect the temperature in engine oil. The dipstick can easily be inserted instead of the normal oil dipstick. The adjustable fixing tightens the opening so that during operation the oil cannot penetrate. With the help of the fixing, the immersion length of the dipstick can be modified.

### Thermocouple:

- 1 x type K
- other thermocouples \_\_\_\_\_

### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

### Spring-Ø:

- 3,5 mm

### Spring material:

- 1.4571

Nominal length: \_\_\_\_\_ mm

### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

### Accessories:

- fixing adjustable on spring tightening on Ø \_\_\_\_\_ mm
- with batch certificate and identification



- ▶ due to the adjustable immersion depth, it can be applied for the most different engine types!
- ▶ different tightening-Ø possible on request!

### CONFIGURATION EXAMPLE

item no.	thermocouple	nominal length mm	fixing dimension
T860-055-906	1 x type K	670	Ø 8 mm

### general information

temperature range of probe:  
0°C / +200°C

limit deviation:  
class 1

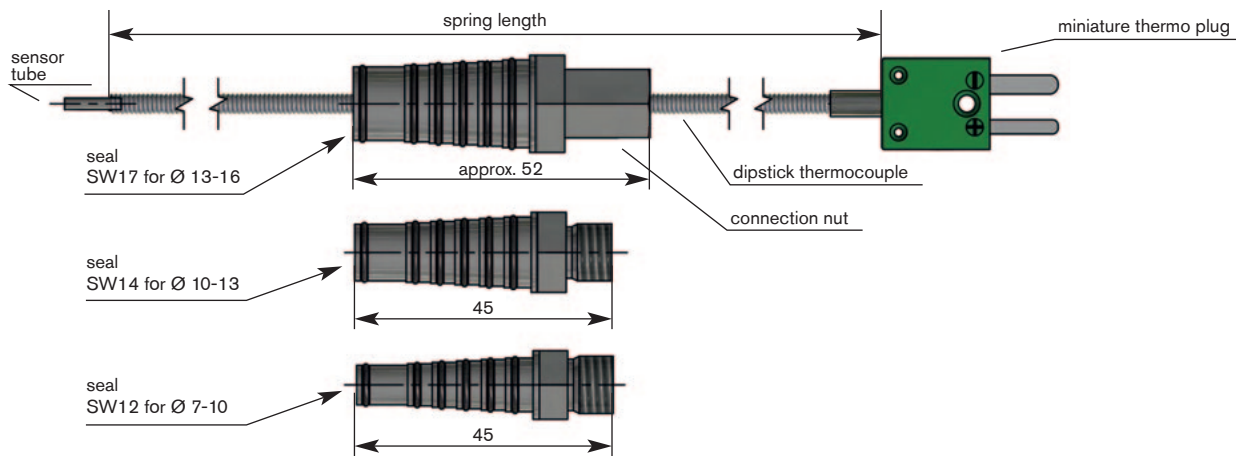
Please note that the temperature stability of the sensor is determined by the weakest parameters.



# TEMPERATURE MEASUREMENT

## IN LIQUIDS

dip-stick thermocouple and adjustable mounting with 3-stage sealing inserts



■ This set can be used for the most different oil filler necks with the help of the 3 sealing inserts.

### Thermocouple:

- 1 x type K
- other thermocouples \_\_\_\_\_

### Class accuracy:

- class 1

### Types of measuring tip:

- form A, insulated measuring tip

### Temperature range:

- 0°C...+200°C

### Sensor tube:

- Ø 2 x 0,3 mm

### Spring:

- Ø 3,5 mm

### Spring length:

- 1500 mm

### Material:

- 1.4310

### Connection end:

- miniature thermo plug with potting



Dipstick thermocouple with sealing inserts is delivered in a case.



The individual sealing inserts can be ordered separately.

### CONFIGURATION EXAMPLE

item no.	thermocouple	measuring point	spring length	connection end
T860-060-108	1 x type K	form A, insulated	1500 mm	miniature thermo plug with potting

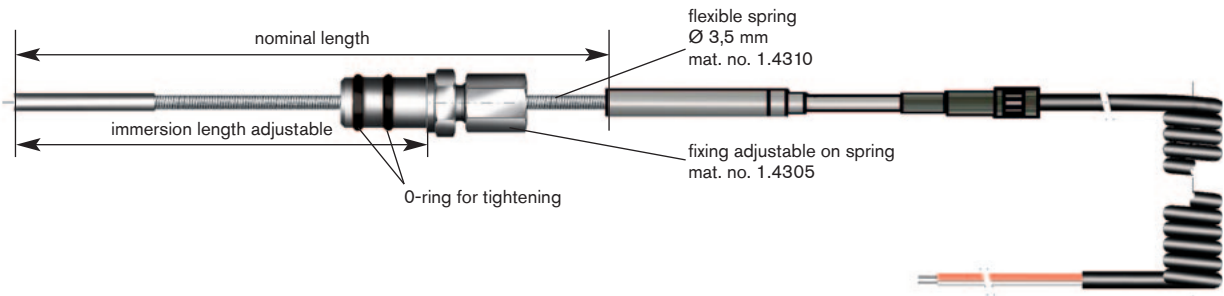
Especially appropriate for temperature measurement in engine oil!

## IN LIQUIDS

dip-stick resistance thermometer



■ with helix cable 4 x 0,14 mm<sup>2</sup> (+90°C)



■ This dipstick resistance thermometer is especially appropriate to collect the temperature in engine oil. The dipstick can easily be inserted instead of the normal oil dipstick. The adjustable fixing tightens the opening so that during operation the oil cannot penetrate. With the help of the fixing, the immersion length of the dipstick can be modified.

An additional advantage of the spiral cable is that the element can be put into the required position in case of use and afterwards the cable contracts again like a spring.

### RTD:

- 1 x PT100
- 2 x PT100

### Limiting deviation:

- class A     -30°C/+300°C     -100°C/+450°C
- class B     -50°C/+500°C     -196°C/+600°C

### Connection types of inner wire:

- 2-wire circuit
- 3-wire circuit
- 4-wire circuit

Nominal length: \_\_\_\_\_ mm

### Fixing adjustable:

- for tightening-Ø 8 mm
- for tightening-Ø \_\_\_\_\_ mm

### Connection ends:

- bare ends
- cable lugs M4
- other cable ends \_\_\_\_\_
- with batch certificate and identification

### Connection cable:

- RTD cable (FEP / FEP)
- other connection cables (see page 40)



- ▶ due to the adjustable immersion depth, it can be applied for the most different engine types!
- ▶ different tightening-Ø possible on request!

### CONFIGURATION EXAMPLE

item no.	RTD	connection type	fixing dimension
T861-049-392	1 x PT100	4-wire circuit	Ø 8 mm

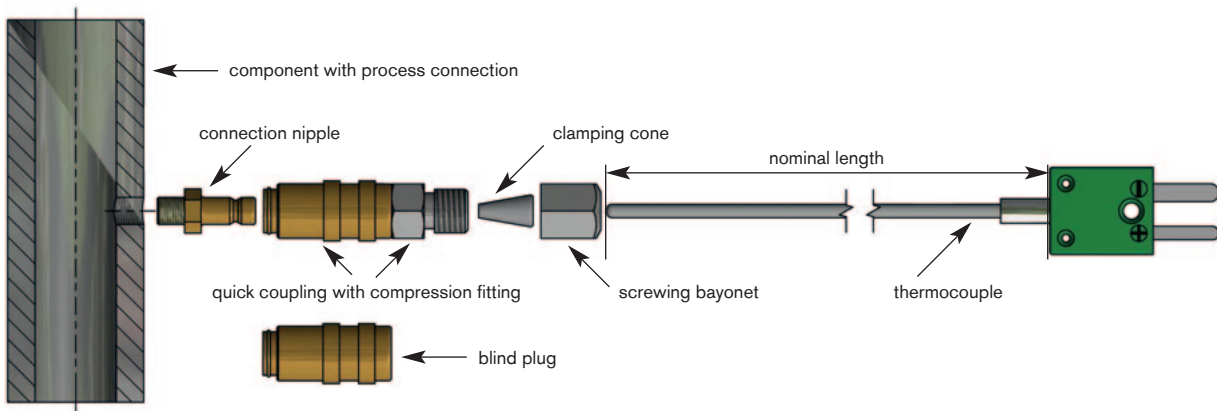
### general information

With a 2-wire circuit only one class accuracy class B accuracy can be confirmed.

# TEMPERATURE MEASUREMENT

## IN LIQUIDS

### quick coupling thermocouple



■ This thermocouple is especially appropriate to collect the temperature in pipe systems. The quick coupling of the thermocouple allows the easy exchange of the thermocouple without disturbing the closed system too much. Optionally the system can be closed by a blind plug. The positioning of the mineral insulated thermocouple is possible by a clamp crewing. Screw-in fitting M5x1 with integrated sealing compound.

#### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

#### Sheath-Ø:

- 1,5 mm
- 3,0 mm

Nominal length thermocouple: \_\_\_\_\_ mm

#### Connection ends:

- miniature thermoplug     miniature socket
- standard plug             standard socket
- free ends \_\_\_\_\_ mm
- other connection ends
  
- with batch certificate and identification



Also available  
as a combination of  
thermocouple and cable!

#### CONFIGURATION EXAMPLES

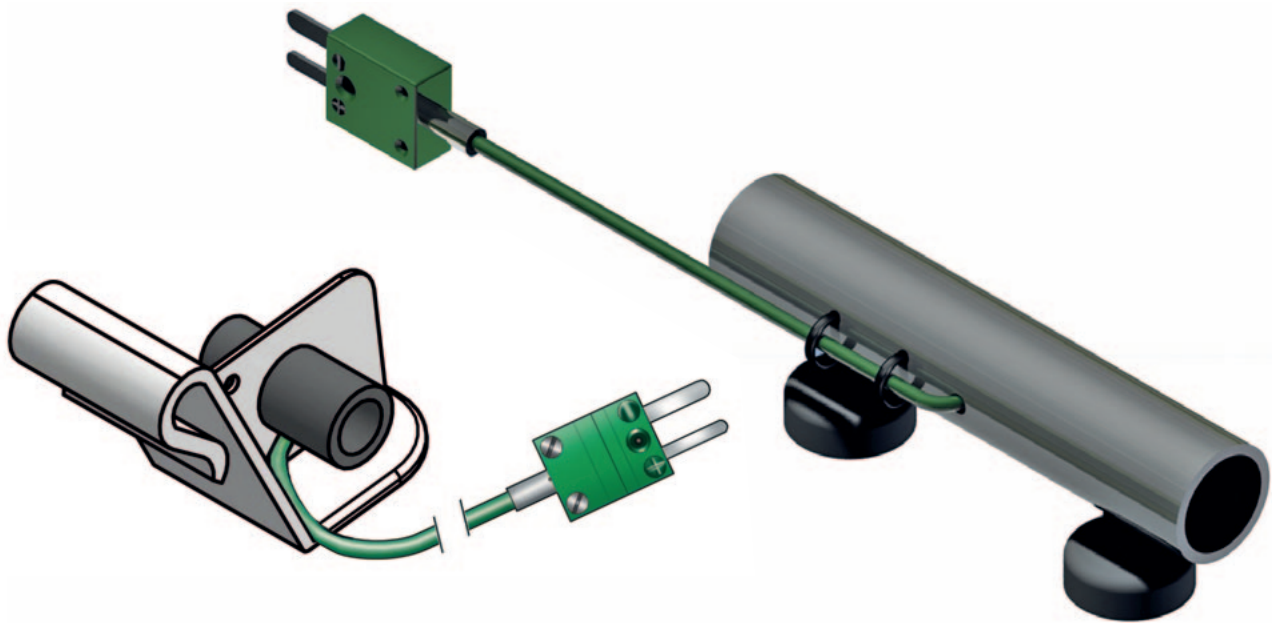
item no.	identification
T027-058-800	connection nipple M5x1
T027-058-122	quick coupling for Ø 1,5 mm min.t/c
T027-058-799	quick coupling for Ø 3,0 mm min.t/c
T027-058-156	blind plug

Please choose thermocouple on page 8

# TEMPERATURE MEASUREMENT

## IN AIR AND GASES

outdoor temperature sensor



■ The outdoor temperature sensor is placed on the side window pane and is fixed by closing the window. Due to the plastic construction a damage of the window pane and the gasket is avoided. A version with two magnetic feet can be mounted at any place on the steel vehicle body.

### Connection ends:

- miniature thermoplug
- miniature socket
- standard plug
- standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

outdoor temperature sensor with magnetic feet

#### CONFIGURATION EXAMPLE

item no.	thermocouple	cable	cable length mm	connection ends	dimension mm
T999-054-584	type K	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2500	miniature thermoplug	Ø 25 x 100

outdoor temperature sensor for the window pane

#### CONFIGURATION EXAMPLE

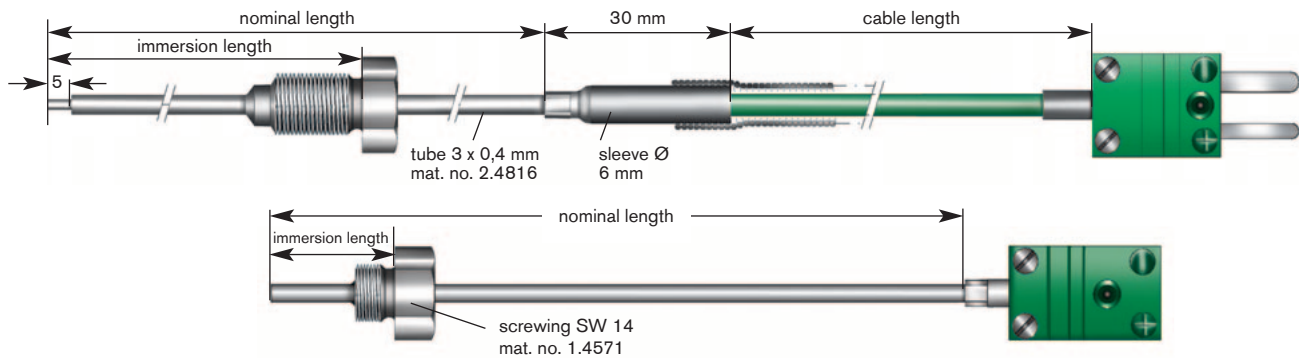
item no.	thermocouple	cable	cable length mm	connection ends
T999-053-055	type K	2 x 0,22 mm <sup>2</sup> FEP/FEP	2000	miniature thermoplug

# TEMPERATURE MEASUREMENT

also available as  
Type J and T

## IN AIR AND GASES

### screw-in thermocouple



■ For temperature measurement at engine test benches. Especially appropriate to collect the temperature in the combustion gas flow at the manifold. The reinforcement tube shall increase service life. The small diameter of the thermocouple guarantees a short response time. The screening of the cable is equally a mechanical protection as well as protection against electromagnetic interference.

#### Thermocouple:

- 1 x type J
- 1 x type K
- other thermocouples \_\_\_\_\_

#### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

#### Kink protection behind sleeve:

- with kink protection
- without kink protection

#### Sheath-Ø:

- 1,5 mm
- 3,0 mm
- 4,5 mm
- 6,0 mm

#### Reinforcing tube-Ø:

- without
- 3,0 mm
- \_\_\_\_\_ mm

#### Sheath material:

- 1.4541 (800°C)
- 2.4816 (1100°C)
- other sheath materials (on request) \_\_\_\_\_

Nominal length: \_\_\_\_\_ mm

Immersion length: \_\_\_\_\_ mm

Thread: \_\_\_\_\_ mm

Screwing: \_\_\_\_\_ mm

#### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

#### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

#### Connection ends:

- miniature thermoplug
- miniature socket
- standard plug
- standard socket
- free ends \_\_\_\_\_ mm
- other connection ends
- with batch certificate and identification

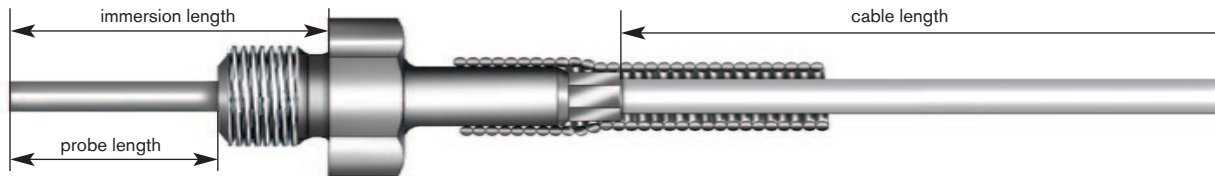
#### CONFIGURATION EXAMPLES

item no.	type	Ø mm	thread	immersion length mm	probe length mm	thread length mm	cable	cable length mm	connection ends
T848-058-794	K	1,50	M6	20	13	7	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2000	miniature thermoplug
T848-059-408	K	1,50	M8	20	13	7	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	2000	miniature thermoplug
T848-058-437	K	3,00	M6	25	60	8	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	500	miniature thermoplug
T848-046-828	K	3,00	M10	25	156	10	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	500	miniature thermoplug

different threads possible on request!

## IN AIR AND GASES

screw-in resistance thermometer



■ For temperature measurement, for example at engine test benches. Especially appropriate to collect the temperature in the engine room, for example at the oil pressure switch or wherever the same thread is to be found.

### RTD:

- 1 x PT100
- 2 x PT100

### Limiting deviation:

- class A     -30°C/+300°C     -100°C/+450°C
- class B     -50°C/+500°C     -196°C/+600°C

### Connection types of inner wire:

- 2-wire circuit
- 3-wire circuit
- 4-wire circuit

### Sheath-Ø:

- 1,5 mm     3,0 mm     4,5 mm
- other sheath-Ø \_\_\_\_\_

Probe length: \_\_\_\_\_ mm

Immersion length: \_\_\_\_\_ mm

Thread: \_\_\_\_\_ mm

### Type:

- with kink protection
- without kink protection

### Connection cable:

- RTD cable (FEP / FEP)
- other connection cables (see page 40)

### Connection cable length:

- 0,50 m     1,00 m
- 1,50 m     2,00 m
- 3,00 m     5,00 m
- 10,0 m     other length \_\_\_\_\_ m

### Connection ends:

- bare ends
- endsleeves
- cable lugs M4
- tinned
- other cable ends \_\_\_\_\_
- with batch certificate and identification

### general information

With a 2-wire circuit only one class accuracy class B accuracy can be confirmed.

material 1.4541: +800°C

Please note that the temperature stability of the sensor is determined by the weakest parameters.

### CONFIGURATION EXAMPLES

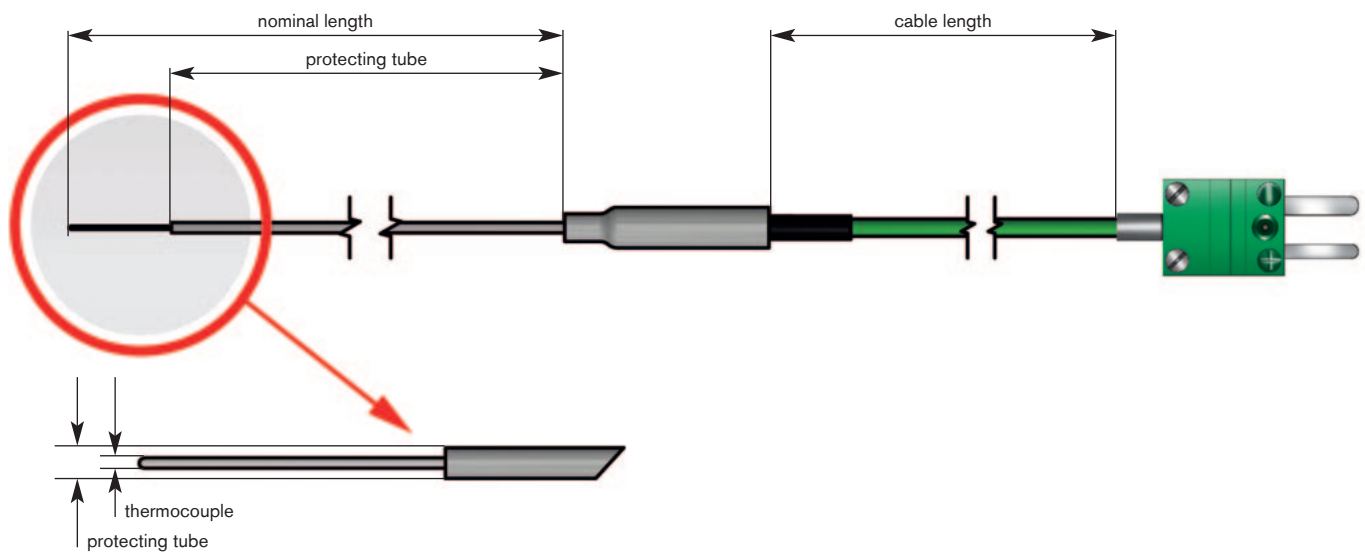
item no.	RTD	connection type	Ø mm	thread	immersion length mm	cable	cable length mm	connection ends
T871-057-518	1 x PT100	4-wire circuit	1,50	M6	15	FEP/FEP	1000	Lemo FFA.0S
T871-052-910	1 x PT100	4-wire circuit	3,00	G1/2	22	FEP/FEP	1000	bare ends



# TEMPERATURE MEASUREMENT

## IN AIR AND GASES

### airflow thermocouple



■ For temperature measurement, for example at engine test benches. Especially appropriate to collect the temperature of the airflow, for example in the turbocharger. The small diameter of the measuring tip guarantees a quick response time. The screening of the cable offers at the same time mechanical protection as well as protection against electromagnetic interference. Usually fixing can be done by clamping screw connections.

#### Thermocouple:

- 1 x type J
  - 1 x type K
  - 2 x type J
  - 2 x type K
- } from Ø 1,5 mm
- other thermocouples \_\_\_\_\_

#### Sheath material:

- 1.4541 (+800°C)
- 2.4816 (+1100°C)
- other sheath materials \_\_\_\_\_

#### Protecting tube:

- length \_\_\_\_\_ mm

#### Connection ends:

- miniature thermoplug
- standard plug
- free ends \_\_\_\_\_ mm
- other connection ends
- miniature socket
- standard socket

#### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

#### Nominal length: \_\_\_\_\_ mm

- with batch certificate and identification
- Dakks calibration on request
- accessories (fix): \_\_\_\_\_

#### CONFIGURATION EXAMPLES

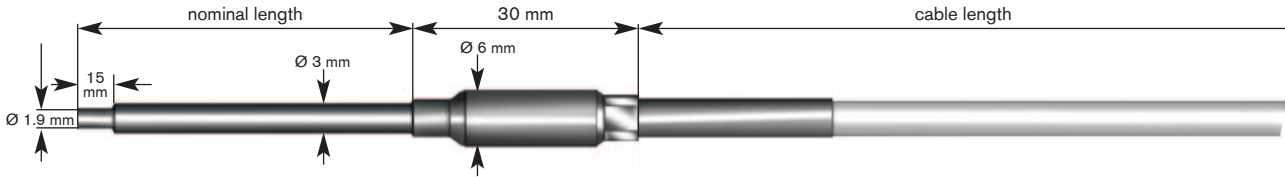
item no.	Ø min.t/c mm	Ø protecting tube mm	material	nominal length mm	cable	cable length mm	connection ends
T207-058-948	0,50	1,50	2.4816	138	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	250	miniature thermoplug
T207-058-946	1,50	3,00	2.4816	150	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	250	miniature thermoplug
T207-055-402	1,50	3,00	2.4816	150	2 x 0,22 mm <sup>2</sup> FEP/C/FEP	3000	miniature thermoplug

# TEMPERATURE MEASUREMENT

small measuring tip Ø guarantees quick response times!

## IN AIR AND GASES

airflow resistance thermometer



■ For temperature measurement, for example at engine test benches. Especially appropriate to collect the temperature of the airflow, for example in the turbocharger. The small diameter of the measuring tip guarantees a quick response time. The screening of the cable offers at the same time mechanical protection as well as protection against electromagnetic interference. Usually fixing can be done by clamping screw connections.

### RTD:

- 1 x PT100
- 2 x PT100

### Limiting deviation:

- class A     -30°C/+300°C     -100°C/+450°C
- class B     -50°C/+500°C     -196°C/+600°C

### Connection types of inner wire:

- 2-wire circuit
- 3-wire circuit
- 4-wire circuit

Nominal length: \_\_\_\_\_ mm

### Type:

- with kink protection
- without kink protection



class AA on request!

### Connection cable:

- RTD cable (FEP / FEP)
- other connection cables (see page 40)

### Connection cable length:

- 0,50 m
- 1,00 m
- 1,50 m
- 2,00 m
- 3,00 m
- 5,00 m
- 10,0 m
- other length \_\_\_\_\_ m

### Connection ends:

- bare ends
- endsleeves
- cable lugs M4
- tinned
- other cable ends \_\_\_\_\_
- with batch certificate and identification

### CONFIGURATION EXAMPLE

item no.	RTD	connection type	Ø min.t/c mm	Ø protecting mm	nominal length mm	cable	cable length mm	connection ends
T870-058-439	1 x PT100	3-wire circuit	1,9 x 15	3	70	FEP/FEP	1000	bare ends

### general information

With a 2-wire circuit only one class accuracy class B accuracy can be confirmed.

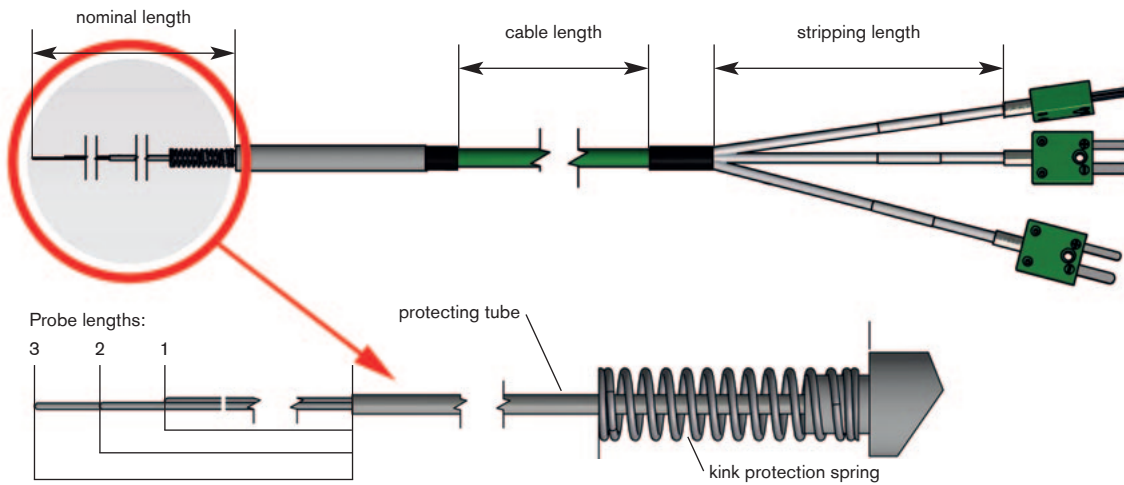
material 1.4541: +800°C

Please note that the temperature stability of the sensor is determined by the weakest parameters.

# TEMPERATURE MEASUREMENT

## IN AIR AND GASES

### multiple step thermocouple



■ This multiple step thermocouple is especially appropriate for a temperature collection in the particle filter and catalytic converter. Due to the stepwise arrangement of the thermocouples, the temperature can be measured at different points.

#### Thermocouple:

- 1 x type J
- 1 x type K
- 2 x type J } from Ø 1,5 mm
- 2 x type K }
- other thermocouples \_\_\_\_\_

#### Sheath material:

- 1.4541 (+800°C)
- 2.4816 (+1100°C)
- other sheath materials \_\_\_\_\_
- material of protecting tube \_\_\_\_\_

#### Connection ends:

- miniature thermoplug  miniature socket
- standard plug  standard socket
- free ends \_\_\_\_\_ mm
- other connection ends \_\_\_\_\_

#### Sheath-Ø:

- 0,5 mm

#### Protecting tube-Ø:

- 1,5 mm

#### Type of measuring tip:

- class 1, form A, insulated measuring tip
- class 1, form B, welded measuring tip

#### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

#### Nominal length: \_\_\_\_\_ mm

- with batch certificate and identification
- Dakks calibration on request
- accessories (fix): \_\_\_\_\_

#### Probe length: 1 \_\_\_\_\_ mm

2 \_\_\_\_\_ mm

3 \_\_\_\_\_ mm

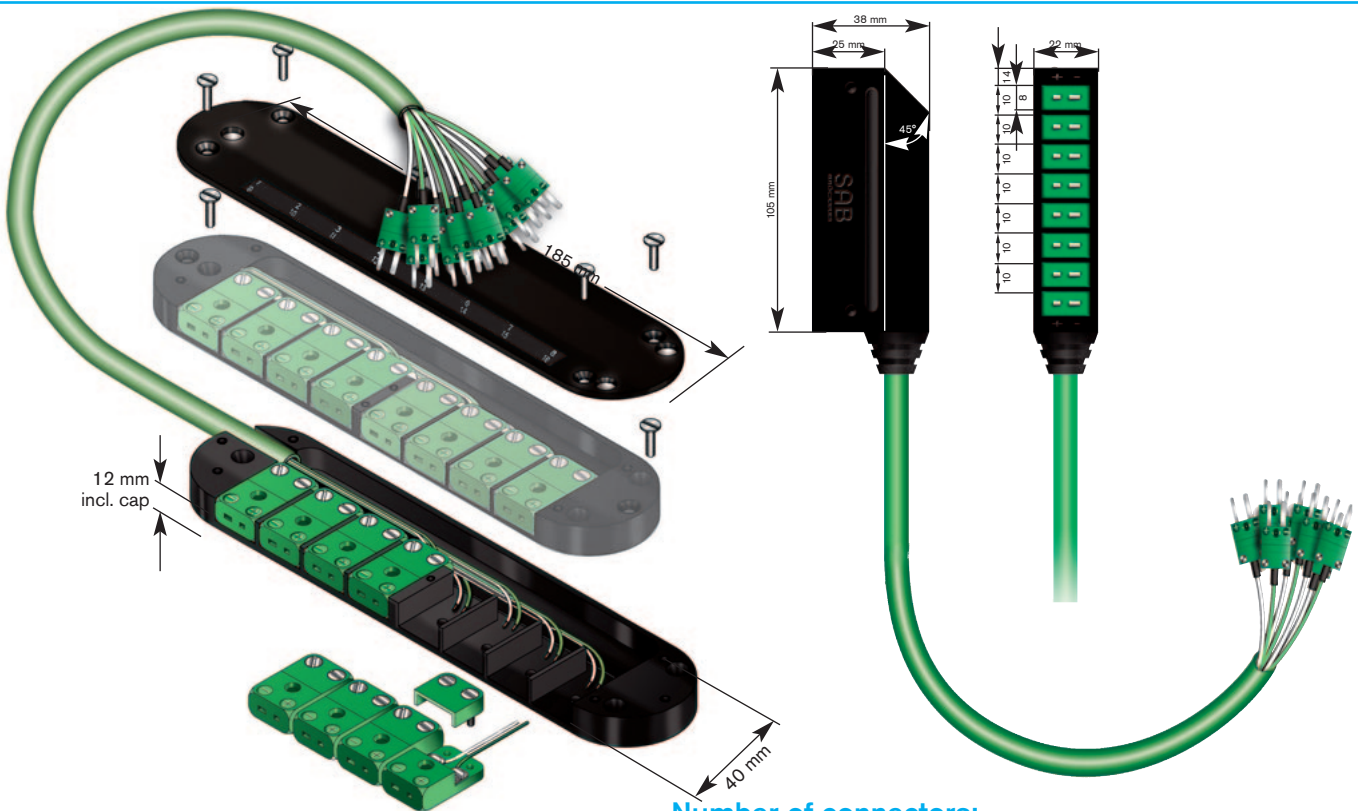
#### CONFIGURATION EXAMPLES

item no.	type	Ø min.t/c mm	Ø protecting tube mm	EL 1 mm	EL 2 mm	EL 3 mm	cable	cable length mm	stripping length mm	connection ends
T499-058-977	K	0,5	1,5	130	167	204	3 x 2 x 0,22 mm <sup>2</sup> FEP/C/FEP	600	85	miniature thermoplug
T499-058-979	K	0,5	1,5	130	186	242	3 x 2 x 0,22 mm <sup>2</sup> FEP/C/FEP	600	85	miniature thermoplug

# ACCESSORIES

## CONNECTORS

8-plug and 16-plug connectors in plastic / aluminium



■ This item is used, for example in automobile industry in test vehicles. Thermocouples can be easily connected. In case of failure, the faulty element can be exchanged without much effort. Test engines require temperature measurements at the most different points, e.g. in oilpans, cooling tubes and combustion gases, etc. Cables coming from the different measuring points can be plugged into the connector conveniently. Advantage: reduced wiring effort. On request we are able to provide the company logo as well as individual fixing bores.

The plastic connector offers also recessed grips for easy handling. Due to the plastic housing damages in the passenger area are avoided. The small and space saving construction form offers an advantage compared with aluminium connectors.

### Number of connectors:

- 8 miniature sockets
- 16 miniature sockets

### Connection cable:

- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / C / FEP)
- Thermocouple extension cable  
2 x 0,22 mm<sup>2</sup> (FEP / FEP)
- other connection cables (see page 39)

### Connection cable length:

- 0,50 m     1,00 m
- 1,50 m     2,00 m
- 3,00 m     5,00 m
- 10,0 m     other length \_\_\_\_\_ m

### Connection ends:

- miniature thermoplug     miniature socket
- standard plug     standard socket
- free ends \_\_\_\_\_ mm
- other connection ends

### Type:

- 8-plug, plastic
- 8-plug, aluminium     16-plug, aluminium

### CONFIGURATION EXAMPLES

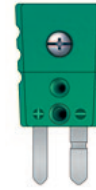
tem no.	material	channels	cable	cable length mm	stripping length mm	connection ends
T065-052-975	plastic	8	8 x 2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	100	miniature thermoplug
T065-053-717	plastic	8	8 x 2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	100	bare ends
T065-058-810	aluminium	8	8 x 2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	250	miniature thermoplug
T065-038-531	aluminium	16	16 x 2 x 0,22 mm <sup>2</sup> FEP/C/FEP	1000	300	miniature thermoplug

# ACCESSORIES

## thermo plug

standard thermo plug up to max. 200°C	
item no.	min.t/c type
T021-007-056	J (Fe-CuNi)
T021-007-057	K (NiCr-Ni)

HT thermo plug up to max. 350°C	
item no.	min.t/c type
T021-007-064	J (Fe-CuNi)
T021-007-065	K (NiCr-Ni)



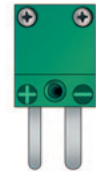
standard thermo socket up to max. 200°C	
item no.	min.t/c type
T021-007-104	J (Fe-CuNi)
T021-000-679	K (NiCr-Ni)

HT thermo socket up to max. 350°C	
item no.	min.t/c type
T021-007-111	J (Fe-CuNi)
T021-007-112	K (NiCr-Ni)



miniature thermo plug up to max. 200°C	
item no.	min.t/c type
T021-007-071	J (Fe-CuNi)
T021-007-072	K (NiCr-Ni)

HT miniature thermo plug up to ax. 350°C	
item no.	min.t/c type
T021-044-383	K (NiCr-Ni)



miniature thermo socket up to max. 200°C	
item no.	min.t/c type
T021-007-118	J (Fe-CuNi)
T021-007-119	K (NiCr-Ni)

miniature thermo socket up to max. 350°C	
item no.	min.t/c type
T021-044-382	K (NiCr-Ni)



## cable fixing for:

standard and high temperature plug	
item no.	
T021-007-035	

miniature plug	
item no.	
T021-007-041	



locking plate	
item no.	
T021-029-182	



special steel cable tie	
item no.	length
T020-058-936	150 mm
T020-058-937	200 mm

Spare pads 100 pcs	
item no.	material
T095-044-258	glass cloth tape
T095-056-403	PI foil



# ACCESSORIES

clamp screw connection made of stainless steel with clamping cone PTFE

MTE ø mm	thread	width across flat	item no.	clamping cone in exchange item no.
1,0	M 6 x 1	10	T025-050-911	T025-050-912
1,5	M 6 x 1	10	T025-041-015	T025-050-913
1,5	M 8 x 1	10	T025-044-648	T025-048-577
1,5	M 8 x 1,25	10	T025-041-016	T025-041-402
2,0	M 8 x 1	10	T025-046-947	on request
3,0	M 8 x 1	10	T025-044-649	T025-048-578
3,0	M 8 x 1,25	10	T025-041-017	T025-041-403

pressure resistance for clamp screw connection  
with clamping cone PTFE: up to approx. 10 bar at room temperature  
max. application up to +200°C



clamp screw connection made of stainless steel with clamping cone stainless steel

MTE ø mm	thread	width across flat	item no.	clamping cone in exchange item no.
1,0	M 6 x 1	10	T025-048-328	T025-048-329
1,0	M 8 x 1	10	T025-046-946	T025-048-329
1,5	M 6 x 1	10	T025-041-404	T025-050-914
1,5	M 8 x 1	10	T025-044-647	T025-049-313
1,5	M 8 x 1,25	10	T025-041-019	T025-049-313
2,0	M 8 x 1	10	T025-046-945	T025-048-323
2,0	M 12 x 1,5	17	T025-048-324	T025-048-325
2,0	M 14 x 1,5	17	T025-048-326	T025-048-327
3,0	M 8 x 1	10	T025-044-646	T025-049-150
3,0	M 8 x 1,25	10	T025-041-018	T025-049-150

Pressure resistance for clamp screw connection  
with clamping cone stainless steel:  
up to approx. 200 bar at room temperature  
max. application up to +600°C


















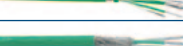
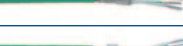








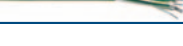


Also  
inch threads  
available.

Other dimension are possible on request!  
Each clamp screw connection includes a clamping cone in delivery.



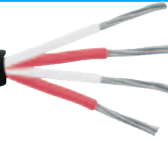
# COMPENSATING AND EXTENSION CABLES

SAB item no.	picture	type	dimension	insulation	sheath	temperature range - +	note	outer-Ø mm	thermoelectric voltage
<b>fibre-glass insulated and special steel armoured cables</b>									
0472-9040		K	2 x 0,22 mm <sup>2</sup>	GL	GL	-40°C +400°C	special steel armoured	3,9	DIN IEC 584 class 1
<b>fiber-glass insulated cable</b>									
0489-0182		J	2 x 0,20 mm	GL	GL	-40°C +250°C	PU-laquer impregnated	1,3	DIN IEC 584 class 1
0489-9002		K	2 x 0,20 mm	GL	GL	-25°C +200°C	PU-laquer impregnated, cable oval	1,3	DIN IEC 584 class 1
0489-9013		K	2 x 0,20 mm	GL	GL	-40°C +400°C	silicone impregnated	1,3	DIN IEC 584 class 1
0490-9016		K	2 x 0,50 mm	GL	GL	-40°C +400°C	PU-laquer impregnated, cable oval	2,0	DIN IEC 584 class 1
<b>polyimide insulated cables</b>									
0433-9138		K	2 x 0,20 mm	PI	PI	-40°C +250°C	one conductor wrapped, both conductors wrapped together, cable oval	0,7	DIN IEC 584 class 1
0433-9262		N	2 x 0,20 mm	PI	PI	-40°C +250°C	one conductor wrapped, both conductors wrapped together, cable oval	0,8	DIN IEC 584 class 1
<b>polyimide / PFA insulated cables</b>									
0433-9196		K	2 x 0,20 mm	PI	PFA	-40°C +250°C	one conductor wrapped, both conductors wrapped together, PFA sheath, cable oval	1,0	DIN IEC 584 class 1
<b>PFA / PFA insulated cables</b>									
0433-9007		J	2 x 0,22 mm <sup>2</sup>	PFA	PFA	-25°C +250°C		2,8	DIN IEC 584 class 1
0433-9086		K	2 x 0,22 mm <sup>2</sup>	PFA	PFA	-25°C +250°C		2,8	DIN IEC 584 class 1
0435-9143		K	2 x 0,22 mm <sup>2</sup>	PFA	PFA	-50°C +250°C	tinned copper braided cable	2,9	DIN IEC 584 class 1
<b>PFA / GL insulated cables</b>									
0473-9009		K	2 x 0,22 mm <sup>2</sup>	PFA	PFA	-40°C +285°C	silicone impregnated	3,2	DIN IEC 584 class 1
<b>FEP / FEP insulated cables</b>									
0433-9223		K	2 x 0,22 mm <sup>2</sup>	FEP	FEP	-40°C +180°C		2,5	DIN IEC 584 class 1
0435-9037		K	2 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	tinned copper braided cable	2,7	DIN IEC 584 class 1
0433-9261		K	2 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	black	2,5	DIN IEC 584 class 1
0433-9157		K	2 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	cable oval	2,5	DIN IEC 584 class 1
0435-9115		N	2 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	tinned copper braided cable	2,6	DIN IEC 584 class 1
<b>multi channel FEP / FEP insulated cables</b>									
0435-9135		K	16 x 2 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	tinned copper braided cable	8,3	DIN IEC 584 class 1
0435-9024		K	4 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	tinned copper braided cable	3,7	DIN IEC 584 class 1
0433-9211		K	4 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	special steel screened cable	4,4	DIN IEC 584 class 1
0435-9149		K	4 x 2 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	tinned copper braided cable	5,5	DIN IEC 584 class 1
0435-9129		K	8 x 2 x 0,22 mm <sup>2</sup>	FEP	FEP	-25°C +180°C	tinned copper braided cable	6,9	DIN IEC 584 class 1
<b>FEP / Besilen® insulated cables</b>									
0433-9033		K	2 x 0,22 mm <sup>2</sup>	FEP	Besilen®	0°C +150°C		3,7	DIN IEC 584 class 1
0433-9193		K	2 x 0,22 mm <sup>2</sup>	FEP	Besilen®	-25°C +180°C	FEP / Besilen® insulated, round	3,8	DIN IEC 584 class 1
<b>Besilen® insulated cables</b>									
0426-1995		K	2 x 0,22 mm <sup>2</sup>	Besilen®	Besilen®	0°C +150°C		3,9	DIN IEC 584 class 1
0426-9059		K	2 x 0,22 mm <sup>2</sup>	Besilen®	Besilen®	-25°C +180°C	thickened cable	4,8	DIN IEC 584 class 1
<b>multi channel Besilen® insulated cables</b>									
0430-9037		J	8 x 2 x 0,22 mm <sup>2</sup>	Besilen®	Besilen®	-25°C +180°C	tinned copper braided cable	13,7	DIN IEC 584 class 1
0426-9061		K	16 x 0,22 mm <sup>2</sup>	Besilen®	Besilen®	-25°C +180°C		8,2	DIN IEC 584 class 1

## RTD SENSOR CABLE

connection cables for RTD

CKSKES · D-VIERSEN · RTD sensor cable 180 TW 4x26/7 AWG 3820-0043



Marking for RTD sensor cable 180 TW 3820-0043:

SAB BRÖCKSKES · D-VIERSEN · RTD sensor cable 180 TW 4x26/7 AWG 3820-0043

### Technical data:

<b>Peak operating voltage:</b>	48 V		
<b>Testing voltage:</b>	core/core	600 V	
	core/screen	600 V	
<b>Min. bending radius</b>			
<i>fixed laying:</i>	5 x d		
<i>flexible application:</i>	10 x d		
<b>Temperature range</b>	<b>180 flex</b>		
	<b>180 C flex</b>		
	<b>180 highflex</b>	<b>180 TW</b>	<b>250 TW</b>
	<b>180 C highflex</b>	<b>180 C TW</b>	<b>250 C TW</b>
<i>fixed laying:</i>	-40/+180 °C	-90/+180 °C	-90/+250 °C
<i>flexible application:</i>	-25/+180 °C	-55/+180 °C	-55/+250 °C
<b>Absence of harmful substances:</b>	acc. to RoHS directive of the European Union		

### Outstanding features:



- high temperature resistant
- small diameter

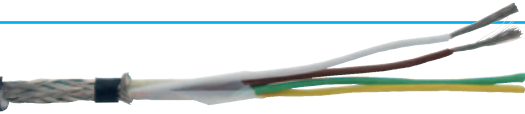
type item no.	no. of cores x cross section	conductor	insulation	colour code	screen	sheath material	sheath colour	outer-ø approx. mm	copper figure kg/km	cable weight ≈ kg/km
<b>RTD sensor cable 180 TW</b>										
38200023	2 x 26/7 AWG	tinned copper	FEP	● ○		FEP		1,9	2,8	6,1
38200033	3 x 26/7 AWG	tinned copper	FEP	● ● ○		FEP		2,0	4,2	8,0
38200043	4 x 26/7 AWG	tinned copper	FEP	● ● ● ○		FEP		2,2	5,6	10,1
<b>RTD sensor cable 180 C TW</b>										
38201023	2 x 26/7 AWG	tinned copper	FEP	● ○	tinned copper	FEP		2,5	9,8	12,7
38201033	3 x 26/7 AWG	tinned copper	FEP	● ● ○	tinned copper	FEP		2,6	11,3	14,7
38201043	4 x 26/7 AWG	tinned copper	FEP	● ● ● ○	tinned copper	FEP		2,8	15,9	19,0
<b>RTD sensor cable 180 flex</b>										
38202023	2 x 26/7 AWG	tinned copper	FEP	● ○		Besilen®		2,5	2,8	8,7
38202033	3 x 26/7 AWG	tinned copper	FEP	● ● ○		Besilen®		2,6	4,2	10,5
38202043	4 x 26/7 AWG	tinned copper	FEP	● ● ● ○		Besilen®		2,8	5,6	12,7
<b>RTD sensor cable 180 C flex</b>										
38203023	2 x 26/7 AWG	tinned copper	FEP	● ○	tinned copper	Besilen®		3,0	9,8	14,1
38203033	3 x 26/7 AWG	tinned copper	FEP	● ● ○	tinned copper	Besilen®		3,1	11,3	16,1
38203043	4 x 26/7 AWG	tinned copper	FEP	● ● ● ○	tinned copper	Besilen®		3,3	15,9	20,4
<b>RTD sensor cable 250 TW</b>										
38204023	2 x 26/7 AWG	nickel-plated copper	PFA	● ○		PFA		1,9	2,8	6,1
38204033	3 x 26/7 AWG	nickel-plated copper	PFA	● ● ○		PFA		2,0	4,2	8,0
38204043	4 x 26/7 AWG	nickel-plated copper	PFA	● ● ● ○		PFA		2,2	5,6	10,1
<b>RTD sensor cable 250 C TW</b>										
38205023	2 x 26/7 AWG	nickel-plated copper	PFA	● ○	tinned copper	PFA		2,5	9,8	12,9
38205033	3 x 26/7 AWG	nickel-plated copper	PFA	● ● ○	tinned copper	PFA		2,6	11,3	14,9
38205043	4 x 26/7 AWG	nickel-plated copper	PFA	● ● ● ○	tinned copper	PFA		2,8	15,9	19,3
<b>RTD sensor cable 180 highflex</b>										
38206023	2 x 26/7 AWG	tinned copper	Besilen®	● ○		Besilen®		3,2	2,8	12,1
38206033	3 x 26/7 AWG	tinned copper	Besilen®	● ● ○		Besilen®		3,3	4,2	14,0
38206043	4 x 26/7 AWG	tinned copper	Besilen®	● ● ● ○		Besilen®		3,6	5,6	16,8
<b>RTD sensor cable 180 C highflex</b>										
38207023	2 x 26/7 AWG	tinned copper	Besilen®	● ○	tinned copper	Besilen®		3,6	13,1	19,2
38207033	3 x 26/7 AWG	tinned copper	Besilen®	● ● ○	tinned copper	Besilen®		3,8	14,6	21,4
38207043	4 x 26/7 AWG	tinned copper	Besilen®	● ● ● ○	tinned copper	Besilen®		4,1	19,4	27,0

Other dimensions and colours are possible on request.

## SENSOR minus 50

low temperature resistant FEP insulated sensor cable down to -50°C

Sensor minus 50 4 x AWG 24/7



Marking for Sensor minus 50 38360424:

SAB BRÖCKSKES · D-VIERSEN · Sensor minus 50 4 x AWG 24/7 3836-0424

**Application:** Low temperature resistant sensor cable down to -50°C for measuring and testing technology. Supply cable for miniature sensors. Strain gauge supply cable with smallest bending radii. For indoor and outdoor use.

### Construction:

<b>Conductor:</b>	tinned copper strands, silver-plated from AWG 32
<b>Insulation:</b>	FEP
<b>Colour code:</b>	with reference to DIN 47100
<b>Wrapping:</b>	foil
<b>Screen:</b>	tinned copper braiding, optical coverage ≥ 85%
<b>Sheath material:</b>	PUR 420 with mat surface
<b>Sheath colour:</b>	black (RAL 9005)

### Technical Data:

<b>Peak operating voltage:</b>	max. 48 V
<b>Testing voltage:</b>	core/core 600 V core/screen 600 V
<b>Min. bending radius</b>	
fixed laying:	2 x d (one single bend)
flexible application:	10 x d
<b>Temperature range cable</b>	
fixed laying*:	-50/+125 °C
flexible application*:	-45/+125 °C
<b>Temperature range conductor:</b>	up to +180 °C (short time use up to +205 °C)
<b>Low temperature resistance:</b>	-50°C acc. to DIN EN 60811-506
<b>Oil resistance:</b>	very good - TMPU acc. to EN 50363-10-2
<b>Fuel resistance:</b>	good
<b>Battery acid resistance:</b>	good
<b>UV resistance:</b>	acc. to HD 605 S1
<b>Ozone resistance:</b>	acc. to EN 50396
<b>Saltwater resistance:</b>	acc. to UL 1309
<b>Absence of harmful substances:</b>	acc. to RoHS directive of the European Union
	*+125 °C – up to 2500 hours

### Outstanding features:



- highest flexibility even with low temperatures down to -45 °C
- absolutely weather resistant
- very easy installation due to anti-adhesive outer jacket - avoidance of stick-slip effect
- low capacity
- smallest bending radii
- easy harnessing
- small outer diameter

item no.	dimension	outer-ø ± 5% mm	copper figure kg/km	cable weight ≈ kg/km
38360234	2 x AWG 34/7	2,2	5,7	8
38360334	3 x AWG 34/7	2,3	6,0	8
38360434	4 x AWG 34/7	2,4	6,0	9
38360634	6 x AWG 34/7	2,6	8,1	11
38360834	8 x AWG 34/7	2,8	10,2	14
38360232	2 x AWG 32/7	2,3	6,0	8
38360332	3 x AWG 32/7	2,3	6,3	9
38360432	4 x AWG 32/7	2,5	6,5	10
38360632	6 x AWG 32/7	2,8	9,0	13
38360832	8 x AWG 32/7	3,1	11,0	16
38360230	2 x AWG 30/7	2,4	6,4	9
38360330	3 x AWG 30/7	2,5	7,4	10
38360430	4 x AWG 30/7	2,6	9,1	12
38360630	6 x AWG 30/7	3,0	11,0	16
38360830	8 x AWG 30/7	3,2	12,9	19

item no.	dimension	outer-ø ± 5% mm	copper figure kg/km	cable weight ≈ kg/km
38360228	2 x AWG 28/7	2,6	8,6	11
38360328	3 x AWG 28/7	2,7	9,8	13
38360428	4 x AWG 28/7	2,8	10,8	14
38360628	6 x AWG 28/7	3,1	14,3	18
38360828	8 x AWG 28/7	3,8	18,1	25
38360226	2 x AWG 26/7	3,0	11,5	15
38360326	3 x AWG 26/7	3,1	12,7	17
38360426	4 x AWG 26/7	3,8	14,6	22
38360626	6 x AWG 26/7	3,9	19,1	28
38360826	8 x AWG 26/7	4,4	25,9	36
38360224	2 x AWG 24/7	3,2	12,8	17
38360324	3 x AWG 24/7	3,3	15,3	20
38360424	4 x AWG 24/7	3,8	18,7	26
38360624	6 x AWG 24/7	4,4	25,3	36
38360824	8 x AWG 24/7	5,0	32,0	46

Other dimensions and colours are possible on request.



### Possible on request:

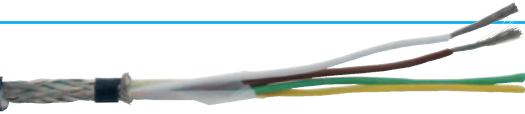
- random lengths or ready harnessed cable
- also available without copper braiding



## SENSOR plus 150

high temperature resistant FEP insulated sensor cable up to +150°C

Sensor plus 150 4 x AWG 24/7



Marking for Sensor plus 150 38370424:

SAB BRÖCKSKES · D-VIERSEN · Sensor plus 150 4 x AWG 24/7 3837-0424

**Application:** High temperature resistant sensor cable up to max. +150°C for measuring and testing technology. Supply cable for miniature sensors. Strain gauge supply cable for smallest bending radii. Connecting cable for modular technology.

### Construction:

<b>Conductor:</b>	tinned copper strands, silver-plated from AWG 32
<b>Insulation:</b>	FEP
<b>Colour code:</b>	with reference to DIN 47100
<b>Wrapping:</b>	foil
<b>Screen:</b>	tinned copper braiding, optical coverage ≥ 85%
<b>Sheath material:</b>	PUR 490 with smooth surface
<b>Sheath colour:</b>	black (RAL 9005)

### Technical Data:

<b>Peak operating voltage:</b>	max. 48 V
<b>Testing voltage:</b>	core/core 600 V core/screen 600 V
<b>Min. bending radius</b>	
fixed laying:	2 x d (one single bend)
flexible application:	10 x d
<b>Temperature range cable</b>	
fixed laying*:	-50/+150 °C
flexible application*:	-40/+150 °C
<b>Temperature range conductor:</b>	up to +180 °C (short time use up to +205 °C)
<b>Oil resistance:</b>	very good - TMPU acc. to EN 50363-10-2
<b>Fuel resistance:</b>	good
<b>Absence of harmful substances:</b>	acc. to RoHS directive of the European Union
	*+150 °C – up to 3000 hours

### Outstanding features:



- Temperature resistance up to +150 °C (up to 3000 hours)
- high flexibility and high abrasion resistance
- high robustness
- low capacity
- smallest bending radii
- easy harnessing
- small outer diameter

item no.	dimension	outer-ø ± 5% mm	copper figure kg/km	cable weight ≈ kg/km
38370234	2 x AWG 34/7	2,2	5,7	8
38370334	3 x AWG 34/7	2,3	6,0	8
38370434	4 x AWG 34/7	2,4	6,0	9
38370634	6 x AWG 34/7	2,6	8,1	11
38370834	8 x AWG 34/7	2,9	10,2	14
38370232	2 x AWG 32/7	2,3	6,0	8
38370332	3 x AWG 32/7	2,3	6,3	9
38370432	4 x AWG 32/7	2,5	6,5	10
38370632	6 x AWG 32/7	2,8	9,0	13
38370832	8 x AWG 32/7	3,1	11,0	16
38370230	2 x AWG 30/7	2,4	6,4	9
38370330	3 x AWG 30/7	2,5	7,4	10
38370430	4 x AWG 30/7	2,6	9,1	12
38370630	6 x AWG 30/7	2,9	10,9	15
38370830	8 x AWG 30/7	3,2	12,9	18

item no.	dimension	outer-ø ± 5% mm	copper figure kg/km	cable weight ≈ kg/km
38370228	2 x AWG 28/7	2,6	8,6	11
38370328	3 x AWG 28/7	2,7	9,8	13
38370428	4 x AWG 28/7	2,8	10,8	14
38370628	6 x AWG 28/7	3,1	14,3	19
38370828	8 x AWG 28/7	3,8	18,1	25
38370226	2 x AWG 26/7	3,0	11,5	15
38370326	3 x AWG 26/7	3,1	12,7	17
38370426	4 x AWG 26/7	3,3	14,6	20
38370626	6 x AWG 26/7	3,9	19,1	28
38370826	8 x AWG 26/7	4,4	25,1	35
38370224	2 x AWG 24/7	3,2	12,8	17
38370324	3 x AWG 24/7	3,3	15,3	20
38370424	4 x AWG 24/7	3,8	18,7	26
38370624	6 x AWG 24/7	4,4	25,3	36
38370824	8 x AWG 24/7	4,8	31,8	45

Other dimensions and colours are possible on request.



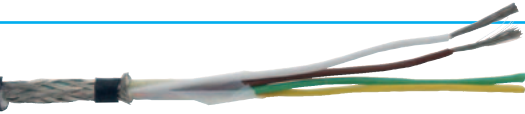
### Possible on request:

- random lengths or ready harnessed cable
- also available as HV thermo cable type K (1-channel and 4-channel)
- also available without copper braiding

## SENSOR plus 250

high temperature resistant PFA insulated sensor cable up to +250°C

Sensor plus 250 4 x AWG 32/7



Marking for Sensor plus 250 38390432:

SAB BRÖCKSKES · D-VIERSEN · Sensor plus 250 4 x AWG 32/7 3839-0432

**Application:** High temperature resistant sensor cable up to max. +250°C for measuring and testing technology. Supply cable for miniature sensors. Strain gauge supply cable for smallest bending radii. Connecting cable for modular technology.

### Construction:

<b>Conductor:</b>	silver-plated copper strands
<b>Insulation:</b>	PFA
<b>Colour code:</b>	with reference to DIN 47100
<b>Wrapping:</b>	foil
<b>Screen:</b>	tinned copper braiding, optical coverage ≥ 85%
<b>Sheath material:</b>	PFA
<b>Sheath colour:</b>	black (RAL 9005)

### Technical Data:

<b>Peak operating voltage:</b>	max. 48 V
<b>Testing voltage:</b>	core/core 600 V core/screen 600 V
<b>Min. bending radius</b>	
<i>fixed laying:</i>	2 x d (one single bend)
<i>flexible application:</i>	10 x d
<b>Temperature range cable</b>	
<i>fixed laying:</i>	-90/+250 °C
<i>flexible application:</i>	-55/+250 °C
<b>Dielectric constant:</b>	approx. 2,1
<b>Fire performance:</b>	flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2
<b>Oil resistance:</b>	very good
<b>Hydraulic oil resistance:</b>	very good
<b>Fuel resistance:</b>	very good
<b>Battery acid resistance:</b>	very good
<b>UV resistance:</b>	very good
<b>Ozone resistance:</b>	very good
<b>Saltwater resistance:</b>	very good
<b>Absence of harmful substances:</b>	acc. to RoHS directive of the European Union

### Outstanding features:



- Temperature resistance up to +250 °C
- absolutely weather resistant
- high abrasion resistance
- very good chemical resistance
- small outer diameter

item no.	dimension	outer-ø ± 5% mm	copper figure kg/km	cable weight ≈ kg/km
38390234	2 x AWG 34/7	1,8	5,7	8
38390330	3 x AWG 30/7	2,1	8,7	11
38390432	4 x AWG 32/7	2,1	8,1	11
38390628	6 x AWG 28/7	2,7	16,0	20

Other dimensions and colours are possible on request.



### Possible on request:

- random lengths  
or ready harnessed cable
- also available without copper braiding

# COMPARISON THERMOCOUPLES / RESISTANCE THERMOMETERS

## resistance thermometers

- ▶ Platinum resistance thermometers are the most accurate sensors and have the best long-time stability.
- due to the chemical resistance of Platinum, the risk of impurity by oxidation and other chemical influences is reduced.
- ▶ high consistency.

## thermocouples

- ▶ larger temperature range than resistance thermometers.
- ▶ small hot junction enables short response time.
- ▶ more robust and resistant against mechanical stress.
- ▶ cheaper.

### ▶ General

A reliable temperature measurement requires a most exact adaptation to the corresponding process. This statement is valid for thermocouples as well as for resistance thermometers.

characteristics	resistance thermometer	thermocouples
▶ dimensions	comparatively large sensor surface	small sensor surface possible
▶ response time	relatively long	short
▶ connection cables	copper cables	thermo compensating cable
▶ accuracy	very good	good
▶ consistency	very good	satisfactory
▶ surface temperature measurement	not possible	possible
▶ hot junction	over the whole length of the RTD	punctual
▶ robustness	good	very good
▶ spontaneous heating	has to be considered	does not occur
▶ temperature range	up to +600°C	higher temperature possible
▶ cold junction	not necessary	necessary
▶ circuit supply	yes	no
▶ vibration resistance	relatively sensitive	very rugged



# RESPONSE TIME MINERAL INSULATED THERMOCOUPLES / RESISTANCE THERMOMETERS

## mineral insulated thermocouples

insulated hot junction		response time in			
(form A) sheath-Ø (mm)	water with 0,2 m/s		air with 2,0 m/s		
	t 0,5 (s)	t 0,9 (s)	t 0,5 (s)	t 0,9 (s)	
0,5	0,06	0,13	1,80	5,50	
1,0	0,15	0,50	3,00	10,00	
1,5	0,21	0,60	8,00	25,00	
3,0	1,20	2,90	23,00	80,00	
4,5	2,50	5,90	37,00	120,00	
6,0	4,00	9,60	60,00	200,00	
8,0	7,00	17,00	100,00	360,00	

welded hot junction		response time in			
(form B) sheath-Ø (mm)	water with 0,2 m/s		air with 2,0 m/s		
	t 0,5 (s)	t 0,9 (s)	t 0,5 (s)	t 0,9 (s)	
0,5	0,03	0,10	1,80	6,00	
1,0	0,06	0,18	3,00	10,00	
1,5	0,13	0,40	8,00	25,00	
3,0	0,22	0,75	23,00	80,00	
4,5	0,45	1,60	33,00	110,00	
6,0	0,55	2,60	55,00	185,00	
8,0	0,75	4,60	97,00	310,00	

## mineral insulated resistance thermometer

sheath-Ø (mm)	response time in			
	water with 0,2 m/s		air with 2,0 m/s	
	t 0,5 (s)	t 0,9 (s)	t 0,5 (s)	t 0,9 (s)
1,6	3,6	5,5	10,8	26,3
3,0	5,2	9,8	20,0	51,0
6,0	10,4	23,2	46,8	121,0

These indications are only reference values as the response time depends on the applied RTD.

### ► General

Mineral insulated thermocouples and mineral insulated resistance thermometers can be bent with a radius of 5 x the outer diameter of the sheath material. Herewith it must be considered that any bending of the measuring tip over a length of 60 mm has to be avoided.

## TEST CERTIFICATES

We offer test reports or test certificates acc. to DIN EN 10204.

- |  |               |
|--|---------------|
| <b>1. Declaration of compliance with the order acc. to DIN EN 10204-2.1</b>                                  | <b>45,- €</b> |
| Manufacturer's declaration of compliance with the order without test results.                                |               |
| <b>2. Test report acc. to DIN EN 10204-2.2 (batch certificate)</b>   | <b>80,- €</b> |
| Manufacturer's declaration of compliance with the order, with test results based on non specific inspection. |               |
| <b>3. Inspection certificate acc. to DIN EN 10204-3.1</b>  | <b>80,- €</b> |
| Manufacturer's declaration of compliance with the order, with test results based on specific inspection.     |               |

The test unit and the execution of the test are determined in the product specification, in official or technical prescriptions and/ or order. The certificate is confirmed by a person independent of production and named by the manufacturer.

List of individual tests per measuring point	25,- €
<b>calibration in „Kryostat“ bath:</b> temperature range -50°C up to +50°C	
<b>calibration in oil bath:</b> temperature range +60°C up to +200°C	
<b>calibration in „Trockenblock-Kalibrator“:</b> temperature range -30°C up to +165°C, +100°C up to +1100°C	
<b>response time in water:</b> determination of 0,1-time, 0,5-time and 0,9-time	
<b>response time in air:</b> determination of 0,1-time, 0,5-time and 0,9-time	

# Ø-TOLERANCES MINERAL INSULATED THERMOCOUPLES

## tolerances of outer diameter

tolerance of outer diameter	
outer-Ø of thermocouples	nominal value +/- limit dimensions
0,5 mm	+/- 0,025 mm
1,0 mm	+/- 0,025 mm
1,5 mm	+/- 0,025 mm
2,0 mm	+/- 0,025 mm
3,0 mm	+/- 0,030 mm
4,5 mm	+/- 0,045 mm
6,0 mm	+/- 0,060 mm
8,0 mm	+/- 0,080 mm

## thermocouple types: form A / form B

Mineral insulated thermocouples listed in this catalogue are according to DIN EN 61515 with regard to shape, construction and geometrical dimensions or refer to it. Regarding the basic values and tolerances the standards DIN EN 60584-1 and DIN EN 60584-2 are valid.

We furnish mineral insulated thermocouples with insulated hot junction (form A) as standard version acc. to DIN EN 61515.

### Form A - ungrounded mineral insulated thermocouple

- ▶ The measuring tip isn't directly welded to the bottom. Mineral insulated thermocouples keep the given min. insulation resistance acc. to DIN EN 61515 of >1000 MΩ at room temperature.

### Form B - grounded mineral insulated thermocouple

- ▶ The measuring tip is electrically connected to the sheath.

## tolerances of length

tolerances of length		
cutting length (mm)	cutting length up to (mm)	tolerances in (mm)
0	300	+/- 2
300	1000	+/- 4
1000	∞	+/- 10



special tolerances  
acc. to agreement

## tolerances of thermocouples

type	standard	material	class 1		class 2		class 3	
			temperature range	(2) limit deviation	temperature range	(2) limit deviation	temperature range	(2) limit deviation
T	DIN EN 60584	Cu-CuNi	-40 up to +350°C	±0,5°C or 0,40%	-40 up to +350°C	±1,0°C or 0,75%	-200 up to +40°C	±1,0°C or 1,5%
(1) U	DIN 43710	Cu-CuNi	-	-	0 up to +600°C	±3,0°C or 0,75%	-	-
J	DIN EN 60584	Fe-CuNi	-40 up to +750°C	±1,5°C or 0,40%	-40 up to +750°C	±2,5°C or 0,75%	-	-
(1)L	DIN 43710	Fe-CuNi	-	-	0 up to +900°C	±3,0°C or 0,75%	-	-
K	DIN EN 60584	NiCr-Ni	-40 up to +1000°C	±1,5°C or 0,40%	-40 up to +1200°C	±2,5°C or 0,75%	-200 up to +40°C	±2,5°C or 1,5%
E	DIN EN 60584	NiCr-CuNi	-40 up to +800°C	±1,5°C or 0,40%	-40 up to +900°C	±2,5°C or 0,75%	-200 up to +40°C	±2,5°C or 1,5%
N	DIN EN 60584	NiCrSi-NiSi	-40 up to +1000°C	±1,5°C or 0,40%	-40 up to +1200°C	±2,5°C or 0,75%	-200 up to +40°C	±2,5°C or 1,5%
S	DIN EN 60584	PtRh 10-Pt	0 up to +1600°C	±1,0°C or <sup>(3)</sup>	0 up to +1600°C	±1,5°C or 0,25%	-	-
R	DIN EN 60584	PtRh13-Pt	0 up to +1600°C	±1,0°C or <sup>(3)</sup>	0 up to +1600°C	±1,5°C or 0,25%	-	-
B	DIN EN 60584	PtRh30-PtRh6	-	-	+600 up to +1700°C	±1,5°C or 0,25%	+600 up to +1700°C	±4,0°C or 0,5%

Classes 1, 2, and 3 are valid for thermocouples.

<sup>(1)</sup> Since April 1994 the standard DIN 43710 is no longer valid.

<sup>(2)</sup> For the limit deviation, the higher value is valid.

<sup>(3)</sup> 1°C or  $[1 + (t - 1100) \times 0,003]$  °C

# CHARACTERISTICS OF THERMOCOUPLES

characteristics thermocouples	general	composition	temperature range	suitable application	unsuitable application
<b>type E</b>	base metal thermocouple NiCr - CuNi (nickel-chrome/ copper-nickel) single wires made of non precious metals	<b>EP-leg:</b> 89-90% nickel, 9-9,5% chrome, 0,5% silicium and iron, balance: C, Mn, Nb, Co <b>EN-leg:</b> 55% copper, 45% nickel, approx. 0,1% cobalt, iron and manganese	-200°C/+700°C	<ul style="list-style-type: none"> <li>▶ in pure, oxidizing (air) or neutral atmosphere (inert gases)</li> <li>▶ high resistance against corrosion</li> <li>▶ small thermal conductivity</li> </ul>	<ul style="list-style-type: none"> <li>▶ do not apply in sulphuric, reducing or alternately oxidizing and reducing atmosphere</li> <li>▶ do not apply in vacuum for a long time</li> </ul>
<b>type J</b>	base metal thermocouple Fe - CuNi (iron/copper-nickel) single wires made of non precious metals	<b>JP-leg:</b> 99,5% iron, approx. 0,25% manganese, approx. 0,12% copper, balance: other impurities <b>JN-leg:</b> 55% copper, 45% nickel, approx. 0,1% cobalt, iron and manganese	-180°C/+700°C	<ul style="list-style-type: none"> <li>▶ from 0 - +760°C in vacuum, oxidizing (air), reducing or inert atmosphere (inert gases)</li> </ul>	<ul style="list-style-type: none"> <li>▶ temperatures below 0°C</li> <li>▶ sulphurous atmosphere above +500°C</li> <li>▶ above +760°C only with bigger wire diameters</li> </ul>
<b>type K</b>	base thermocouple NiCr - NiAl (nickel-chrome/ nickel-aluminium) single wires made of non precious metals	<b>KP-leg:</b> 89-90% nickel, 9-9,5% chrome, 0,5% silicium and iron, balance: C, Mn, Nb, Co <b>KN-leg:</b> 95-96% nickel, 1-1,5% silicium, 1-2,3% aluminium, 1-3,2% manganese, 0,5% cobalt, balance: Fe, Cu, Pb	-270°C/+1372°C	<ul style="list-style-type: none"> <li>▶ from +250°C - +1260°C in pure, oxidizing (air) and neutral atmosphere (inert gases)</li> <li>▶ for higher temperatures bigger wire diameters are recommended</li> </ul>	<ul style="list-style-type: none"> <li>▶ between +250°C up to +600°C not suitable for exact measurements with quick temperature changes</li> <li>▶ not appropriate for a longer time with high temperatures in vacuum</li> <li>▶ do not apply with high temperatures in sulphurous, reducing or alternately oxidizing and reducing atmosphere without protection</li> <li>▶ do not use in atmosphere favourizing „green mould“</li> </ul>
<b>type L</b>	base thermocouple Fe - CuNi (iron/copper-nickel) single wires made of non precious metals	<b>LP-leg:</b> 99,5% iron, approx. 0,25% manganese, approx. 0,12% copper, balance: other impurities <b>LN-leg:</b> 55% copper, 45% nickel, approx. 0,1% cobalt, iron and manganese	0°C/+900°C	<ul style="list-style-type: none"> <li>▶ from 0°C - +760°C in vacuum, oxidizing (air), reducing or inert atmosphere (inert gases)</li> <li>▶ above +500°C bigger wire diameters are recommended</li> </ul>	<ul style="list-style-type: none"> <li>▶ temperatures below 0°C</li> <li>▶ sulphurous atmosphere above +500°C</li> <li>▶ above +760°C only with bigger wire diameters</li> </ul>
<b>type N</b>	base thermocouple NiCrSi - NiSi (nickel-chrome-silicium/ nickel-silicium-magnesium) single wires made of non precious metals	<b>NP-leg:</b> 84% nickel, 14-14,4% chrome, 1,3-1,6% silicium, balance (not more than 0,1%): Mn, Fe, C, Co <b>NN-leg:</b> 95% nickel, 4,2-4,6% silicium, 0,5-1,5% magnesium, balance: Fe, Co, Mn, C, (altogether 0,1-0,3%)	-270°C/+1300°C	<ul style="list-style-type: none"> <li>▶ from +300°C - +1260°C in pure, oxidizing (air) and neutral atmosphere (inert gases)</li> </ul>	<ul style="list-style-type: none"> <li>▶ do not use with high temperatures in sulphurous, reducing or alternately oxidizing and reducing atmosphere without protection</li> <li>▶ do not use with high temperatures in vacuum</li> <li>▶ do not use in atmosphere favourizing „green mould“</li> <li>▶ reducing atmosphere</li> </ul>
<b>type R</b>	base thermocouple Pt13%Rh - Pt (platinum 13% rhodium/platinum) single wires made of platinum and platinum-rhodium alloy	<b>RP-leg:</b> platinum with 99,99% purity with a rhodium alloy (purity 99,98%) 13±0,05% rhodium portion <b>RN-leg:</b> platinum with 99,99% purity	-50°C/+1768,1°C (melting point) recommended: up to +1300°C	<ul style="list-style-type: none"> <li>▶ pure, oxidizing atmosphere (air), non aggressive (inert-) gases and short-term in vacuum</li> <li>▶ above +1200°C type B more appropriate</li> </ul>	<ul style="list-style-type: none"> <li>▶ reducing atmosphere</li> <li>▶ metal gases (for example plumb or zinc)</li> <li>▶ aggressive vapours containing arsenic, phosphor or sulphur</li> <li>▶ do never use metal protecting tubes with higher temperatures</li> <li>▶ sensitive against impurities of impure metals</li> </ul>
<b>type S</b>	base thermocouple Pt10%Rh - Pt (platinum 10% rhodium/platinum) single wires made of platinum and platinum-rhodium alloy	<b>SP-leg:</b> platinum with 99,99% purity with a rhodium alloy (purity 99,98%) 10±0,05% rhodium portion <b>SN-leg:</b> platinum with 99,99% purity	-50°C/+1768,1°C (melting point) recommended: up to +1300°C	<ul style="list-style-type: none"> <li>▶ pure, oxidizing atmospheres (air), non aggressive (inert-) gases and short-term in vacuum</li> <li>▶ above +1200°C type B more appropriate</li> </ul>	<ul style="list-style-type: none"> <li>▶ reducing atmosphere</li> <li>▶ metal gases (for example plumb or zinck)</li> <li>▶ aggressive vapours containing arsenic, phosphor or sulphur</li> <li>▶ do never use metal protecting tubes with higher temperatures</li> <li>▶ sensitive against impurities of impure metals</li> </ul>
<b>type B</b>	base thermocouple (Pt30%Rh - Pt6%Rh platinum - 0% rhodium/ platinum-6% rhodium) single wires made of platinum and platinum-rhodium alloy	<b>BP-leg:</b> platinum with 99,99% purity with a rhodium alloy (purity 99,98%) 29,60±0,2% rhodium portion <b>BN-leg:</b> platinum with 99,99% purity with a rhodium alloy (purity 99,98%) 6,12±0,02% rhodium portion	max. +1820°C (melting point) ordinary up to +1700°C	<ul style="list-style-type: none"> <li>▶ pure, oxidizing atmospheres</li> <li>▶ neutral atmospheres</li> <li>▶ vacuum</li> </ul>	<ul style="list-style-type: none"> <li>▶ reducing atmosphere or such with aggressive vapours or impurities which react with metals of the platinum group, if it isn't protected with a non metal protecting tube</li> </ul>
<b>type T</b>	base thermocouple Cu - CuNi (copper/copper-nickel) single wires made of non precious metals	<b>TP-leg:</b> 99,95% copper, 0,02-0,07% oxygen, 0,01% impurities <b>TN-leg:</b> 55% copper, 45% nickel, approx. 0,1% cobalt, iron and manganese	-270°C/+400°C	<ul style="list-style-type: none"> <li>▶ from -200°C - +370°C in vacuum, oxidizing (air), reducing or inert atmosphere (inert gases)</li> <li>▶ with higher temperatures bigger wire diameters are recommended</li> </ul>	<ul style="list-style-type: none"> <li>▶ above +370°C not appropriate in a hydrogen atmosphere</li> <li>▶ not appropriate in radioactive environment</li> </ul>
<b>type U</b>	base thermocouple Cu - CuNi (copper/copper-nickel) single wires made of non precious metals	<b>UP-leg:</b> 99,95% copper, 0,02-0,07% oxygen, 0,01% impurities <b>UN-leg:</b> 55% copper, 45% nickel, approx. 0,1% cobalt, iron and manganese	0°C/+600°C (+400°C)	<ul style="list-style-type: none"> <li>▶ from -200°C - +370°C in vacuum, oxidizing (air), reducing or inert atmosphere (inert gases)</li> <li>▶ with higher temperatures bigger wire diameters are recommended</li> </ul>	<ul style="list-style-type: none"> <li>▶ above +370°C not appropriate in a hydrogen atmosphere</li> <li>▶ not appropriate in radioactive environment</li> </ul>

Abbreviations: C= carbon, Mn= manganese, Nb=niobium, Co=cobalt, Fe= iron, Pb=plomb, Cu=copper

CuNi is also called Constantan®

# APPLICATION TEMPERATURE LIMITS AND APPLICATION ADVICE FOR MINERAL INSULATED MATERIALS

## Application temperature limits:

The different mineral insulated thermocouple types have generally a metal sheath made of special steel material no. 1.4541 or of Inconel material no. 2.4816.

Other sheath materials are available on request.

The max. application temperature of mineral insulated thermocouples in pure air without any further harmful gaseous components are as follows:

material no.	sheath material	max. application temperature
1.4541	special steel	800°C
2.4816	Alloy 600	1100°C

- An important quality characteristic of the sheath material is its resistance against corrosion
- With higher measuring temperatures especially with cyclic stress, the wall thickness is reduced by scaling
- Aggressive gaseous components can be harmful to the sheath material
- Bigger diameters increase the service life of mineral insulated thermocouples

*The above mentioned information do not claim to be complete.*

*Herewith, we would like to point out that the allowed application temperature and service life of mineral insulated thermocouples are influenced by lots of circumstances.*

## Mineral insulated material:

The following table shows in which fields mineral insulated materials have good oxidation and alternating temperature resistance.

The application temperature limits in different media are as follows.

measuring medium	application temperature	
	1.4541	2.4816
air	approx. 800°C	approx. 1100°C
carbon dioxide	approx. 650°C	approx. 500°C
benzene	approx. 100°C	not recommended
benzol	approx. 100°C	not recommended
boric acid	approx. 100°C	not recommended
butyl alcohol	approx. 100°C	not recommended
up to 50°G.L phosphoric acid	approx. 100°C	not recommended
nitric acid	approx. 100°C	not recommended
liquid sodium	not recommended	approx. 750°C
sulphurous air	not recommended	approx. 550°C
chlorine free water	not recommended	approx. 590°C

## sheath materials for mineral insulated thermocouples:

trade mark	mat. no.	material characteristics	application	availability
Inconell Alloy 600	2.4816	very good general resistance against corrosion as well as resistant against stress corrosion / excellent resistance against oxidation temperatures about approx. 1000°C	pressurised water reactor / nuclear power / industrial furnaces / steam boiler / turbines / exhaust gas measurement	type L (Ø 1,5/3/6) / type K (Ø 0,25/.../10) / type K double wall thickness (Ø 1,5/3) / type S (Ø 1,5/3/18) / type J (Ø 1, 5/6) / type N (Ø 1/1,5/3/6)

# BASIC VALUES OF RTDs

## accuracy classes acc. to DIN EN 60751:2009-5

class	validity range °C		limit deviation* °C
	leaded resistor	film resistor	
AA	-50 up to +250	0 up to +150	± (0,1 + 0,0017 [t])
A	-100 up to +450	-30 up to +300	± (0,15 + 0,002 [t])
B	-196 up to +600	-50 up to +500	± (0,3 + 0,005 [t])
C	-196 up to +600	-50 up to +600	± (0,6 + 0,01 [t])

<sup>a</sup> [t] = Value of temperature in °C without considering the sign

For resistance thermometers that belong to the above context, the temperature coefficient  $\alpha$  is defined as:

$$\alpha = \frac{R_{100} - R_0}{100 \times R_0} = \text{and has the numerical value } 0,003851/^{\circ}\text{C}$$

with:  $R_{100}$  is the resistance at 100°C and  $R_0$  is the resistance at 0°C.

## Limit deviations for PT100 thermometers

abbreviation of RTD PT100 DIN EN 60751					
RTD material platinum					
application range -200 up to + 850 °C (class B)					
ITS 90 resistance and permitted deviation					
measuring temperature °C	basic value Ω	allowed deviation			
		class A		class B	
	Ω	Ω	°C	Ω	°C
-200	18,52	±0,24	±0,55	±0,56	±1,30
-100	60,26	±0,14	±0,35	±0,32	±0,80
0	100,00	±0,06	±0,15	±0,12	±0,30
100	138,51	±0,13	±0,35	±0,30	±0,80
200	175,86	±0,20	±0,55	±0,48	±1,30
300	212,05	±0,27	±0,75	±0,64	±1,80
400	247,09	±0,33	±0,95	±0,79	±2,30
500	280,98	±0,38	±1,15	±0,93	±2,80
600	313,71	±0,43	±1,35	±1,06	±3,30
650	329,64	±0,46	±1,45	±1,13	±3,60
700	345,28	-	-	±1,17	±3,80
800	375,70	-	-	±1,28	±4,30
850	390,48	-	-	±1,34	±4,60





































for the term „basic values“ see DIN 16160 part 5

Resistance thermometers with different accuracy classes and validity ranges as for example acc. to DIN EN 60751:2009-5 (class AA) are available on request.



# COLOUR CODE AND TEMPERATURE RANGE

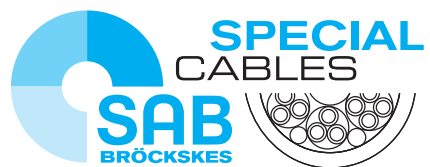
for compensating and extension cables

THERMOCOUPLE							
Code	Material ⊕ ⊖	Identification		Identification		Identification	
		THL	AGL	THL	AGL	THL	AGL
T	Cu - Cu Ni	 TX -25° to +100°C		 0° to +100°C	 0° to +100°C	 -25° to +200°C	
U	Cu - Cu Ni		 UX 0° to +200°C				
J	Fe - Cu Ni	 JX -25° to +200°C		 0° to +200°C	 0° to +200°C	 -25° to +200°C	
L	Fe - Cu Ni		 LX 0° to +200°C				
E	Ni Cr - Cu Ni	 EX -25° to +200°C		 0° to +200°C	 0° to +200°C	 -25° to +200°C	
K	Ni Cr - Ni	 KX -25° to +200°C		 0° to +200°C	 0° to +200°C	 -25° to +200°C	
K	Ni Cr - Ni	 KCA 0° to +150°C				 0° to +150°C	
K	Ni Cr - Ni	 KCB 0° to +100°C			 0° to +100°C	 0° to +100°C	
N	Ni Cr Si - Ni Si	 NX -25° to +200°C	 NC 0° to +150°C				
R S	Pt Rh 13 - Pt Pt Rh 10 - Pt	 RCB/ SCB 0° to +200°C		 0° to +200°C	 0° to +200°C	 0° to +200°C	
B	Pt Rh 30 - Pt Rh 6			 0° to +100°C		 0° to +100°C	

The application temperature range of the cable is limited by the highest application temperature of the insulating material or the application temperature range of the conductor material. In all cases the respective lower figure is valid. The compensating cable for the thermocouple type B can also be manufactured, deviating from the corresponding standards, for a temperature range from 0 to +200°C (SAB-Type BC-200). Variant colour codes can be manufactured for a minimum order quantity.

\* The standard 43710 was withdrawn in April 1994.  
Therefore, the element types "U" and "L" are not standardized anymore.

THL = extension cable · AGL = compensating cable



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