

# V-PAD tube skin thermocouple assembly Model TC59-V

WIKA data sheet TE 65.59



further approvals  
see page 7

## Applications

- Chemical industry
- Superheated steam applications
- Refineries
- Heating furnaces and high-performance boilers
- Heat exchangers

## Special features

- Application ranges from 0 ... 1,200 °C
- Flexible sheathed cable, mineral-insulated internal leads
- High mechanical strength, shock resistant



V-PAD tube skin thermocouple, model TC59-V

## Description

The patented WIKA V-PAD enables the surface temperature of a pipe within a combustion furnace to be measured accurately.

The name V-PAD is derived from the shape of the sensor. It is V-shaped and enables a welded connection to be made between the sensor and the pipe.

In the V-PAD, the flexible part of the sensor is a mineral-insulated cable (sheathed cable). It consists of a metal outer sheath, which contains the insulated internal leads, compressed within a high-density ceramic composition. The internal leads are made from thermo material. The material of the outer sheath can be selected to match the application.

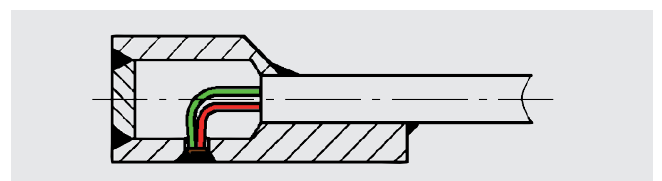
At one end of the sheathed cable, the internal leads are welded together. For the versions with a non-insulated (grounded) measuring point, the sheath is welded to the thermocouple. At the other end of the sheathed cable the ends of the leads are connected and the sheathed cable is hermetically sealed using a sealing compound.

The lead ends form the platform for the electrical connection. Cables, plug-in connectors or connector sockets can be connected to them.

### Sensor design

The tube skin thermocouple is supplied with a non-insulated measuring point (grounded).

Only in this way it is possible to ensure that the temperature-sensitive measuring point is positioned as close as possible to the pipe surface. By welding the V-PAD to the pipe, the measuring point becomes part of the pipe surface and provides the most accurate measurement results.



## Sensor

Model	Recommended max. temperature
K (NiCr-Ni)	1,200 °C
N (NiCrSi-NiSi)	1,200 °C

### Tolerance value

A cold junction temperature of 0 °C is taken as basis with the definition of the tolerance value of thermocouples.

When using a compensating cable or thermocouple cable, an additional measuring error must be considered.

### Type K

Class	Temperature range	Tolerance value
<b>DIN EN 60584 part 2</b>		
1	-40 ... +375 °C	±1.5 °C
1	+375 ... +1,000 °C	±0.0040 •  t  <sup>1)</sup>
2	-40 ... +333 °C	±2.5 °C
2	+333 ... +1,200 °C	±0.0075 •  t  <sup>1)</sup>
<b>ISA (ANSI) MC96.1-1982</b>		
Standard	0 ... +750 °C	±2.2 °C or <sup>2)</sup> ±0.75 %
Special	0 ... +750 °C	±1.1 °C or <sup>2)</sup> ±0.4 %

### Type N

Class	Temperature range	Tolerance value
<b>DIN EN 60584 part 2</b>		
1	-40 ... +375 °C	±1.5 °C
1	+375 ... +1,000 °C	±0.0040 •  t  <sup>1)</sup>
2	-40 ... +333 °C	±2.5 °C
2	+333 ... +1,200 °C	±0.0075 •  t  <sup>1)</sup>

1) |t| is the value of the temperature in °C irrespective of the sign.  
2) Whichever is the greater

Limited error with selected temperatures in °C for thermocouples types K and N

Temperature (ITS 90) °C	Tolerance value DIN EN 60584 part 2	
	Class 1 °C	Class 2 °C
0	±1.5	±2.50
100	±1.5	±2.50
200	±1.5	±2.50
300	±1.5	±2.50
400	±1.6	±3.00
500	±2.0	±3.75
600	±2.4	±4.50
700	±2.8	±5.25
800	±3.2	±6.00
900	±3.6	±6.75
1,000	±4.0	±7.50
1,100	-	±8.25
1,200	-	±9.00

Other thermocouples on request

## Mechanical design

Through its special design the V-PAD offers a high accuracy and a fast response characteristic.

The measurement accuracy can be further increased by an additional, optimised insulating screen.

### Sheathed cable

The sheathed cable is flexible. The minimum bending radius is 5-times the sheath diameter.

### Sheath diameter

- 6.0 mm
- 8.0 mm

Other sheath diameters on request

It is recommended that as thick a sheathed cable as possible is used, since it will have better mechanical and electrical characteristics.

### V-PAD and sheath materials

- Ni-alloy 2.4816 (Inconel 600)
  - up to 1,200 °C (air)
  - standard material for applications which require specific corrosion resistance properties under exposure to high temperatures, resistant to induced stress corrosion cracking and pitting in media containing chloride
  - highly resistant to halogens, chlorine, hydrogen chloride
  - problematic applications in sulphurous fuels
- Steels
  - up to 850 °C (air)
  - good corrosion resistance with aggressive media as well as steam and flue gases in chemical media

V-PAD and sheath material	Resistance in sulphurous ambient	maximum temperature
2.4665 (Hastelloy X®)	medium	1,150 °C
2.4816 (Inconel 600®)	low	1,150 °C
1.4841 (310 SS)	medium	1,150 °C
1.4749 (446 SS)	high	1,150 °C
Pyrosil D®	high	1,200 °C
Haynes HR 160®	very high	1,250 °C
1.4401 (316 SS)	medium	850 °C

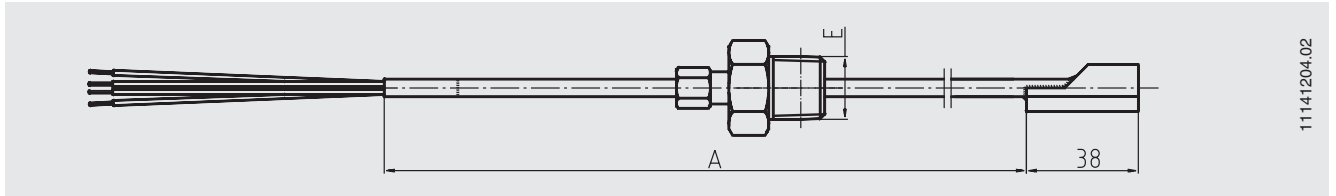
Other thermocouples on request

## Design and electrical connection

V-PAD thermocouples are classified into the following variants, depending on the nature of their electrical connections:

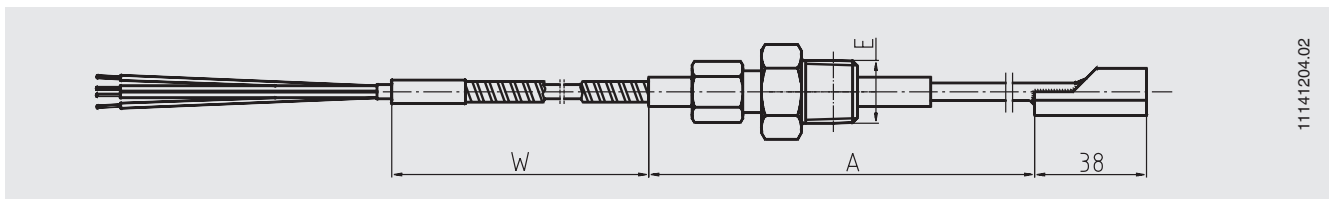
- Design with compression fitting on sheathed cable and leads
- Design with compression fitting on sheathed cable and extension cable
- Design with connection head

### Design with compression fitting on sheathed cable and leads



- Cable length 100 mm, other lengths on request
- Thermo wire  $\varnothing$  0.22 mm<sup>2</sup>
- Compensating cable type depending on the sensor type, PTFE insulated
- The sealing from the process is performed by the compression fitting. It can be supplied in all common thread sizes (e.g. G 1/2, 1/2 NPT, 3/4 NPT).

### Design with compression fitting on sheathed cable and extension cable



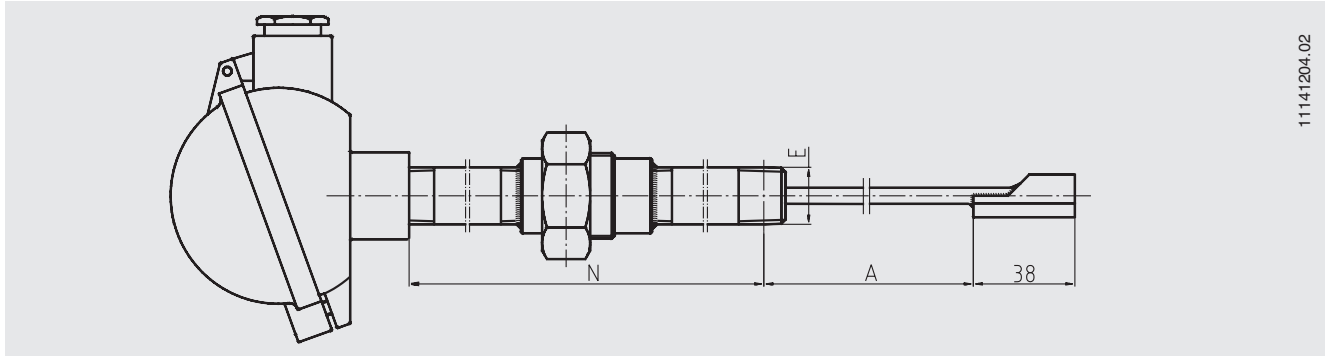
- Cable length to user specifications
- Compensating cable, leads 0.22 mm<sup>2</sup>, compensating cable type depending on the sensor type
- Number of leads depends on the number of sensors, lead ends bare
- Insulation (material / ambient temperature max.):
  - PVC 105 °C
  - Silicone 200 °C
  - PTFE 250 °C
  - Fibreglass 400 °C
- Other versions on request
- The sealing from the process is performed by the compression fitting. It can be supplied in all common thread sizes (e.g. G 1/2, 1/2 NPT, 3/4 NPT).

### Colour coding of the connecting leads

Sensor	Standard	Outer sheath colour	Positive terminal	Negative terminal
K	DIN EN 60584-3	green	green	white
N	DIN EN 60584-3	pink	pink	white

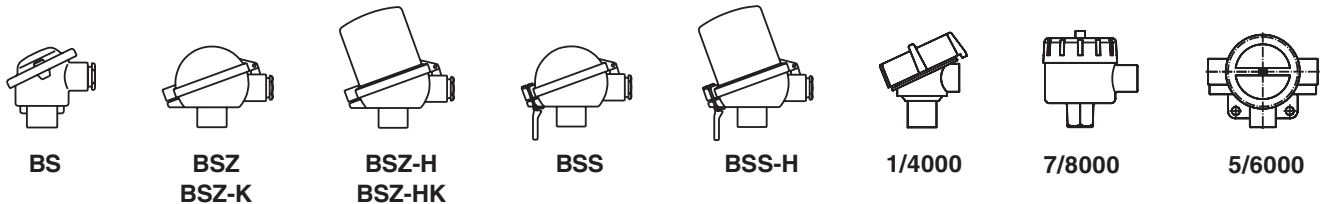
## Design with connection head

V-PAD with connection head, neck tube with multipart fitting (optional) and sheathed cable



The sealing from the process occurs within the neck tube.

## Connection head



Model	Material	Cable entry <sup>1)</sup>	Ingress protection	Cap	Surface finish <sup>2)</sup>
<b>BS</b>	Aluminium	M20 x 1.5	IP 65	Cap with 2 screws	Blue, painted
<b>BSZ</b>	Aluminium	M20 x 1.5	IP 65	Hinged cover with cylinder head screw	Blue, painted
<b>BSZ-K</b>	Plastic	M20 x 1.5	IP 65	Hinged cover with cylinder head screw	Plastic
<b>BSZ-H</b>	Aluminium	M20 x 1.5	IP 65	Hinged cover with cylinder head screw	Blue, painted
<b>BSZ-HK</b>	Plastic	M20 x 1.5	IP 65	Hinged cover with cylinder head screw	Plastic
<b>BSS</b>	Aluminium	M20 x 1.5	IP 65	Hinged cover with clip	Blue, painted
<b>BSS-H</b>	Aluminium	M20 x 1.5	IP 65	Hinged cover with clip	Blue, painted
<b>1/4000 F</b>	Aluminium	½ NPT	IP 65	Screw cover	Blue, painted
<b>1/4000 S</b>	Stainless steel	½ NPT	IP 65	Screw cover	Blank
<b>7/8000 W</b>	Aluminium	M20 x 1.5	IP 65	Screw cover	Blue, painted
<b>7/8000 S</b>	Stainless steel	½ NPT	IP 65	Screw cover	Blank
<b>5/6000 F</b>	Aluminium	3 x M20 x 1.5	IP 65	Screw cover	Blue, painted
<b>DIH10/BSZ-H</b>	Aluminium	M20 x 1.5	IP 65	Hinged cover with cylinder head screw and LED indicator DIH10	Blue, painted with indicator

1) Standard, others on request

2) RAL 5022

## Field temperature transmitter (option)

### Field temperature transmitter, model TIF50

As an alternative to the standard connection head the thermometer can be fitted with an optional model TIF50 field temperature transmitter.

A remote version for tube/surface mounting for the thermometer designs with connection cable is also possible. The field temperature transmitter comprises a 4 ... 20 mA/ HART® protocol output and is equipped with an LCD indication module.



**Field temperature transmitter**  
**Fig. left: model TIF50, head version**  
**Fig. right: model TIF50, wall mounting**

## Connection head with digital indicator (option)

### Connection head with digital indicator, model DIH10

As an alternative to the standard connection head the thermometer can be fitted with an optional DIH10 digital indicator.

For operation, a 4 ... 20 mA transmitter is needed, which is mounted to the measuring insert. The indication range is factory configured to the measuring range of the transmitter.



**Connection head with digital indicator, model DIH10**

## Transmitter (option)

A transmitter can be mounted directly into the connection head.

The following installation variants are thus possible:

- Mounted instead of terminal block
- Mounted within the cap of the connection head
- Mounting not possible

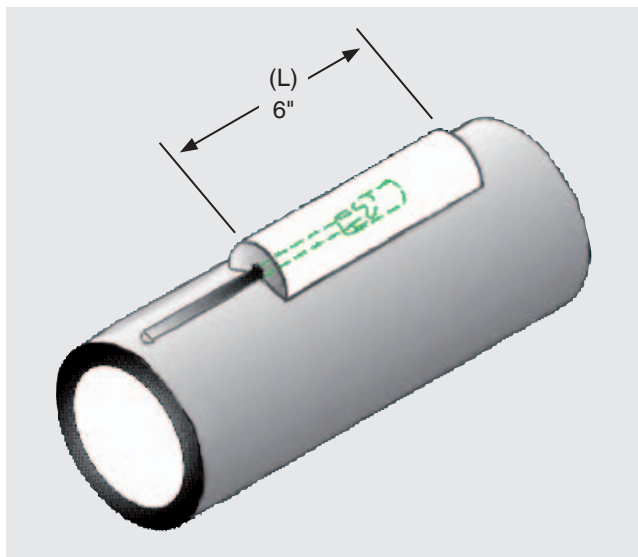
Connection head	Transmitter model		
	T12	T32	T53
BS	-	-	○
BSZ/BSZ-K	○	○	○
BSZ-H/BSZ-HK	●	●	●
BSS	○	○	○
BSS-H	●	●	●
1/4000	○	○	○
7/8000	○	○	○
DIH10	○	○	-

Model	Description	Explosion protection	Data sheet
T12	Digital transmitter, PC configurable	Optional	TE 12.03
T32	Digital transmitter, HART® protocol	Optional	TE 32.04
T53	Digital transmitter FOUNDATION™ Fieldbus and PROFIBUS® PA	Standard	TE 53.01
TIF50	Digital field temperature transmitter, HART® protocol	Optional	TE 62.01

## Heat shield (option)

In contrast to most other surface measurements, with applications in combustion plants the temperature outside of the pipe is higher than that inside it. The heat is mostly generated by an open flame and, therefore, high gas velocities and a high thermal radiation density prevail. Since the V-PAD protrudes from the flush pipe surface, it is heated more intensively than the pipe itself, due to both radiation and convection. This may lead to a positive measuring error, i.e. the measurement shows too high a temperature. To reduce this distortion, which is dependant upon the operating conditions, the V-PAD can be supplied with an additional heat shield.

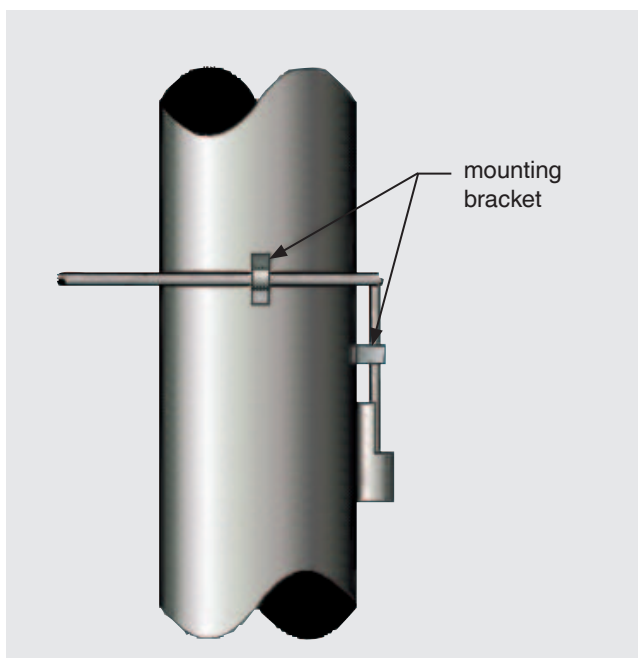
However, the shield must be designed, in terms of material as well as layout, to match precisely the pipe being measured. This means that the external diameter of the pipe must be specified.



## Installation

It is recommended that the mineral-insulated cable is placed in the radiation shadow for the measurement. To fix the cable, you can order fastening brackets that, ideally, should be manufactured from the same material as the pipe. To compensate for thermal expansion, the MI cable should be laid in one, or several, loops.

Upon customer request, the mineral-insulated cable can be bent in advance to prepare it for installation.



Mounting bracket		
MI cable Ø	Article number	Material
Ø 6 ... 8 mm	11051841	Inconel 600
Ø 10 mm	11197634	Inconel 600

## Explosion protection (option)

Thermocouples of the TC59 series are available with a EC-type examination certificate for "intrinsically safe", Ex i, ignition protection.

These instruments comply with the requirements of 94/9/EC (ATEX) directive for gas and dust.

For all instrument variants of TC59-V the thermocouple is grounded welded. The intrinsically safe circuits are galvanically connected to the earth potential.

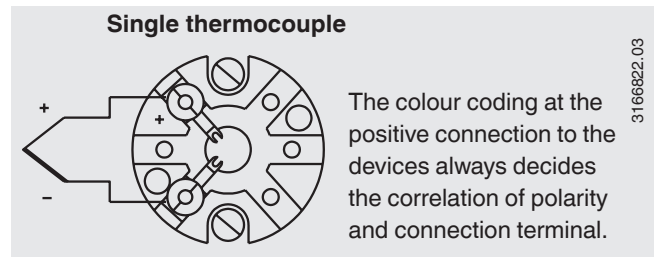
The classification/suitability of the instrument (permissible power,  $P_{max}$ , as well as the permissible ambient temperature) for the respective category can be seen on the EC-type examination certificate and in the operating instructions.

Built-in transmitters have their own EC-type examination certificate. The permissible ambient temperature ranges of the built-in transmitters can be taken from the corresponding transmitter approval. The system operator is responsible for using suitable thermowells.

The internal inductance ( $L_i$ ) and capacitance ( $C_i$ ) for cable probes are found on the product label and they should be taken into account when connecting to an intrinsically-safe power supply.

## Electrical connection

### Ceramic terminal block



For the electrical connections of built-in temperature transmitters as well as for pin assignment of the model TIF50 field temperature transmitter and model DIH10 connection head with digital indicator see the corresponding data sheets or operating instructions.

## Approvals

- ATEX
- IECEX
- NEPSI
- GOST-R
- KOSHA
- PESO
- MakNII

## Certificates

- KazInMetr
- BelGIM

further approvals and certificates see locale website

## Ordering information

Model / Explosion protection / Connection head / Cable entry / Terminal block, transmitter / Design of thread / Measuring element / Sensor type / Temperature range / Probe diameter / Pipe diameter / Materials / Thread size / Connection cable, sheath / Lengths N, W, A / Certificates / Options

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