



Tubeskin thermocouple assembly Model TC59-V

WIKA data sheet TE 65.59



For further approvals,
see page 9

V-PAD®

Applications

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

Special features

- Special block design
- Application ranges from 0 ... 1,260 °C [32 ... 2,300 °F]
- Flexible sheathed cable, mineral-insulated internal leads
- High mechanical strength, shock-resistant



V-PAD® tubeskin thermocouple, model TC59-V

Description

The V-PAD® model TC59-V provides accurate and reliable temperature readings of process tubes inside combustion furnaces. Through extensive testing at WIKA's R&D centre in Houston, Texas, the V-PAD® has been designed to provide unmatched accuracies in varying process conditions.

At the heart of the V-PAD® thermocouple is a patent pending V-shaped block designed to enable a full penetration weld between the sensor and the process tube. The flexible part of the sensor is a mineral-insulated metal-sheathed cable. It consists of a metal outer sheath which contains the insulated internal thermocouple conductors compressed within a high-density ceramic composition. The materials of the thermocouple can be selected to match the application.

Inside the V-PAD® block, the internal conductors are welded together to form a non-insulated (grounded) measuring point. The other end of the mineral-insulated metal-sheathed cable provides a hermetically sealed platform for the electrical connection. Cables, plug-in connectors, or connector sockets can be connected here.

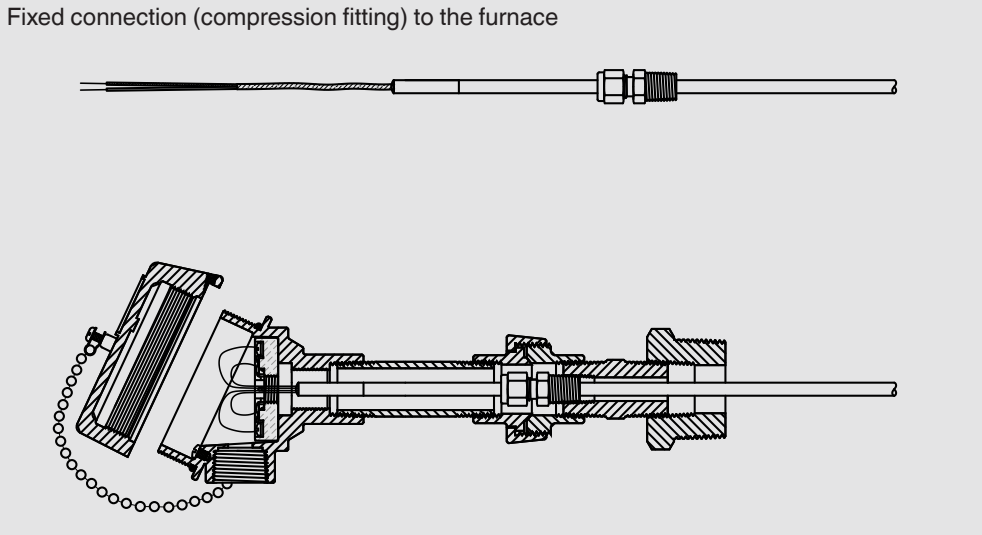
The V-PAD® thermocouple can also be fitted with a diagnostic junction which can be used for diagnostics of the measuring junction and environmental conditions.

Sensor design

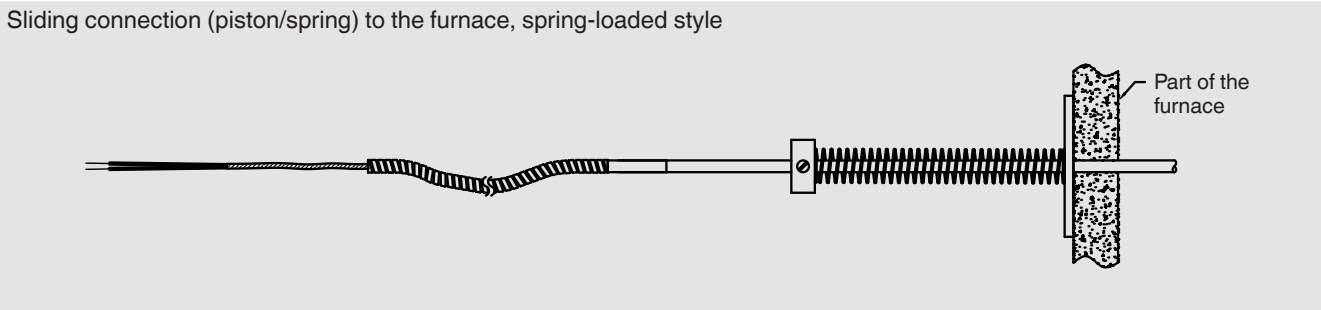
This tubeskin thermocouple assembly is supplied with a non-insulated measuring point (grounded). Only in this way it is possible to ensure that the temperature-sensitive measuring point becomes part of the tube surface when welding the V-PAD® to the tube. This enables the most accurate measuring results.

Overview of versions

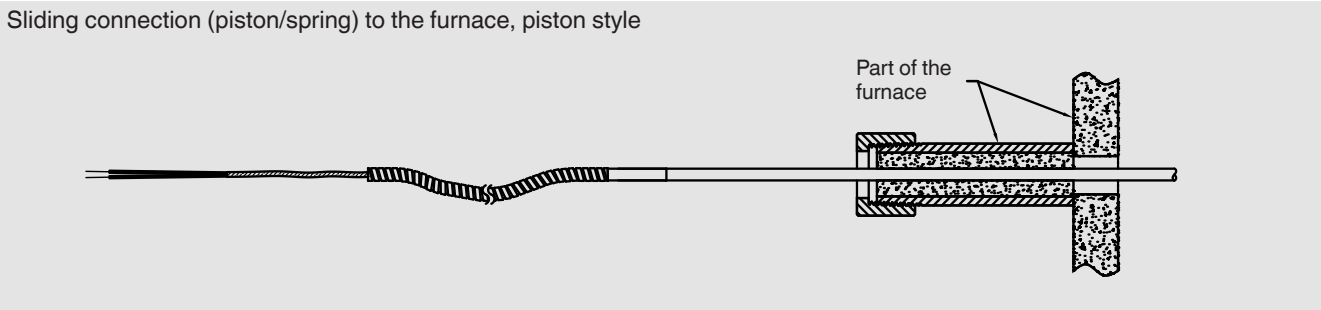
Fixed connection (compression fitting) to the furnace



Sliding connection (piston/spring) to the furnace, spring-loaded style

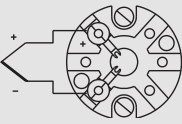
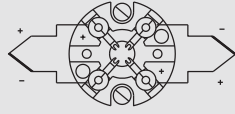
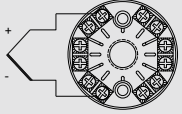
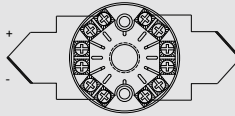
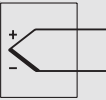
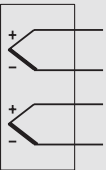


Sliding connection (piston/spring) to the furnace, piston style



Measuring element		
Type	Thermocouple per IEC 60584-1 or ASTM E230 Types K, J, N	
	→ Other measuring elements on request	
Measuring point	Grounded	
Validity limits of the class accuracy per EN 60584-1		
Type K	Class 2	-40 ... +1,200 °C [-40 ... +2,192 °F]
	Class 1	-40 ... +1,000 °C [-40 ... +1,832 °F]
Type J	Class 2	-40 ... +750 °C [-40 ... +1,382 °F]
	Class 1	-40 ... +750 °C [-40 ... +1,382 °F]
Type N	Class 2	-40 ... +1,200 °C [-40 ... +2,192 °F]
	Class 1	-40 ... +1,000 °C [-40 ... +1,832 °F]
Validity limits of the class accuracy per ASTM-E230		
Type K	Standard	0 ... 1,260 °C [32 ... 2,300 °F]
	Special	0 ... 1,260 °C [32 ... 2,300 °F]
Type J	Standard	0 ... 760 °C [32 ... 1,400 °F]
	Special	0 ... 760 °C [32 ... 1,400 °F]
Type N	Standard	0 ... 1,260 °C [32 ... 2,300 °F]
	Special	0 ... 1,260 °C [32 ... 2,300 °F]

The table shows the temperature ranges listed in the respective standards, in which the tolerance values (class accuracies) are valid. When using a compensating cable or thermocouple cable, an additional measured error must be considered. For the tolerance value of thermocouples, a cold junction temperature of 0 °C [32 °F] has been taken as the basis.

Colour code of cable		
Marking of the polarity	The colour coding at the positive poles of the instrument decides the correlation of polarity and terminal	
Ceramic terminal block	Single thermocouple	
	Dual thermocouple	
Crastin terminal block	Single thermocouple	
	Dual thermocouple	
Cable connection	Single thermocouple	
	Dual thermocouple	

IEC 60584-3


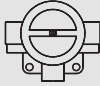

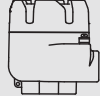
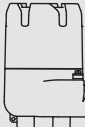
Thermocouple type	Positive leg	Negative leg
K	Green	White
J	Black	White
N	Pink	White

ASTM E230

Thermocouple type	Positive leg	Negative leg
K	Yellow	Red
J	White	Red
N	Orange	Red

→ For detailed specifications for thermocouples, see IEC 60584-1 or ASTM E230 and technical information IN 00.23 at www.wika.com.

Connection head

Model		Material	Cable entry thread size	Ingress protection (max.) ¹⁾ IEC/EN 60529	Cap	Surface	Connection to neck tube
	1/4000	Aluminium	<ul style="list-style-type: none"> ■ ½ NPT ■ ¾ NPT ■ M20 x 1.5 	IP66 ²⁾	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	1/4000	Stainless steel	<ul style="list-style-type: none"> ■ ½ NPT ■ ¾ NPT ■ M20 x 1.5 	IP66 ²⁾	Screw-on lid	Natural finish	½ NPT
	5/6000	Aluminium	<ul style="list-style-type: none"> ■ 3 x ½ NPT ■ 3 x ¾ NPT ■ 3 x M20 x 1.5 	IP66 ²⁾	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	5/6000	Stainless steel	<ul style="list-style-type: none"> ■ 3 x ½ NPT ■ 3 x ¾ NPT ■ 3 x M20 x 1.5 	IP66 ²⁾	Screw-on lid	Natural finish	½ NPT
	7/8000	Aluminium	<ul style="list-style-type: none"> ■ ½ NPT ■ ¾ NPT ■ M20 x 1.5 	IP66 ²⁾	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	7/8000	Stainless steel	<ul style="list-style-type: none"> ■ ½ NPT ■ ¾ NPT ■ M20 x 1.5 	IP66 ²⁾	Screw-on lid	Natural finish	½ NPT
	PIH-L	Aluminium	<ul style="list-style-type: none"> ■ ½ NPT / closed ■ M20 x 1.5 / closed ■ 2 x ½ NPT ■ 2 x M20 x 1.5 	IP66 ²⁾	Screw-on lid, flat	Blue lid, painted Grey lower body, painted	<ul style="list-style-type: none"> ■ ½ NPT ■ M20 x 1.5
	PIH-H	Aluminium	<ul style="list-style-type: none"> ■ ½ NPT / closed ■ M20 x 1.5 / closed ■ 2 x ½ NPT ■ 2 x M20 x 1.5 	IP66 ²⁾	Screw-on lid, high	Blue lid, painted Grey lower body, painted	<ul style="list-style-type: none"> ■ ½ NPT ■ M20 x 1.5

1) IP ingress protection of the connection head. The IP ingress protection of the complete TC59-E instrument does not necessarily have to correspond to the connection head.

2) Suitable sealing / cable gland required

IP ingress protection per IEC/EN 60529

First index number	Degree of protection / Short description	Test parameters
Degrees of protection against solid foreign bodies (defined by the 1st index number)		
5	Dust-protected	Per IEC/EN 60529
6	Dust-tight	Per IEC/EN 60529
Degrees of protection against water (defined by the 2nd index number)		
4	Protected against splash water	Per IEC/EN 60529
5	Protected against water jets	Per IEC/EN 60529
6	Protected against strong water jets	Per IEC/EN 60529

Standard ingress protection of the model TC59-V is IP65.

The specified degrees of protection apply under the following conditions:

- Use of a suitable cable gland
- Use of a cable cross-section appropriate for the gland or select the appropriate cable gland for the available cable
- Adhere to the tightening torques for all threaded connections





Field temperature transmitter, model TIF50 (option)

As an alternative to the standard connection head, the sensor can be fitted with an optional model TIF50 field temperature transmitter. A remote version for tube/surface mounting for the sensor 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

Transmitter

Transmitter models	Model T16	Model T32	Model T38	Model TIF50
Transmitter data sheet	TE 16.01	TE 32.04	TE 38.01	TE 62.01
Figure				
Output				
4 ... 20 mA	x	x	x	x
HART® protocol	-	x	x	x
Input	<ul style="list-style-type: none"> ■ Type K ■ Type J ■ Type E ■ Type N ■ Type T 	<ul style="list-style-type: none"> ■ Type K ■ Type J ■ Type E ■ Type N ■ Type T 	<ul style="list-style-type: none"> ■ Type K ■ Type J ■ Type E ■ Type N ■ Type T 	<ul style="list-style-type: none"> ■ Type K ■ Type J ■ Type E ■ Type N ■ Type T
Explosion protection	Ex version possible			

Possible mounting positions for transmitters	Model T16	Model T32	Model T38
1/4000	○	○	○
5/6000	○	○	○
7/8000	○	○	○
PIH-L/PIH-H	○	○	○

Legend:

- Mounted instead of terminal block
- Mounting not possible

The mounting of a transmitter is possible with all the connection heads listed here. For a correct determination of the overall measuring deviation, the sensor and transmitter measuring deviations must be added.

Process connection

Process connection	
Design	V-PAD®
	<ul style="list-style-type: none"> ■ The design ensures a full penetration weld to the tube, giving the measuring point the ability to become part of the tube surface. ■ The shape promotes high accuracy and fast response. ■ Designed to be mounted onto any tube diameter.
	→ Diagnostic junction available on request
Material (weldable)	Stainless steel 310
	→ Other materials on request

Mineral-insulated metal-sheathed cable (MIMS cable)

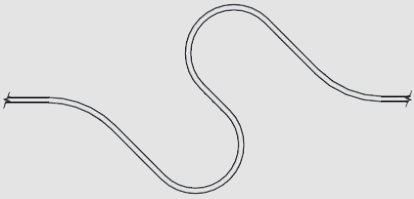



Mineral-insulated metal-sheathed cable (MIMS cable)		
Design	<ul style="list-style-type: none"> ■ Fixed connection (compression fitting) to the furnace ■ Sliding connection (piston/spring) to the furnace 	
Bending radius	Five times the sheath diameter	
Cable length	Fixed connection	150 mm [6 in]
		Other lengths on request
	Sliding connection	User specifications
Sheath diameter	<ul style="list-style-type: none"> ■ 6.0 mm [0.24 in] ■ 6.4 mm [0.25 in] ■ 7.9 mm [0.31 in] ■ 9.5 mm [0.37 in] 	
	→ Other diameters on request	
Compression fitting	Fixed connection	The sealing from the process is performed by the compression fitting. It can be supplied in most common thread sizes.
	Sliding connection	-
Compensating cable	Fixed connection	PTFE-insulated (standard)
	Sliding connection	User specifications
Wire ends	Terminal block	-
	Cable connection	User specifications
Sheath material	Resistance in sulphurous ambient	Resistance in maximum temperature
Stainless steel 310	Medium	1,150 °C [2,102 °F]
Stainless steel 446 ¹⁾	High	1,150 °C [2,102 °F]
Alloy X	Medium	1,150 °C [2,102 °F]
Alloy 600	Low	1,150 °C [2,102 °F]
Haynes HR 160®	Very high	1,200 °C [2,192 °F]
Pyrosil D®	High	1,250 °C [2,282 °F]
Stainless steel 316	Medium	850 °C [1,562 °F]
	→ Other materials on request	

1) Depending on design

Fixed connection: Can be mounted directly to the neck or remotely

Sliding connection: Can be mounted remotely

Expansion loops

Expansion loops	
Design	<ul style="list-style-type: none"> ■ Designed to account for maximum tube movement from startup position to operating temperature ■ In accordance with permissible space available
S-loop	
Single coil	
Multiple coil	
Spiral loop	





Operating conditions


Operating conditions	
Ambient and storage temperature	
PVC	105 °C [221 °F]
PTFE/PFA	250 °C [482 °F]
Fibreglass	400 °C [752 °F]
Vibration resistance	50 g (probe tip)

Approvals


Logo	Description	Country
	EU declaration of conformity	European Union
	EMC directive ¹⁾	
	EN 61326 emission (group 1, class B) and immunity (industrial application)	
	RoHS directive	

Optional approvals

Logo	Description	Region
	EU declaration of conformity	European Union
	<p>ATEX directive</p> <p>Hazardous areas</p> <p>- Ex i Zone 1 gas II 2G Ex ia IIC T6...T4 Gb Zone 1 mounting to zone 0 gas II 1/2 G Ex ia IIC T6...T4 Ga/Gb Zone 21 dust II 2 D Ex ia IIIC T85°C...T135°C Db Zone 21 mounting to zone 20 dust II 1/2 D Ex ia IIIC T85°C...T135°C Da/Db</p> <p>- Ex e Zone 1 gas II 2 G Ex eb IIC T4, T5, T6 Gb Zone 1 mounting to zone 0 gas II 1/2 G Ex eb IIC T4, T5, T6 Ga/Gb</p> <p>- Ex t Zone 21 dust II 2 D Ex tb IIIC T135°C, T100°C, T85°C Db Zone 21 mounting to zone 20 dust II 1/2 D Ex tb IIIC T135°C, T100°C, T85°C Db</p> <p>- Ex d Zone 1 gas II 2G Ex db IIB + H2 T6...T4 Gb Zone 1 gas II 2G Ex db IIC T6...T4 Gb Zone 1 mounting to zone 0 gas II 1/2 G Ex db IIB + H2 T6...T4 Ga/Gb Zone 1 mounting to zone 0 gas II 1/2 G Ex db IIC T6...T4 Ga/Gb</p>	
	IECEx	International
	<p>Hazardous areas</p> <p>- Ex i Zone 1 gas Ex ia IIC T6...T4 Gb Zone 1 mounting to zone 0 gas Ex ia IIC T6...T4 Ga/Gb Zone 21 dust Ex ia IIIC T85°C...T135°C Db Zone 21 mounting to zone 20 dust Ex ia IIIC T85°C...T135°C Da/Db</p> <p>- Ex e Zone 1 gas Ex eb IIC T4, T5, T6 Gb Zone 1 mounting to zone 0 gas Ex eb IIC T4, T5, T6 Ga/Gb</p> <p>- Ex t Zone 21 dust Ex tb IIIC T135°C, T100°C, T85°C Db</p> <p>- Ex d Zone 1 gas Ex db IIB + H2 T4, T5, T6 Gb Zone 1 gas Ex db IIC T4, T5, T6 Gb Zone 1 mounting to zone 0 gas Ex db IIB + H2 T4, T5, T6 Ga/Gb Zone 1 mounting to zone 0 gas Ex db IIC T4, T5, T6 Ga/Gb</p>	
	FM	USA and Canada
	<p>Hazardous areas</p> <p>- Ex d Division 1 gas Class I, division 1, groups B, C, D, T6, type 4/4X (XP) Division 1 dust Class II or III, division 1, groups E, F, G T6, type 4/4X Division 2 gas Class I, division 2, groups B, C, D, T6 type 4/4X</p>	
	CSA	USA and Canada
	<p>Hazardous areas</p> <p>- Ex d Division 1 gas Class I, division 1, groups B, C, D, type 4/4X (XP) Division 1 dust Class II, groups E, F, G, type 4/4X Division 1 dust Class III, type 4/4X</p> <p>- Ex NI Division 2 gas Class I, division 2, groups B, C, D, type 4/4X</p> <p>- Ex d Zone 1 gas Ex d IIC Gb T6/T5/T4 (FP - Zone 1 gas Ex d IIB + H2 Gb T6/T5/T4 CAN)</p> <p>- Ex d Zone 1 gas Class I, zone 1, AEx d IIC Gb T6/T5/T4 (FP - Zone 1 gas Class I, zone 1, AEx d IIB + H2 Gb T6/T5/T4 USA)</p>	

Logo	Description	Region
	CCC Hazardous areas - Ex i Zone 0 gas Ex ia IIC T1...T6 Ga Zone 1 gas Ex ia IIC T1...T6 Gb Zone 1 mounting to zone 0 gas Ex ia IIC T6...T4 Ga/Gb Zone 1 gas Ex ib IIC T1...T6 Gb Zone 2 gas Ex ic IIC T1...T6 Gc Zone 20 dust Ex ia IIIC T ₂₀₀ 65°C/T ₂₀₀ 95°C/T ₂₀₀ 125°C Da Zone 21 dust Ex ia IIIC T65°C/T95°C/T125°C Db Zone 21 mounting to zone 20 dust Ex ia IIIC T ₂₀₀ 65°C/T ₂₀₀ 95°C/T ₂₀₀ 125°C Da/Db Zone 21 dust Ex ia IIIC T65°C/T95°C/T125°C Db - Ex e Zone 2 mounting to zone 1 gas Ex eb IIC T1...T6 Gb/Gc Zone 2 gas Ex ec IIC T1...T6 Gc - Ex t Zone 21 dust Ex tb IIIC T85°C Db - Ex d Zone 1 gas Ex db IIB + H2 T4...T6 Gb Zone 1 gas Ex db IIC T4...T6 Gb	China

Accessories

Model	Description	Order number
	Tube clips	
	Material: stainless steel 310	
	MI cable Ø 6.0 ... 6.4 mm [0.24 ... 0.25 in]	55984088
	MI cable Ø 7.9 ... 9.5 mm [0.31 ... 0.37 in]	55984095

→ Other materials on request

Design consideration

WIKA uses trained specialists to customise the temperature measuring locations to the application. These specialists utilise best practices derived from scientific properties to optimise the life and accuracy of the thermocouple. They make suggestions to optimise the system for temperature, movement, and burner firing.

Some design considerations that can help determine measuring locations for the specific application in order to choose the best suitable product:

- Heat transfer (radiation, convection, conduction)
- Junction (grounded, ungrounded)
- Flame impingement
- Furnace exit design options
- Burner fuel (flue gas composition)
- Type of welding (TIG, shielded metal arc welding, temperature monitoring)
- Mounting (location, orientation)
- Operating vs. design temperatures
- Bending radius
- Path to furnace wall
- Furnace design (burner positions)

Installation services



- Short downtimes
- Fast commissioning
- Ensuring process safety
- Options for extended warranty
- Compliance with local safety regulations
- Environmentally conscious handling

Ordering information

Model / Explosion protection / Sensor type / Temperature range / Measuring element / Probe diameter / Materials / Tube diameter / Connection head / Cable entry / Terminal block, transmitter / Design / Electrical connection / Thread size / Connection cable / Lengths N, W, A / Options / Accessories / Expansion loops

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In case of a different interpretation of the translated and the English data sheet, the English wording shall prevail.

