Tubeskin thermocouple assembly, extractable
Model TC59-E

For further approvals, see page 8

eTEFRACTO-PAD®

Applications

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

Special features

- Removable thermocouple design
- Proprietary thermal shield design, integrated one-step installation
- Ranges of use from 0 ... 1,260 °C [32 ... 2,300 °F]
- Flexible sheathed cable, mineral-insulated internal leads
- High mechanical strength, shock-resistant

eTEFRACTO-PAD® sensor, guide channel, and shield

Description

The eTEFRACTO-PAD® model TC59-E is a product developed at the WIKA Houston R&D center. Taking into account the knowledge of customer applications, needs and requirements, extensive testing was done to ensure the product addresses proven accuracy and ease of installation.

This unique thermocouple design allows for the weldable parts (guide channel, thermal shield, and tube clips) to be installed by the manufacturer of the heater / boiler or even by the tube manufacturer in the case of specialty furnace tubes. A proprietary moldable shield is placed over the guide channel and sheathed cable. This shield and insulation is a key component for the eTEFRACTO-PAD®, providing accurate temperature measurement and is a patent-pending WIKA innovation in several countries (patent pending, property right: US 17/554,754, EP 21215402.5 and CN 202111548816.4).

Sensor design

The eTEFRACTO-PAD® is a thermocouple design utilizing a guide channel and optimized thermal shield which combine to provide a single one-step process of welding to the tube. Inside the guide channel, a extractable thermocouple sensor is made from a mineral-insulated metal-sheathed cable. It contains the insulated internal leads compressed within a high-density ceramic composition. At the hot end, the internal leads are welded together to form an insulated (ungrounded) or non-insulated (grounded) measuring location. At the cold end, the ends of the leads are hermetically sealed and connected to lead ends that form the platform for the electrical connection. Cables, plug-in connectors or connector sockets can be connected to them.

This revolutionary sensor is an engineered solution for the tubeskin industry and will be designed for each application and installation. The materials of each component can be selected to match the application. By utilizing these engineered components you can be confident the eTEFRACTO-PAD® design will provide accurate measuring results.

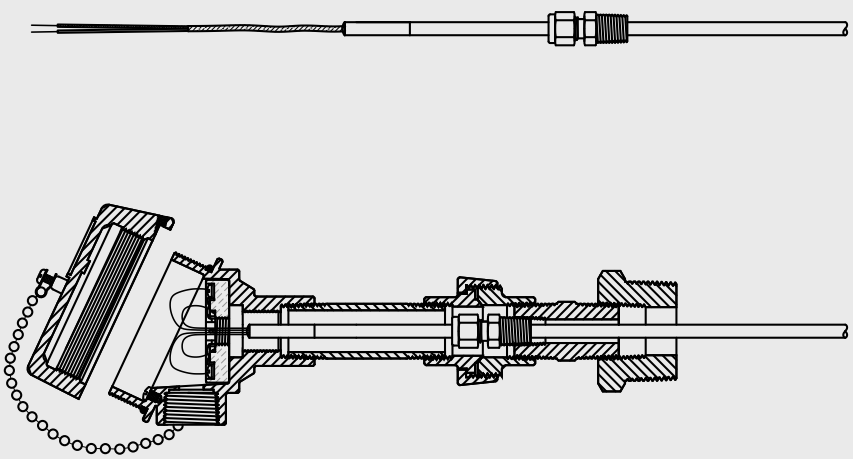
Smart in sensing

Data sheets showing similar products:
Tubeskin thermocouple assembly; model TC59-T; see data sheet TE 65.60
Tubeskin thermocouple assembly; model TC59-V; see data sheet TE 65.59
Tubeskin thermocouple assembly; model TC59-X; see data sheet TE 65.57

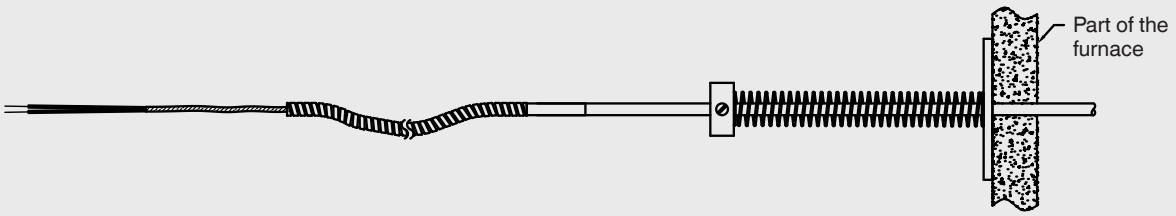
Measuring element

Overview of versions

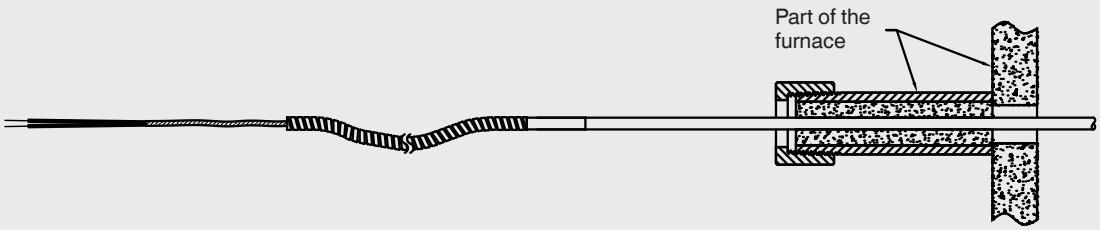
Fixed connection (compression fitting) to the furnace



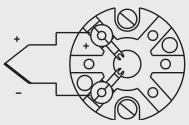
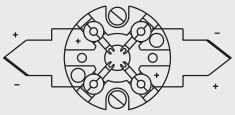
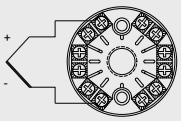
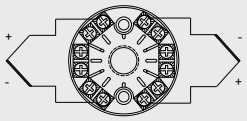
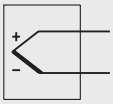
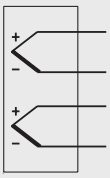
Sliding connection (piston/spring) to the furnace, spring-loaded style



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



Measuring element	
Type of measuring element	Thermocouple per IEC 60584-1 or ASTM E230 Types K, J, N
	→ Other measuring elements on request
Measuring point	■ Ungrounded (standard) ■ Grounded (welded to the sheath)

Measuring element		
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	
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]

Colour code of cable

IEC 60584-3

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

ASTM E230

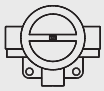
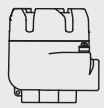
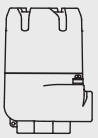
Thermocouple type	Positive leg	Negative leg
K	Yellow	Red
J	White	Red
N	Orange	Red

→ For detailed specifications for thermocouples, see IEC 60584-1 or ASTM E230 and technical Information IN 00.23 at

www.wika.com.

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 measuring 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.

Connection head

Model		Material	Cable entry thread size	Ingress protection (max.) [1] IEC/EN 60529	Cap	Surface	Connection to neck tube
	**1/4000**	Aluminium	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66 [2]	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	1/4000	Stainless steel	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66 [2]	Screw-on lid	Natural finish	½ NPT
	**5/6000**	Aluminium	■ 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	■ 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	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66 [2]	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	7/8000	Stainless steel	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66 [2]	Screw-on lid	Natural finish	½ NPT
	**PIH-L**	Aluminium	■ 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	■ ½ NPT ■ M20 x 1.5
	**PIH-H**	Aluminium	■ 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	■ 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

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	■ Type K ■ Type J ■ Type E ■ Type N ■ Type T	■ Type K ■ Type J ■ Type E ■ Type N ■ Type T	■ Type K ■ Type J ■ Type E ■ Type N ■ Type T	■ 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	eTEFRACTO-PAD®	
	■ Strong welded connection on three sides of the heat shield ■ This in combination with the moldable insulation offers accuracy and reliability in demanding applications ■ Designed for high heat flux and/or difficult applications, including flame impingement applications ■ A guide channel allows for easy sensor installation / removal. ■ Special features of the guide channel ensure intimate sensor contact with the tube being measured.	
Material (weldable)	Stainless steel 310	
	→ Other materials on request	

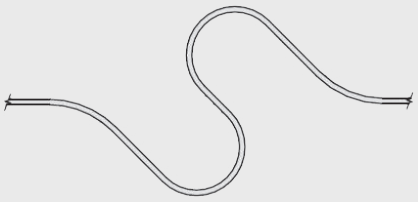
Mineral-insulated metal-sheathed cable (MIMS cable)

Sheathed cable (MIMS cable)			
Design	■ 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	■ 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	■ Designed to account for maximum tube movement from startup position to operating temperature ■ In accordance with allowable space available
S-loop	
Single coil	
Multiple coil	
Spiral loop	

Operating conditions

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

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-E 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

Approvals

Logo	Description	Region
CE	**EU declaration of conformity**	European Union

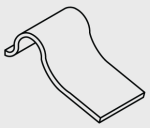
Optional approvals

Logo	Description			Region
Ex	**EU declaration of conformity**			European Union
	ATEX directive			
	Hazardous areas			
	- 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 dust	II 2D Ex tb IIIC T85°C Db IP66	
IEC IECEx	**IECEx**			International
	Hazardous areas			
	- Ex d	Zone 1 gas	Ex db IIB + H2 T6...T4 Gb	
		Zone 1 gas	Ex db IIC T6...T4 Gb	
		Zone 1 dust	Ex tb IIIC T85°C Db IP66	
FM APPROVED	**FM**			USA and Canada
	Hazardous areas			
	- Ex d (XP)	Division 1 gas	Class I, division 1, groups B, C, D, T6, type 4/4X	
		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 A, B, C, D, T6 type 4/4X	
SP US	**CSA**			USA and Canada
	Hazardous areas			
	- Ex d (XP)	Division 1 gas	Class I, division 1, groups B, C, D, type 4/4X	
		Division 1 dust	Class II, groups E, F, G, type 4/4X	
		Division 1 dust	Class III, type 4/4X	
	- Ex NI	Division 2 gas	Class I, division 2, groups B, C, D, type 4/4X	
	- Ex d (FP - CAN)	Zone 1 gas	Ex d IIC Gb T6/T5/T4	
		Zone 1 gas	Ex d IIB + H2 Gb T6/T5/T4	
	- Ex d (FP - USA)	Zone 1 gas	Class I, zone 1, AEx d IIC Gb T6/T5/T4	
		Zone 1 gas	Class I, zone 1, AEx d IIB + H2 Gb T6/T5/T4	

Patents, property rights

Patent number	Description
US 17/554,754 **EP 21215402.5** **CN 202111548816.4**	Thermocouple sensor assembly (patent pending)

Accessories

Model		Description	Order number
	**Tube clips**	Material: Stainless steel 310	
		MI cable Ø 6.0 ... 6.4 mm [0.24 ... 0.25 in]	55984097
		MI cable Ø 7.9 ... 9.5 mm [0.31 ... 0.37 in]	55984101

→ 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 loacations 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)
- Welding procedure (TIG, stick, temperature monitoring)
- Mounting (location, orientation)
- Operating vs. design temperatures
- Bending radius
- Path to furnace wall
- Furnace design (burner locations)

Benefits

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

Ordering information

Model / Explosion protection / Connection head / Terminal block, transmitter / Expansion loops / Mineral-insulated sheathed cable (MIMS cable) / Material / Cable entry / Design / Electrical connection / Measuring element / Sensor type / Temperature range / Probe diameter / Tube diameter / Materials / Thread size / Connection cable, sheath / Lenghts N, W, A / Accessories / Options

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