

Hot Runner Thermocouples Model TC46

WIKA Data Sheet TE 65.46

Applications

- Plastics and rubber industry
- Hot Runner bushings, drops and nozzles
- Hot Runner manifolds
- Moulds used in injection moulding machines
- For direct installation in the process

Special Features

- Moulded transition eliminates all possibilities of potential defects when inserted, formed and used in Hot Runner systems.
- The sensor can be formed or mounted into the process, or with the use of a swivel nut or a spring-loaded bushing.
- The thermocouple sensors are available with a variety of sheath materials including austenitic 300 series and ferritic 400 series stainless steel, corrosion resistant and high temperature oxidation resistant alloys.
- Sensor diameter from 0.5 ... 3.0 mm (0.020" ... 0.118")
- Extension cable are available in a variety of insulation materials. These include kapton, fibreglass, PTFE or PVC with or without stainless steel overbraid

Description

The TC46 series thermocouples are custom Hot Runner sensors designed to suit all applications where metal sheathed thermocouples are required. An extensive range of elements, transitions and process connections can be individually selected for the appropriate application. With the flexibility and small diameters in which they are available, Model TC46 thermocouples can be used in locations that are not easily accessible.

The unique design of the Hot Runner temperature sensors are especially suited for applications where the metal sensor tip is fitted directly into a drilled hole or press fitted into a grooved channel along the machined parts.



Hot Runner Thermocouples Model TC46

In the standard version the thermocouples are manufactured without process connections. Fastening elements such as a swivel nut, spring-loaded, compression fitting or custom designed hold down devices can be attached and are available as options.

Sensor

The junction is located at the tip of the sensor.

Sensor type

- Type J (Fe-CuNi)
- Type L (Fe-CuNi)
- Type K (NiCr-Ni)

Number of sensors

2-wire single circuit
4-wire dual circuit

Classification tolerance

- European Class 1 and 2 per DIN EN 60584-2
DIN 43714 and DIN 43713: 1991
International DIN 43722: 1994
JISC 1610: 1981
NFC 4232
BS 1843
- North American Class 1 and 2
ISA standard and special per ANSI MC 96.1 - 1982

Measuring point

- Isolated (ungrounded)
- Non isolated (grounded)

Options

- Lengths and diameters standard or customer specified
- Calibration - single point or multiple point
- TAG identification for traceability of the thermocouple materials (Identification for lead extensions, metal sheath and manufacturing date)
- Selectable accuracy tolerance
- Mounting options customer specified
- Transition options customer specified

Basic values and limiting errors

A cold junction temperature of 0 °C is taken as the basis for the definition of the thermocouple's sensor limiting error.

Temperature (ITS 90) °C	Limiting error DIN EN 60584	
	Type J °C	Type K °C
0	± 2.5	± 2.5
200	± 2.5	± 2.5
400	± 3.0	± 3.0
600	± 4.5	± 4.5
800	not defined	± 6.0

Type J DIN EN 60584

Class	Temperature range	Limiting error
1	-40 ... +375 °C	± 1.5 °C
1	+375 ... +750 °C	± 0.0040 • t ¹⁾
2	-40 ... +333 °C	± 2.5 °C
2	+333 ... +750 °C	± 0.0075 • t ¹⁾

Type K DIN EN 60584

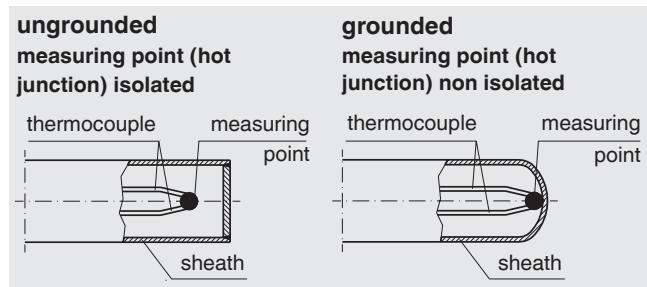
Class	Temperature range	Limiting error
1	-40 ... +375 °C	± 1.5 °C
1	+375 ... +1000 °C	± 0.0040 • t ¹⁾
2	-40 ... +333 °C	± 2.5 °C
2	+333 ... +1200 °C	± 0.0075 • t ¹⁾

1) |t| is the value of the temperature in °C without consideration of the sign.

Sensor tip designs

In the standard version a sensor is incorporated which is appropriate for the selected measuring range.

Hot Runner thermocouples can be constructed in two different ways:



Mineral insulated sheath design

The sheath section of the sensor is a mineral insulated design. This consists of a stainless steel outer sheath with conductors drawn through it and insulated with a highly compressed ceramic powder, magnesium oxide (MgO). The sheath on the sensors has been annelid allowing for the entire sheath area to be formed at the time of installation or during manufacturing. These thermocouples adhere to the ASTM E839 – 8.5.2 specification which outlines the maximum bend tolerance without any defect. The sensor sheath can be closely wrapped three full turns on a mandrel with a diameter twice the sheath diameter.

Due to this flexibility, the sensor can be applied in areas that are difficult to access.

Sheath diameter:

- 0.5 mm
- 1.0 mm
- 1.5 mm
- 1.6 mm
- 2.0 mm
- 3.0 mm
- Others on request

Sheath material

- Stainless steel
 - up to 800 °C (air)
 - good corrosion resistance with aggressive media as well as steam and flue gases in chemical media
- Ni-alloy 2.4816 (Inconel 600)
 - up to 1200 °C (air)
 - standard material for applications which require specific corrosion resistance properties and exposure to high temperatures, resistant to induced stress corrosion cracking and pitting in media containing chloride
 - resistant to corrosion caused by aqueous ammonia in all temperatures and concentrations
 - highly resistant to halogens, chlorine, hydrogen chloride

Others on request

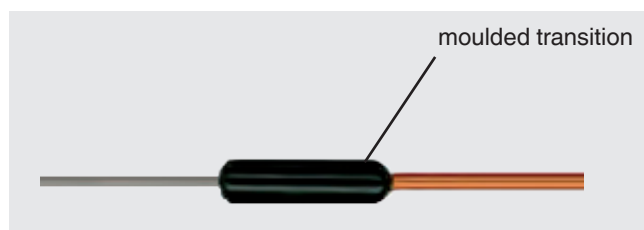
Transition

The junction between the sheath probe of the thermocouple and the connecting lead wire is moulded, brazed, crimped or potted depending on the design. This area should not be submerged into the process and must not be bent. Compression fittings or set screws should not be attached to the transition. The type and dimensions of the transition depend largely on the combination between input leads and metal sheath and the sealing requirements. The temperature at the transition is further limited by the potted sealing compound

Moulded transition

- A unique design highly recommended and used in the Hot Runner industry. The high temperature moulded transition eliminates all potential issues that may cause failures during the installation or during production runs.
- The moulded transition eliminates moisture leakage into the sheath or lead wires.
- The transition can withstand temperatures -20 ... +535 °C.
- Pull force strength against the moulded transition is tested up to 13 kg (29 lbs).
- Sheath bending capabilities can be adjacent to the moulded transition
- Standard dimensions Ø 5 mm x 20 mm (0.197" x 0.787") long

Others on request



Lead wire

A variety of insulating materials are available to adapt to different prevailing process conditions. The lead wire termination end can be supplied ready for connection, fitted with a plug as an option.

- Thermocouple, fit to sensor
 - Cross section: min. 0.20 mm² (24 awg)
 - Insulation material: Kapton, PVC, PTFE or fibreglass. With or without stainless steel over braid
- Other options available

Operating temperatures

The following temperatures limits apply to the conventional connecting lead wire.

- Kapton -25 ... +260 °C
- Fibreglass -50 ... +482 °C
- PTFE -50 ... +260 °C
- PVC -20 ... +105 °C

Kapton / Kapton

500 °F (260 °C)
Polyimide tape insulation for improved electrical properties and high temperature applications.



500 °F (260 °C)
Polyimide tape jacket for excellent abrasion and cut through properties and very high resistance to moisture and chemicals.

Fibreglass / Fibreglass

900 °F (482 °C)
Wrapped fibreglass insulation for improved moisture and abrasion resistance at high temperatures.



900 °F (482 °C)
Braided fibreglass for additional flexibility and abrasion resistance at high temperatures.

PVC / PVC

221 °F (105 °C)
PVC insulation for economy, durability and mechanical strength



221 °F (105 °C)
PVC jacket for economy, durability and mechanical strength. It is also tough and resistant to flame, abrasion and moisture.

PTFE / PTFE

500 °F (260 °C)
PFA insulation for improved electrical properties and high temperature applications.



500 °F (260 °C)
PFA jacket for chemical inertness to solvents, acids and oils.

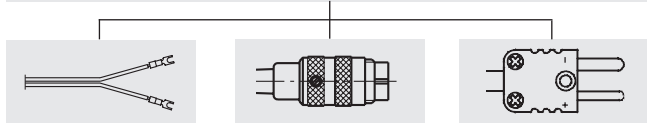
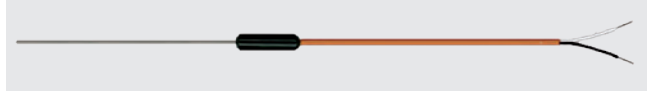
Optional plugs

For optionally-fitted connecting plugs the maximum permissible temperature at the plug is 85 °C.

Design

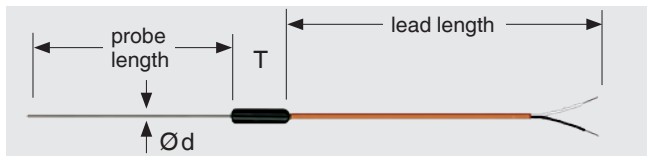
Depending on their electrical connection, Hot Runner thermocouples are divided into the following designs:

- Connecting individual insulated lead wires to the conductors of the probe
- Connecting pair of insulated lead wire to the conductors of the probe
- Optional connecting plugs can be attached to the probe conductors



Note

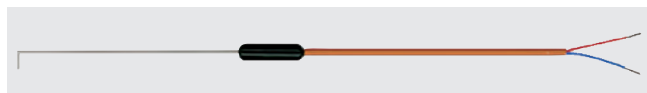
- Standard lead lengths
1000 mm (39") with additional intervals of 500 mm (20")
Other lengths on request
- Thermo wire $\varnothing 0.20 \text{ mm}^2$
Type of insulated lead wires attached to the sensor are kapton, fibreglass, PTFE or PVC
Other versions on request



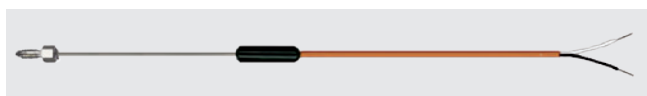
Process connections

The thermocouples can be fitted with optional process connections or formed within the ASTM E839 – 8.5.2 specifications. These various connectors are individually specified.

- Formed / bent probe
Individually specified as per drawings



- Swivel nut connection
Are used to fit the probe into a threaded connection with a female thread.

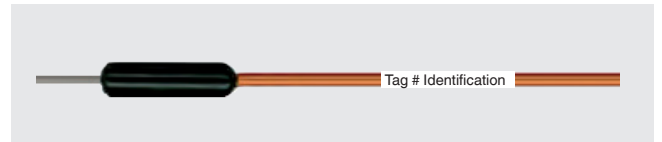


- Spring-loaded connection
Allows simple adjustments to the required insertion length at the installation point ensures a positive contact between the medium and the thermocouple junction.



Optional tag identification

- Custom tag identification number and or calibration code
- Batch identification for manufacturing traceability



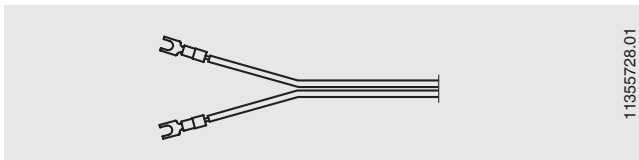
Plug (option)

Hot Runner thermocouples can be supplied with plugs attached.

The following options are available:

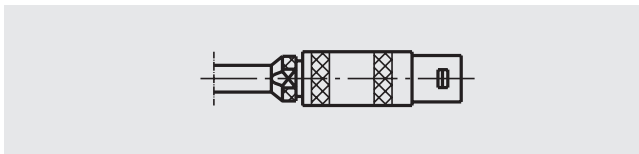
■ Spade lugs

(not suitable for versions with bare connecting wires)



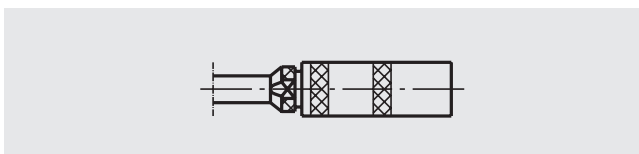
■ Lemosa plug size 1 S (male)

■ Lemosa plug size 2 S (male)

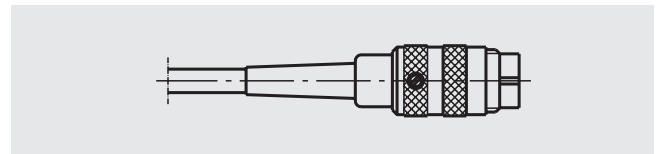


■ Lemosa plug size 1 S (female)

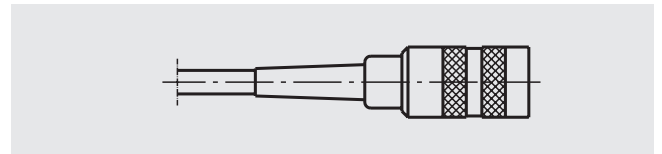
■ Lemosa plug size 2 S (female)



■ Screw-in-plug, Binder (male)

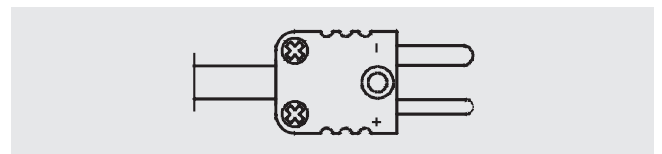


■ Screw-in-plug, Binder (female)



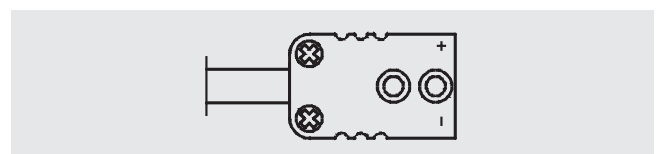
■ Standard thermo plug 2-pin (male)

■ Miniature thermo plug 2-pin (male)



■ Standard thermo plug 2-pin (female)

■ Miniature thermo plug 2-pin (female)



Electrical connection

Cable	3171 966.01	Lemosa plug, (male) on cable	3374 896.01	Binder plug (series 680), (male) on cable (screw-in-plug)	3374900.02
Colour codes of the wire ends see table on page 8					
single thermocouple					
dual thermocouple					
Thermo plug	Positive and negative terminal are marked. Two thermo connectors are used with dual thermo- couples.				

Thermocouple tolerances (Reference Junction at 0 °C)

IEC Tolerance class per EN 60584-2				
Thermocouple type		Tolerance class 1	Tolerance class 2	Tolerance class 3
T	Temperature range	-40 ... +125 °C	-40 ... +133 °C	-67 ... +40 °C
	Tolerance value	±0.5 °C	±1.0 °C	±1.0 °C
	Temperature range	+125 ... +350 °C	+133 ... +350 °C	-200 ... -67 °C
	Tolerance value	±0.004 ltl	±0.0075 ltl	±0.015 ltl
J	Temperature range	-40 ... 375 °C	-40 ... +333 °C	-
	Tolerance value	±1.5 °C	±2.5 °C	-
	Temperature range	+375 ... +750 °C	+333 ... +750 °C	-
	Tolerance value	±0.004 ltl	±0.0075 ltl	-
E	Temperature range	-40 ... +375 °C	-40 ... +333 °C	-167 ... +40 °C
	Tolerance value	±1.5 °C	±2.5 °C	±2.5 °C
	Temperature range	+375 ... +800 °C	+333 ... +900 °C	-200 ... -167 °C
	Tolerance value	±0.004 ltl	±0.0075 ltl	±0.015 ltl
K or N	Temperature range	-40 ... +375 °C	+40 ... +333 °C	-167 ... +40 °C
	Tolerance value	±1.5 °C	±2.5 °C	±2.5 °C
	Temperature range	+375 ... +1000 °C	+333 ... +1200 °C	-200 ... -167 °C
	Tolerance value	±0.004 ltl	±0.0075 ltl	±0.015 ltl
R or S	Temperature range	0 ... +1100 °C	0 ... +600 °C	-
	Tolerance value	±1.0 °C	±1.5 °C	-
	Temperature range	+1100 ... +1600 °C	+600 ... +1600 °C	-
	Tolerance value	±[1 + 0.003 (t-1100)]	±0.0025 ltl	-
B	Temperature range	-	-	+600 ... +800 °C
	Tolerance value	-	-	+4.0 °C
	Temperature range	-	+600 ... +1700 °C	+800 ... +1700 °C
	Tolerance value	-	±0.0025 ltl	+0.005 ltl

ASTM Limits of error (ASTM E230)					
Thermocouple type		Standard limits		Special limits	
		(whichever value is greater)		(whichever value is greater)	
T	Temperature range	0 ... +370 °C	+32 ... +700 °F	0 ... +370 °C	+32 ... +700 °F
	Tolerance value	±1 °C or ±0.75 %	±1.8 °F or ±0.75 %	±0.5 °C or 0.4 %	±0.9 °F or 0.4 %
	Temperature range	-200 ... 0 °C	-328 ... 32 °F	-	-
	Tolerance value	±1.0 °C or ±1.5 %	±1.8 °F or ±1.5 %	-	-
J	Temperature range	0 ... +760 °C	+32 ... +1400 °F	0 ... +760 °C	+32 ... +1400 °F
	Tolerance value	±2.2 °C or ±0.75 %	±4.0 °F or ±0.75 %	±1.1 °C or 0.4 %	±2.0 °F or 0.4 %
E	Temperature range	0 ... +870 °C	+32 ... +1600 °F	0 ... +870 °C	+32 ... +1600 °F
	Tolerance value	±1.7 °C or ±0.5 %	±3.1 °F or ±0.5 %	±1.0 °C or ±0.4 %	±1.8 °F or ±0.4 %
	Temperature range	-200 ... 0 °C	-328 ... 32 °F	-	-
	Tolerance value	±1.7 °C or ±1.0 %	±3.1 °F or ±1.0 %	-	-
K	Temperature range	0 ... +1260 °C	+32 ... +2300 °F	0 ... +1260 °C	+32 ... +2300 °F
	Tolerance value	±2.2 °C or ±0.75 %	±4.0 °F or ±0.75 %	±1.1 °C or ±0.4 %	±2.0 °F or ±0.4 %
	Temperature range	-200 ... 0 °C	-328 ... 32 °F	-	-
	Tolerance value	±2.2 °C or ±2.0 %	±4.0 °F or ±2.0 %	-	-
N	Temperature range	0 ... +1260 °C	+32 ... +2300 °F	0 ... +1260 °C	+32 ... +2300 °F
	Tolerance value	±2.2 °C or ±0.75 %	±4.0 °F or ±0.75 %	±1.1 °C or ±0.4 %	±2.0 °F or ±0.4 %
R or S	Temperature range	0 ... +1480 °C	+32 ... +2700 °F	0 ... +1480 °C	+32 ... +2700 °F
	Tolerance value	±1.5 °C or ±0.25 %	±2.7 °F or ±0.25 %	±0.6 °C or ±0.1 %	±1.1 °F or ±0.1 %
B	Temperature range	+870 ... 1700 °C	+1600 ... +3100 °F	+870 ... 1700 °C	+1600 ... +3100 °F
	Tolerance value	±0.5 %	±0.5 %	±0.25 %	±0.25 %
W, W3 or W5 *	Temperature range	0 ... +2315 °C	+32 ... +4200 °F	-	-
	Tolerance value	±4.4 °C or 1.0 %	±8.0 °F or 1.0 %	-	-

* not ANSI symbols

Thermocouple and extension wire colour codes

Country	North America		Britain / Czechoslovakia	Germany / The Netherlands	Japan	France	International	
National Standard	ANSI MC 96.1 T/C Grade	ANSI MC 96.1 Extension Grade	BS 1843	DIN 43714	ISC1610-198	NF C42-323	IEC 584-3 T/C Grade	IEC 584-3 Intrinsically Safe
N				No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes		
J								
K								
E								
T								
R	None Established							
S	None Established							
B	None Established		No Standard Use Copper Wire			No Standard Use Copper Wire		
W	None Established		None Established	No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes	None Established	None Established
W3	None Established		None Established	No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes	None Established	None Established
W5	None Established		None Established	No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes	No Standard Use ANSI Colour Codes	None Established	None Established

The specifications given in this document represent the state of engineering at the time of publishing. We reserve the right to make modifications to the specifications and materials.



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