

# Insertion thermometer With connection lead Model TF45

WIKA data sheet TE 67.15

## Applications

- Solar thermal systems, renewable energies
- Machine building
- Compressors
- Cooling, heating, ventilation and air-conditioning
- Furnace and equipment manufacturing

## Special features

- Measuring ranges from -50 ... +260 °C (-58 ... +500 °F)
- Connection lead from PVC, silicone, PTFE
- In 2- or 4-wire connection
- Probe sleeve from stainless steel
- Dust and splash-proof IP65



Insertion thermometer, model TF45

## Description

The model TF45 insertion thermometer is mainly used to measure the temperature of gaseous substances and also the surfaces of solids in the range of -50 ... +260 °C (-58 ... +500 °F). In conjunction with an additional thermowell, the insertion thermometer can also be used for temperature measurement in liquid media.

The measuring element is connected to a connection lead and built into a heat-conducting probe sleeve made of stainless steel. The probe sleeve is proof against dust and jets of water and compressed onto the connection lead.

Depending on the version, the connection leads are suited to different temperature ranges and operating conditions.

## Measuring element

WIKA standardly uses the following measuring elements for the model TF45 insertion thermometer:

- Pt1000, class B per DIN EN 60751
- Pt100, class B per DIN EN 60751
- NTC 10 k $\Omega$ , B (25/85) = 3976
- KTY81-210

Others on request

Platinum elements offer the advantage of meeting international standards (IEC/EN 60751).

Nickel elements are also standardised, but not internationally. Due to material- and production-specific criteria, a standardisation of semiconductor elements, e.g. NTCs and KTY, is not possible. For this reason their interchangeability is limited.

Further advantages of platinum elements are: better long-term stability and better behaviour over temperature cycles, a wider temperature range as well as a high measurement accuracy and linearity.

High measurement accuracy and linearity are also possible with NTCs, but only in a very limited temperature range.

### Strengths and weaknesses of the different measuring elements

	Pt100	Pt1000	NTC	KTY
Temperature range	++	++	-	-
Accuracy	++	++	-	-
Linearity	++	++	-	++
Long-term stability	++	++	+	+
International standards	++	++	-	-
Temperature sensitivity [dR/dT]	+	-	++	+
Impact of the connection lead	+	-	++	+

### Connection method

The lead resistance of the connection lead affects the measured value of 2-wire connections and must be taken into consideration.

For copper cable with cross-section 0.22 mm<sup>2</sup> the following value applies: 0.162  $\Omega$ /m  $\rightarrow$  0.42  $^{\circ}$ C/m for Pt100

With a Pt1000 measuring element, the influence of the connection lead of 0.04  $^{\circ}$ C/m is a factor of 10 lower. The lead resistance becomes still less significant in relation to the basic resistance  $R_{25}$  with a KTY or NTC element.

With a Pt100 measuring element, there is the additional possibility of selecting a 4-wire connection, thus eliminating the influence of the lead resistance on the measuring result.

For all versions of the model TF45 insertion thermometer, WIKA offers a 2-wire connection as standard.

With Pt1000, a class A measuring element in a 2-wire connection is more effective and more cost-efficient than a lead wire in 4-wire connection.

Example:

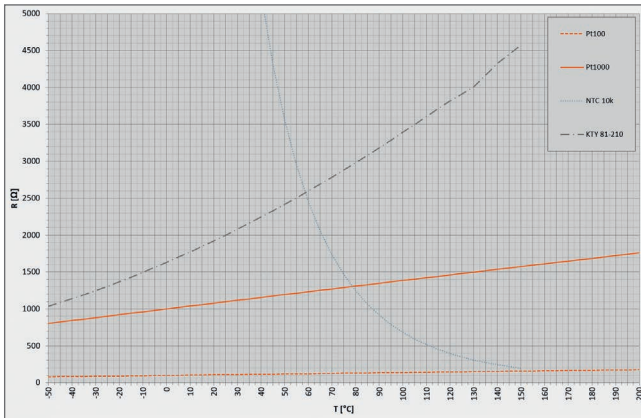
Measuring error at 150  $^{\circ}$ C, cable length 10 m, conductor cross-section 0.22 mm<sup>2</sup>:

Measuring element	Connection method	Tolerance class	Measuring error in $^{\circ}$ C
Pt100	2-wire	B	5.25
	2-wire	A	4.65
	4-wire	B	1.05
	4-wire	A	0.45
Pt1000	2-wire	B	1.47
	2-wire	A	0.87
	4-wire	B	1.05
	4-wire	A	0.45

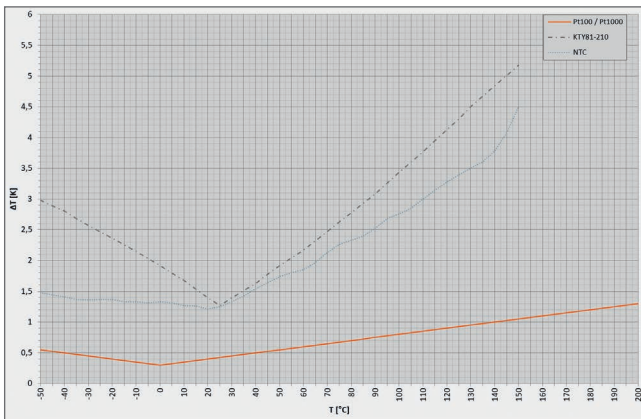
## Characteristic curves

The following characteristic curves show the typical curve shapes for the standard WIKA measuring elements, depending on the temperature and the typical tolerance curves.

### ■ Typical characteristic curves



### ■ Typical tolerance curves



## Temperature ranges

### Medium temperature (measuring range)

The measuring range depends on the insulation material of the connection lead and on the measuring element:

Measuring element	Connection lead		
	PVC	Silicone	PTFE
NTC	-20 ... +105 °C	-30 ... +130 °C	
KTY		-50 ... +150 °C	
Pt100		-50 ... +200 °C	-50 ... +260 °C
Pt1000			

### Ambient temperature

The maximum permissible ambient temperature depends on the insulation material of the connection lead.

Connection lead	Ambient temperature
PVC	-20 ... +105 °C
Silicone	-50 ... +200 °C
PTFE	-50 ... +260 °C

## Probe sleeve

To protect against moisture and mechanical loads, the measuring element and the connection point are protected by a stainless steel probe sleeve.

The following diameters and sleeve lengths are available as standard:

Sleeve diameter in mm	Standard length A in mm
6	32, 40, 50, 80, 110, 135
5	50

To use the model TF45 insertion thermometer in liquid media, thermowells with a G 1/2 mounting thread (material: brass) are available in four insertion lengths. On ordering, please give the order number!

Thermowell	Order number
Insertion length $U_1 = 50$ mm	14238211
Insertion length $U_1 = 100$ mm	14238212
Insertion length $U_1 = 150$ mm	14238213
Insertion length $U_1 = 200$ mm	14238214



Brass thermowell for TF45

## Response time

The response time is strongly influenced by

- Probe sleeve used (diameter, material)
- Heat transfer from the probe sleeve to the measuring element
- Flow rate of the medium

WIKA has optimised the design of the model TF45 insertion thermometers for an optimal heat transmission from the medium to the measuring element.

The following table shows the typical response times for the model TF45 insertion thermometers:

Probe sleeve		Response time	
Material	Diameter	t <sub>0.5</sub>	t <sub>0.9</sub>
Stainless steel	6.0 mm	2.7 s	7 s
Stainless steel	5.0 mm	2.2 s	6 s

## Connection lead

In order to be matched to the prevailing environmental conditions, connection leads are available with different insulation materials.

The lead ends can also be supplied with blank bare wires, end splices or ready-made with customer-specific plug connector.

The following table gives an overview of the main characteristics of insulation materials available for the TF45.

Insulation material		PVC	Silicone	PTFE
<b>Highest working temperature</b>		105 °C	200 °C	260 °C
<b>Flammability</b>		self-extinguishing	self-extinguishing	not flammable
<b>Water absorption</b>		slight	slight	none
<b>Suitability for steam</b>		good	limited	very good
<b>Chemical resistance against</b>	Dilute bases	+	+	+
	Dilute acids	+	+	+
	Alcohol	+	+	+
	Petrol	+	-	+
	Benzene	-	-	+
	Mineral oil	+	+	+

Legend:

- + resistant
- not resistant

The values given in the table are only given as guide values, and are not to be used as the minimum requirements in specifications.

## **Vibration resistance**

The typical uses for the model TF45 insertion thermometers are those areas where only low to medium vibration levels occur. Nevertheless, the thermometers have been designed in such a way that the acceleration values, defined in IEC/EN 60751, of 3 g can generally be exceeded for higher demands.

Depending on the version, the mounting situation, medium and temperature, the vibration resistance can be up to 6 g.

## **Shock resistance**

Up to 100 g, depending on version, installation situation and temperature

## **Electrical connection**

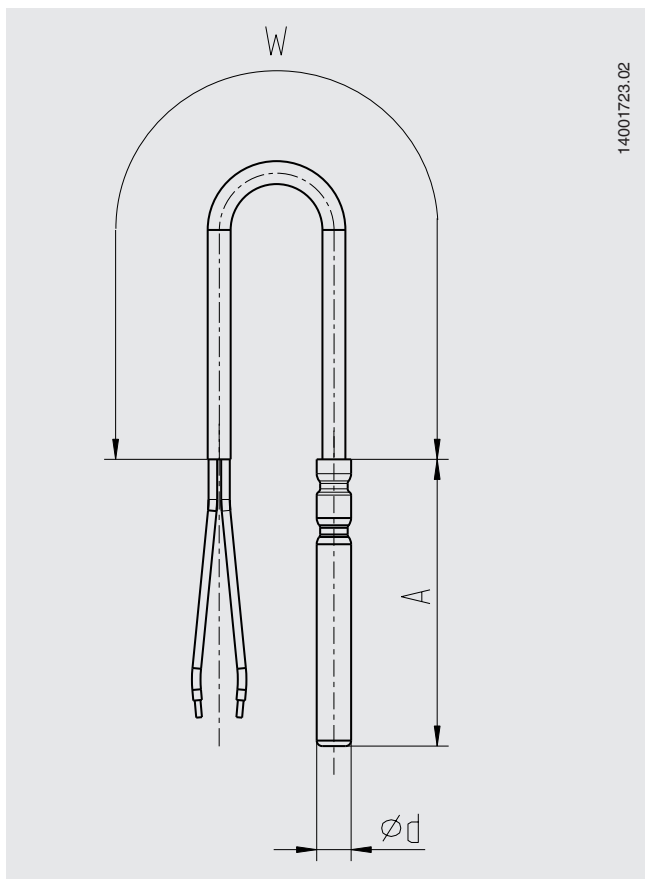
- Blank bare wires
  - End splices
  - Connector to specification
- Other connections on request

## **Ingress protection**

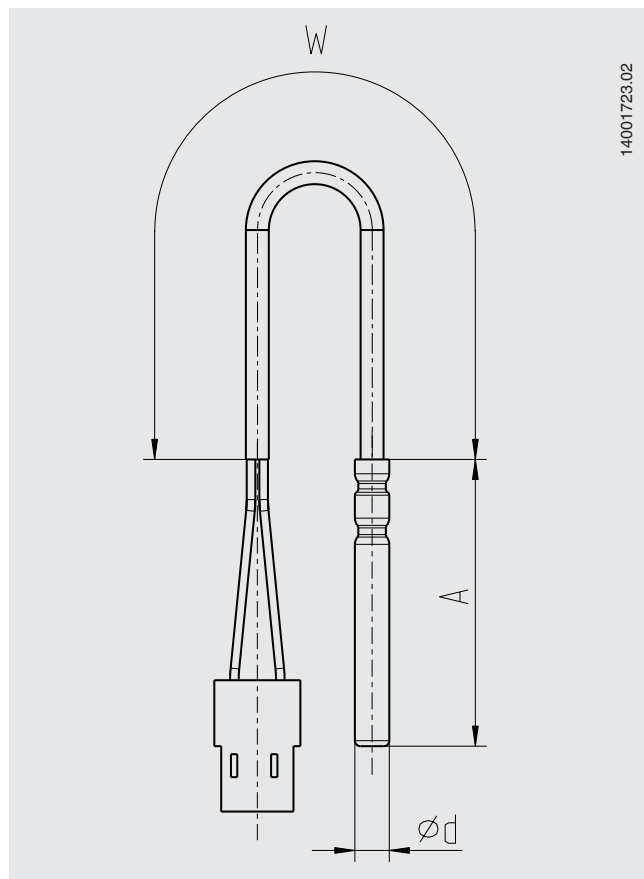
IP65 for the transition of probe sleeve/connection lead

## Dimensions in mm

Model TF45 with blank bare wires,  
with end splices



Model TF45 with connector








Legend:

Ød Probe sleeve diameter

A Sleeve length

W Cable length

## Approvals

Logo	Description	Country
	<b>EU declaration of conformity</b> RoHS directive	European Union
	<b>GOST (option)</b> Metrology, measurement technology	Russia
	<b>KazInMetr (option)</b> Metrology, measurement technology	Kazakhstan
	<b>UkrSEPRO (option)</b> Metrology, measurement technology	Ukraine
	<b>Uzstandard (option)</b> Metrology, measurement technology	Uzbekistan

Approvals and certificates, see website

## Manufacturer's information and certificates

Logo	Description
-	China RoHS directive

## Ordering information

When ordering choose one criterion from each category.

### Measuring element / Connection method / Tolerance

- 1 x Pt1000 / 2-wire / class B, EN 60751
- 1 x Pt100 / 2-wire / class B, EN 60751
- 1 x NTC 10 k $\Omega$ , B (25/85) = 3976 / 2-wire / 5 %
- 1 x KTY81-210 / 2-wire

Others on request

### Probe sleeve: material

- Stainless steel

### Probe sleeve: diameter x length

- 6 mm x 50 mm
- 6 mm x 32 mm
- 6 mm x 40 mm
- 6 mm x 80 mm
- 6 mm x 110 mm
- 6 mm x 135 mm
- 5 mm x 50 mm

### Connection lead

- Single and fully silicone-isolated
- Single and fully PVC-isolated
- Single and fully PTFE or PFA-insulated

### Cable length W

- 1,000 mm
- 3,000 mm
- 5,000 mm

Others on request (in 500 mm steps)

### Electrical connection

- Blank bare wires
- End splices

Others on request

## Ordering information

Model / Measuring range / Measuring element / Connection method / Tolerance / Material, diameter and length of the probe sleeve / Insulation and length of the connection lead / Cable length W / Electrical connection

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