

# SensyTemp TSH200 Straight thermocouples

## Cost-effective Modular Design Supports Numerous Applications



### For High Temperature Applications up to 1800 °C (3272 °F)

#### Modular system

- Thermocouple, thermowell, gas-tight inner tube, holding tube, connection head, transmitter
- Supports numerous configurations

#### Approvals

- Manufacturer's declaration for use in intrinsically safe circuits
- GOST Russia
- GOST Ukraine
- GOST Kazakhstan

#### Transmitter in connection head

- Reduced wiring
- High measuring accuracy
- High interference resistance
- Interface to all state-of-the-art process management systems
- Process safety via SIL classification

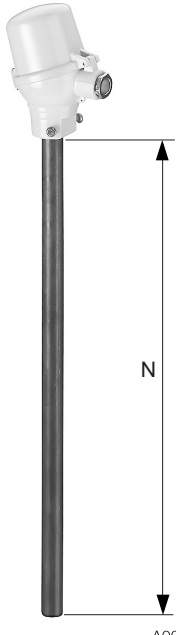
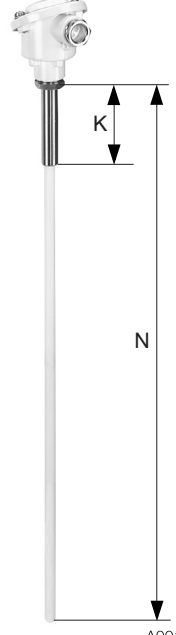
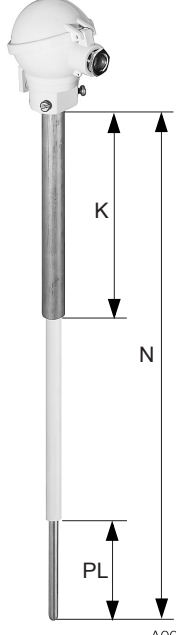
#### Areas of application

- Industrial furnaces
- Garbage and hazardous waste incineration
- Reheating and tempering furnaces
- Cement and brick production
- Porcelain and ceramics industry
- Glass manufacturing
- Smelting operations
- Blast furnaces, air-circulation furnaces

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## 1 Overview of straight thermocouples

Model	TSH210	TSH220	TSH250
			
Designs	In accordance with EN 50446: AM, AMK, BM, BMK	In accordance with EN 50446: AK, AKK, BK	In accordance with ABB-standard: AK-P, AK-P-MP, BK-PS
Thermowell properties	Metal thermowell	Ceramic thermowell	Ceramic thermowell with platinum finish
max. operating temperature	1300 °C (2372 °F)	1800 °C (3272 °F)	1650 °C (3002 °F)
Components	Thermocouple, thermowell, inner tube, process connection, connection head, transmitter	Thermocouple, thermowell, inner tube, holding tube, process connection, connection head, transmitter	Thermocouple, thermowell, platinum sleeve, intermediate tube, holding tube, connection head, transmitter
Standard process connection	Stop flange with counter flange, threaded socket, welded standard flange		
Thermowell Ø mm (inch)	15; 22; 26; 26,7; 32 (0.59; 0.87; 1.05; 1.26)	8; 10; 15; 16; 24; 26 (0.31; 0.39; 0.59; 0.63; 0.94; 1.02)	9,1 (0.36)
Standard thermowell materials	1.4571, 1.4749, 1.4841, Kanthal AF, Inconel 601	Ceramic C530, Ceramic C610, Ceramic C799	Ceramic C799 with platinum sleeve FGS-PtRh10%
Standard inner tube materials	Ceramic C610	Ceramic C799	-
Standard holding tube materials	Without holding tube (one-piece metal thermowell)	Stainless steel 1.4571 (AISI 316 Ti)	Stainless steel 1.4571 (AISI 316 Ti)
Connection heads	A, AUS, AUZ, AUZH, B, BUS, BUZ, BUZH		
Output signals	Thermovoltage, 4 ... 20 mA, HART, PROFIBUS PA, FOUNDATION Fieldbus		
Thermocouples (EN 60584)	Type K, J, N, R, S, B single/dual	Type K, J, N, R, S, B single/dual	Type R, S, B single/dual, 3-way stage with AK-P-MP
Explosion protection class	Installation in non-Ex zone, with manufacturer's declaration for connection to intrinsically safe circuits		
Application	Reheating and hardening furnaces, smelting operations, blast furnaces, waste incineration, flue-gas desulfurization	Cement and brick manufacturing, porcelain and ceramics industry, garbage and hazardous waste incineration, glass industry, steel industry	Glass melting
Process pressure	depressurized		
Weight for standard designs	1,0 ... 7,0 kg (2.20 ... 15.43 lb)	0,5 ... 5,0 kg (1.10 ... 11.02 lb)	1,0 ... 5,0 kg (1.10 ... 11.02 lb)

## 2 Designs

In EN 50446, designs are divided into the following categories, according to the shape of the connection head and material of the thermowell:

AM, AMK, BM, BMK, AK, AKK, BK, BKK

The three letters stand for the following designs:

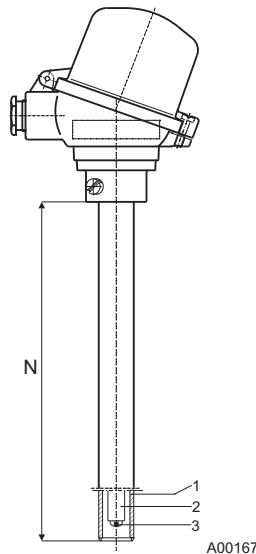
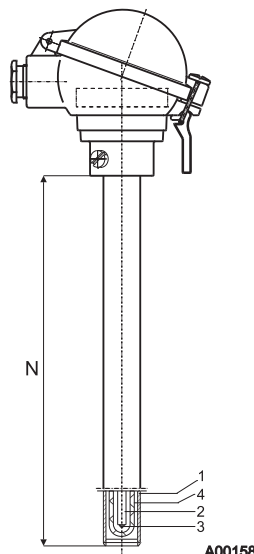
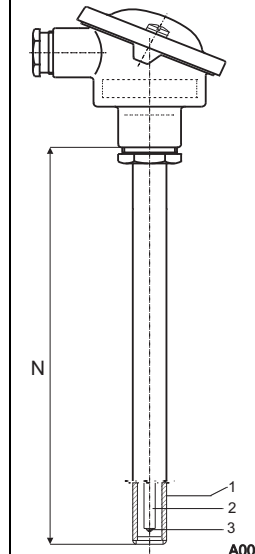
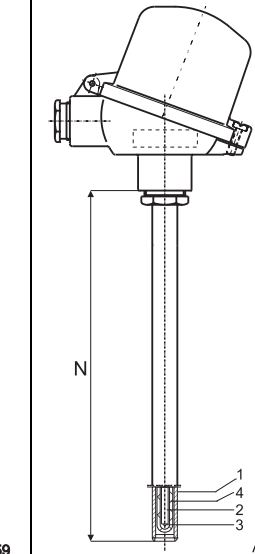
1. position:	A B	Connection head, form A Connection head, form B
2. position:	M K	Metal thermowell Ceramic thermowell
3. position:	K n.a.	Ceramic inner tube Without inner tube

For use in glass melting, ABB has defined the following three designs in accordance with EN 50446: AK-P, AK-P-MP, BK-PS

The first two letters stand for the connection head and thermowell material, as per EN 50446. The additional letters are:

- P: additional **P**latinium sleeve over ceramic thermowell
- PS: screwed **P**latinium sleeve over ceramic thermowell (**S**crewed). This design is available upon request.
- MP: 3-way stage thermocouple (**M**ultipoint)

### 2.1 SensyTemp TSH210 temperature sensor

Design	AM	AMK	BM	BMK
				
Connection heads	A, AUS, AUZ, AUZH	A, AUS, AUZ, AUZH	B, BUS, BUZ, BUZH	B, BUS, BUZ, BUZH
Thermowell	Metal thermowell	Metal thermowell	Metal thermowell	Metal thermowell
Inner tube	without	Ceramic inner tube	without	Ceramic inner tube
Standard nominal length N mm (inch)	500, 710, 1000, 1400, 2000 (19.69, 27.95, 39.37, 55.12, 78.74)	500, 710, 1000, 1400, 2000 (19.69, 27.95, 39.37, 55.12, 78.74)	355, 500, 710, 1000, 1400 (13.98, 19.69, 27.95, 39.37, 55.12)	355, 500, 710, 1000 (13.98, 19.69, 27.95, 39.37)
Nominal length N min. / max. mm (inch)	100 / 5000 (3.94 / 196.85)	100 / 2000 (3.94 / 78.74)	100 / 2000 (3.94 / 78.74)	100 / 1400 (3.94 / 55.12)

- 1) Metal thermowell
- 2) Insulating rod
- 3) Thermocouple
- 4) Ceramic inner tube

## 2.2 SensyTemp TSH200 temperature sensor

Design	AK	AKK	BK
	<p>A00161</p>	<p>A00162</p>	<p>A00163</p>
Connection heads	A, AUS, AUZ, AUZH	A, AUS, AUZ, AUZH	B, BUS, BUZ, BUZH
Thermowell	Ceramic thermowell	Ceramic thermowell	Ceramic thermowell
Inner tube	without	Ceramic inner tube	without
Standard nominal length N mm (inch)	500, 710, 1000, 1400, 2000 (19.69, 27.95, 39.37, 55.12, 78.74)	500, 710, 1000, 1400 (19.69, 27.95, 39.37, 55.12)	355, 500, 710, 1000 (13.98, 19.69, 27.95, 39.37)
Nominal length N min. / max. mm (inch)	K + 100 (3.94) / 2000 (78.74)	K + 100 (3.94) / 2000 (78.74) <sup>1)</sup>	100 (3.94) / 1400 (55.12)

<sup>1)</sup>With thermowell C799, Ø 15 x 2.5 mm and thermowell C610, Ø 16 x 2: N<sub>max</sub> = 1400 mm

(With thermowell C799, Ø 0.59 x 0.10 inch and thermowell C610, Ø 0.63 x 0.08 inch: N<sub>max</sub> = 55.12 inch)

- 1) Ceramic thermowell
- 2) Insulating rod
- 3) Thermocouple
- 4) Ceramic inner tube
- 5) Holding tube

**2.3 SensyTemp TSH250 temperature sensor**

Design	AK-P	AK-P-MP	BK-PS
Connection heads	A, AUS, AUZ, AUZH	A, AUS, AUZ, AUZH	B, BUS, BUZ, BUZH
Thermowell	Ceramic thermowell	Ceramic thermowell	Ceramic thermowell
Measuring tip	Platinum sleeve	Platinum sleeve / 3-way stage thermocouple (Multipoint)	Platinum sleeve, screwed
Standard nominal length N mm (inch)	500, 710, 1000 (19.69, 27.95, 39.37)	500, 710, 1000 (19.69, 27.95, 39.37)	500, 710, 1000 (19.69, 27.95, 39.37)
Nominal length N min. / max. mm (inch)	K + 100 (3.94) / 1400 (55.12)	K + 100 (3.94) / 1400 (55.12)	K + 100 (3.94) / 1400 (55.12)

- |                       |                              |
|-----------------------|------------------------------|
| 1) Ceramic thermowell | 5) Holding tube              |
| 2) Insulating rod     | 6) Lock nut                  |
| 3) Thermocouple       | 7) Platinum sleeve           |
| 4) Ceramic inner tube | 8) Ceramic intermediate tube |

### 3 General information

The permissible load for a temperature sensor depends on several factors:

Medium-specific factors	Installation-specific factors
<ul style="list-style-type: none"> <li>- Medium</li> <li>- Viscosity</li> <li>- Flow rate</li> <li>- Pressure</li> <li>- Temperature</li> </ul>	<ul style="list-style-type: none"> <li>- Thermowell material:</li> <li>- Thermowell form</li> <li>- Insertion depth</li> <li>- Sealable pressure of process connection</li> <li>- Vibration</li> </ul>

Considering the wide range of configuration options, it is not possible to provide generally applicable information. The following information provides recommended values. For conditions that vary significantly from those described herein, contact your ABB partner.

#### 3.1 Ambient temperature at connection head

Connection head without transmitter	-40 ... 150 °C (-40 ... 302 °F)
Connection head with transmitter	-40 ... 85 °C (-40 ... 185 °F)

In specific applications, high temperature sensors are frequently subjected to higher temperatures at the connection head. For this reason, ABB high temperature sensors in the SensyTemp TSH200 series are equipped with a silicon clamping ring instead of a rubber clamping ring at the cable entry (M20 x 1.5 thread) on the connection heads. This increases the permissible ambient temperature from 80 °C (176 °F) to 150 °C (302 °F).

#### 3.2 Process temperature

The maximum process temperature depends on the thermocouple and thermowell material.

The long-term stability is considerably better for thermocouples with thicker wires than for wires with small diameters. For this reason, whenever possible we equip our base metal thermocouples with 2.5 mm (0.10 inch) wire diameters instead of 1.38 mm (0.05 inch). For precious metal thermocouples, we provide wire diameters of 0.5 mm (0.02 inch) as standard. Precious metal thermocouples with wire diameters of 0.35 mm (0.01 inch) are also available upon request.

Recommended max. operating temperature depending on wire diameter:

Thermocouple	Wire Ø mm (inch)	Max. temperature
J	1,38 (0.05)	600 °C (1112 °F)
	2,5 (0.10)	700 °C (1292 °F)
K	1,38 (0.05)	1000 °C (1832 °F)
	2,5 (0.10)	1200 °C (2192 °F)
N	1,38 (0.05)	1000 °C (1832 °F)
	2,5 (0.10)	1200 °C (2192 °F)
R	0,35 (0.01)	1300 °C (2372 °F)
	0,5 (0.02)	1600 °C (2912 °F)
S	0,35 (0.01)	1300 °C (2372 °F)
	0,5 (0.02)	1600 °C (2912 °F)
B	0,35 (0.01)	1400 °C (2552 °F)
	0,5 (0.02)	1800 °C (3272 °F)



#### Important

For type K thermocouples, there is a risk of selective chromic oxidation on the NiCr side (also called green rot) between 800 °C (1472 °F) and 1000 °C (1832 °F) under oxygen-deficient, neutral or reducing atmospheres combined with moisture. The measurement errors resulting from green rot can amount to 100 K. If the operating temperature is consistently in this range, we recommend that you use type N thermocouples, which demonstrate considerably higher stability and oxidation resistance at high temperatures as a result of their silicon alloy. As an alternative, a measuring inset with mineral-insulated, plastic-sheathed cable (SensyTemp TSA101) with 8 mm (0.31 inch) diameter and type K thermocouple can be used upon request.

For temperatures above 1200 °C (2192 °F), only a precious metal thermocouple can be used. With precious metal thermocouples, however, there is a risk of contamination by foreign substances from the environment, e.g., from the ceramic thermowell or inner tube as well as the insulating rod. This risk increases with the temperature. Typical platinum poisons are silicon and phosphor, which are diffused more rapidly at temperatures above 1000 °C (1832 °F).

To prevent this use only high purity aluminum oxide (Al<sub>2</sub>O<sub>3</sub>), with minimal traces of silicon, for the thermowell and inner tube material. ABB uses high purity ceramic C799 as standard material for the insulating rod in precious metal thermocouples. We recommend that you select this material, at least, for the inner tube and, if possible, for the thermowell as well.

### 3.3 Process pressure

High temperature sensors are generally designed for use in pressureless processes.

When mounting the temperature sensor using stop flanges and counter flanges, a pressure of up to approx. 1 bar (14.50 psi) of gas-tightness can be expected with proper installation.

### 3.4 Measuring accuracy of thermocouples

The accuracy of measurements using ABB standard thermocouples corresponds to the international standard IEC 584 / EN 60584. The tolerance information can be found in the "Tolerance classes" table.

#### Tolerance classes

##### Base metal thermocouples

Standard	TE type	Class	Temperature range	Maximum deviation	Color recognition for compensating line
EN 60584 / IEC 584	K (NiCr-Ni)	2	-40 ... 333 °C (-40 ... 631 °F)	± 2,5 °C (± 37 °F)	- white + green Sheathing green
			333 ... 1200 °C (631 ... 2192 °F)	± 0,0075 x [t] (± 32.0135 °F x [t])	
		1	-40 ... 375 °C (-40 ... 707 °F)	± 1,5 °C (± 35 °F)	
			375 ... 1000 °C (707 ... 1832 °F)	± 0,0040 x [t] (± 32.0072 °F x [t])	
	J (Fe-CuNi)	2	-40 ... 333 °C (-40 ... 631 °F)	± 2,5 °C (± 37 °F)	- white + black Sheathing black
			333 ... 750 °C (631 ... 1382 °F)	± 0,0075 x [t] (± 32.0135 °F x [t])	
		1	-40 ... 375 °C (-40 ... 707 °F)	± 1,5 °C (± 35 °F)	
			375 ... 750 °C (707 ... 1382 °F)	± 0,0040 x [t] (± 32.0072 °F x [t])	
	N (NiCrSi-NiSi)	2	-40 ... 333 °C (-40 ... 631 °F)	± 2,5 °C (± 37 °F)	- white + pink Sheathing pink
			333 ... 1200 °C (631 ... 2192 °F)	± 0,0075 x [t] (± 32.0135 °F x [t])	
		1	-40 ... 375 °C (-40 ... 707 °F)	± 1,5 °C (± 35 °F)	
			375 ... 1000 °C (707 ... 1832 °F)	± 0,0040 x [t] (± 32.0072 °F x [t])	

##### Precious metal thermocouples

Standard	TE type	Class	Temperature range	Maximum deviation	Color recognition for compensating line
EN 60584 / IEC 584	S (Pt10Rh-Pt)	2	0 ... 600 °C (32 ... 1112 °F)	± 1,5 °C (± 35 °F)	- white + orange Sheathing orange
			600 ... 1600 °C (1112 ... 2912 °F)	± 0,0025 x [t] (± 32.0045 x [t])	
		1	0 ... 1100 °C (32 ... 2012 °F)	± 1,0 °C (± 32 °F)	
			1100 ... 1600 °C (2012 ... 2912 °F)	± (1 + 0,003 x ([t] - 1100)) (± (1+32.0054 °F x [t] - 2012))	
	R (Pt13Rh-Pt)	2	0 ... 600 °C (32 ... 1112 °F)	± 1,5 °C (± 35 °F)	- white + orange Sheathing orange
			600 ... 1600 °C (1112 ... 2912 °F)	± 0,0025 x [t] (± 32.0045 x [t])	
		1	0 ... 1100 °C (32 ... 2012 °F)	± 1,0 °C (± 32 °F)	
			1100 ... 1600 °C (2012 ... 2912 °F)	± (1 + 0,003 x ([t] - 1100)) (± (1 + 32.0054 °F x [t] - 2012))	
	B (Pt30Rh-Pt6Rh)	3	600 ... 800 °C (1112 ... 1472 °F)	± 4,0 °C (± 39 °F)	- white + gray Sheathing gray
			800 ... 1700 °C (1472 ... 3092 °F)	± 0,005 x [t] (± 32.0090 °F x [t])	
		2	600 ... 1700 °C (1112 ... 3092 °F)	± 0,0025 x [t] (± 32.0045 x [t])	



### **3.5 Measurement accuracy of mounted transmitter**

For information on transmitter accuracy, refer to the documentation on transmitters.

### **3.6 Response times**

For thermocouples in high temperature applications, the response time is not typically relevant, since the temperature fluctuations normally occur over an extended period of time.

### **3.7 Self-heating**

For thermocouples, there is no self-heating.

### 3.8 Installation instructions

Gas-tight ceramic materials are typically only resistant to temperature changes on a limited basis. To reduce the risk of temperature shock and prevent the thermowell from subsequently bursting, temperature sensors with gas-tight ceramic thermowells must be heated before installation.

A gradual immersion in the hot zone can help prevent damage due to major temperature changes.

At high temperatures, we recommend installing temperature sensors in vertical position to protect against bending and mechanical damage to the thermowell.

If the sensor has to be installed in a horizontal position, ensure that the thermowell is supported.

#### 3.8.1 Gas-tight installation

##### 3.8.1.1 SensyTemp TSH210

Gas-tightness up to 1 bar (14.50 psi) can be achieved with a threaded socket or a combination of stop flange / counter flange.

- The threaded socket is attached and simultaneously sealed by clamping the gland seal to the metal thermowell.
- When using the stop flange / counter flange configuration, the unit is clamped between the stop flange and the metal thermowell. A gland seal between counter flange and metal thermowell provides the seal.

The installation length is customizable for both models.

##### SensyTemp TSH210 sample installation

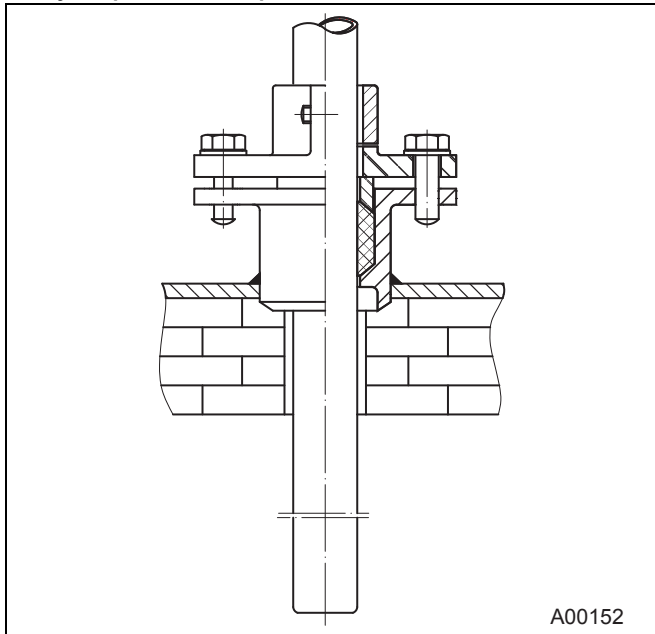


Fig. 1

##### 3.8.1.2 SensyTemp TSH220 / SensyTemp TSH250

Gas-tightness up to 1 bar (14.50 psi) can be achieved only with a combination of stop flange / counter flange.

- When using the stop flange / counter flange configuration, the unit is clamped between the stop flange and the metal holding tube. A gland seal between counter flange and ceramic thermowell provides the seal.

The installation length can be modified only minimally. This must be taken into consideration when ordering.

##### SensyTemp TSH220 sample installation

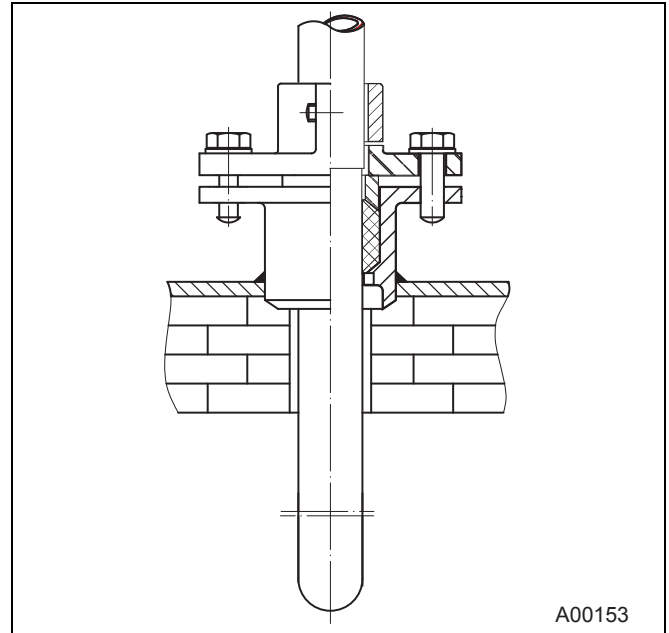


Fig. 2



#### Note

When installing this temperature sensor using a threaded socket, the gland seal is clamped to the metal holding tube to simultaneously mount and seal the unit. Since the ceramic thermowell is transitioned to the holding tube in process, a gas-tightness of 1 bar (14.50 psi) cannot be ensured.

## 4 Connection heads

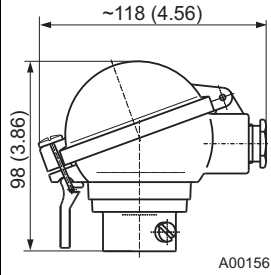
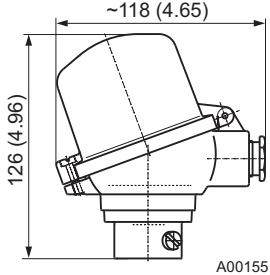
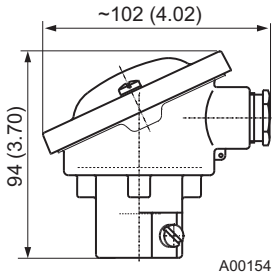
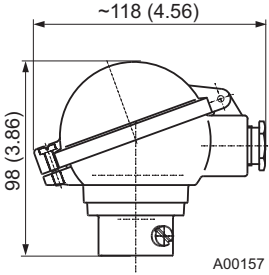
### Functions of the connection head

- Housing of a transmitter or a terminal block
- Protect the connection area against adverse environmental effects

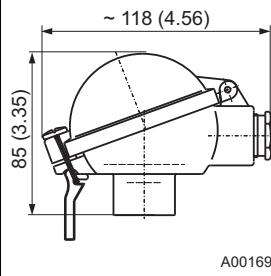
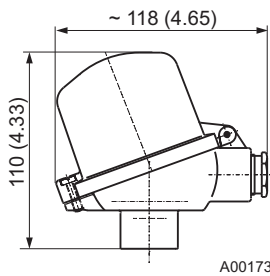
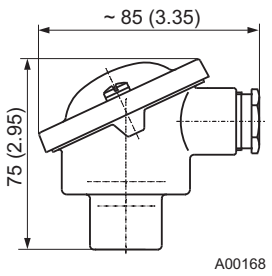
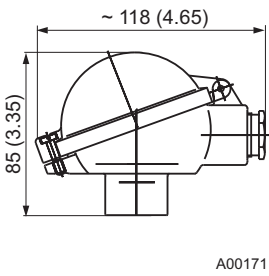
All ABB connection heads in forms A, AUS, AUZ and AUZH ensure a minimum protection class of IP 54 in combination with an ABB thermowell or holding tube and the standard cable entry M20 x 1.5. Thermocouples with these connection heads can also be designed in protection class IP 65. With this option the thermocouples are no longer interchangeable.

The ABB connection heads in forms B, BUS, BUZ and BUZH ensure a minimum protection class of IP 65 in combination with an ABB thermowell or holding tube and the standard cable entry M20 x 1.5.

The following connection heads belong to the SensyTemp TSH200 series of temperature sensors:

Head form	AUS	AUZH	A	AUZ
				
Material	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated
Cover locking system	Hinged cover with quick couplings	Upper hinged cover	Screwed cover	Hinged cover
Transmitter installable	No	Yes	No	No
Standard housing protection system	IP 54 Optional: IP 65			
Thermocouple designs	AM, AMK, AK, AKK, AK-P, AK-P-MP			

Values in mm (inch)

Head form	BUS	BUZH	B	BUZ
				
Material	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated
Cover locking system	Hinged cover with quick couplings	Upper hinged cover	Screwed cover	Hinged cover
Transmitter installable	No	Yes	No	No
Standard housing protection system	IP 65			
Thermocouple designs	BM, BMK, BK, BK-PS			

Values in mm (inch)

## 5 Holding tube

The metal holding tube is the component between the ceramic thermowell and connection head.

The non-mechanical load carrying ceramic thermowell is cemented into the holding tube with a fire-resistant ceramic compound.

### Functions of the holding tube

- Provide a robust mechanical process connection between temperature sensor and ceramic thermowell.
- Bridge existing insulation
- Cooling section between the connection head and medium that protects the connecting point and built-in electronics against high temperatures.

### **i** Important

ABB uses stainless steel material 1.4571 (AISI 316 Ti) in its holding tube instead of the usual unalloyed steel 1.0305 (St 35.8). As a result, the holding tube can be used in areas with significantly higher temperatures.

If the holding tube is protruding directly into the combustion chamber, heat-resistant steel 1.4841 (AISI 314) can be used as an alternative.

For thermocouples in the BK-PS design, the platinum sleeve is screwed directly onto the holding tube without ceramic intermediate pipe. Since temperatures are very high in this type of application, heat-resistant steel 1.4841 (AISI 314) is generally used for the holding tube.

The diameter of the holding tube and standard lengths depend on the diameter of the ceramic thermowell. ABB uses standard dimensions from EN 50446.

In order to prevent the connection head or built-in transmitter from heating up improperly, a longer holding tube may be necessary.

The diagram in fig. 3 shows the increase in temperature in the connection head compared to the ambient temperature depending on the temperature at the process connection.

This diagram can be used for orientation when measuring the holding tube length. In actual applications, the values may differ considerably.

The operator is responsible for ensuring that the max. temperature in the connection head is maintained. This applies, in particular, to explosion risk areas.

### Effect of extension tube length K mm (inch) on the temperature in connection head $T_{Head}$ °C (°F) compared to ambient temperature

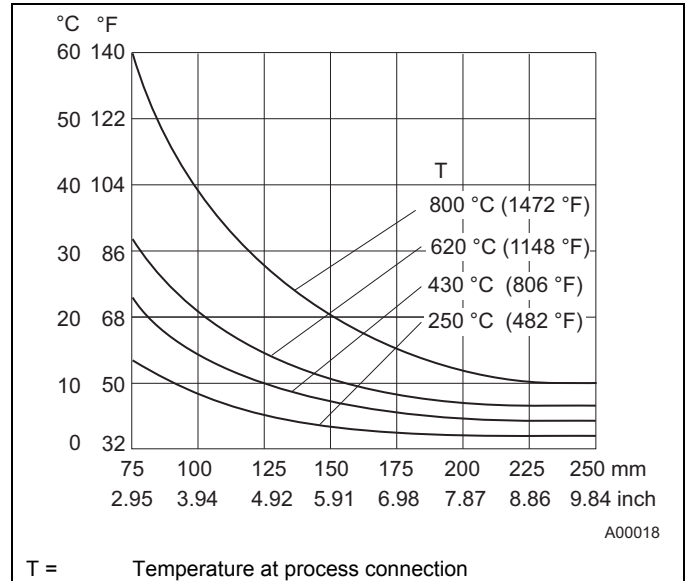


Fig. 3

## 6 Process connections

The unit is mounted primarily via releasable, sliding fasteners that are sealed using a gland seal:

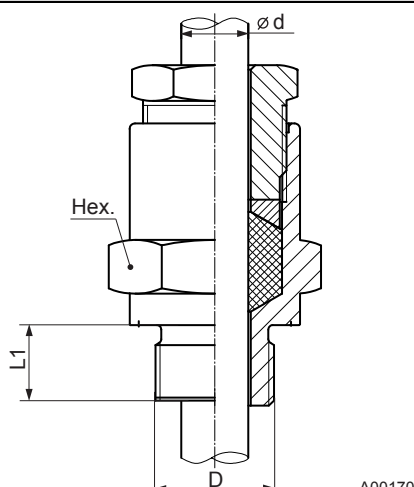
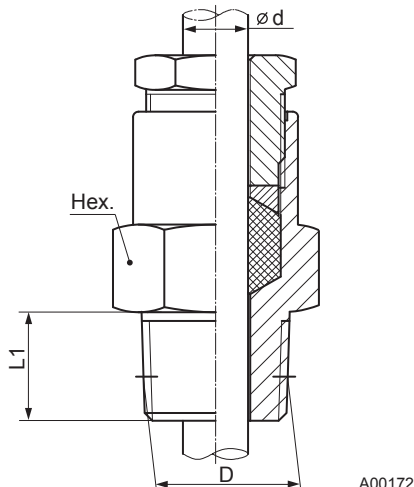
- Threaded socket for screw-in connection
- Stop flange with counter flange for weld-on connection

A gas-tightness of up to approx. 1 bar (14.50 psi) can be achieved for these elements with proper installation.

Another option is to mount the unit using stop flanges without counter flanges. This installation version is not gas-tight.

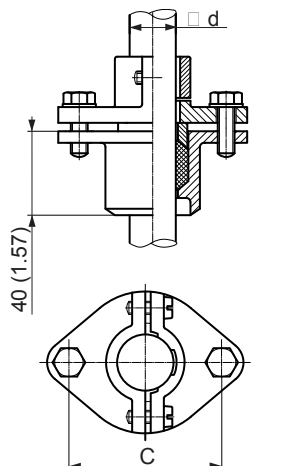
As an alternative, the unit can be shipped with welded standard flanges. For temperature sensors with ceramic thermowell (SensyTemp TSH220 and SensyTemp TSH250), the installation length includes the flange that must be welded to the holding tube. As a result, these designs are also not gas-tight.

### 6.1 Threaded socket

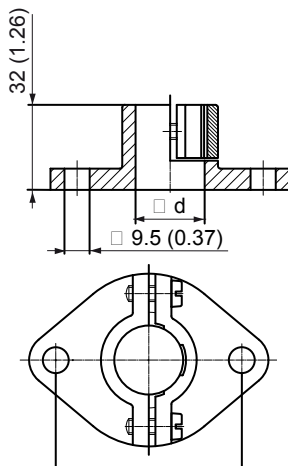
Threaded socket	Thermowell Ø / holding tube Ød mm (inch)	Thread size D	L1 mm (inch)	Hex.
	15 (59)	G 1/2	18 (64)	36
		G 3/4	18 (64)	41
		G 1	25 (77)	45
	22 (72)	G 1	25 (77)	45
	26 (79)	G 1 1/4	30 (86)	55
	26,7 (80.06)	G 1 1/4	30 (86)	55
	15 (59)	1/2 NPT	19 (66)	36
		3/4 NPT	20 (68)	41
		1 NPT	25 (77)	45
	22 (72)	1 NPT	25 (77)	45
	26 (79)	1 1/4 NPT	26 (79)	55
	26,7 (80.06)	1 1/4 NPT	26 (79)	55
	32 (90)	1 1/4 NPT	26 (79)	55

### 6.2 Stop flange with counter flange

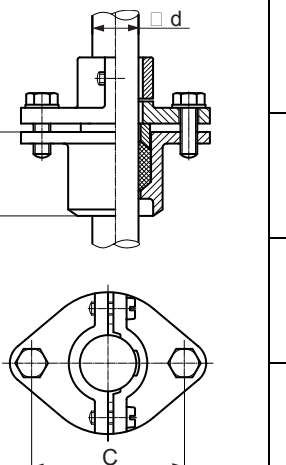
#### Metal thermowells (TSH210)

Stop flange with counter flange	Metal thermowell Ø mm (inch)	c mm (inch)
	15 (59)	55 (131)
	22 (72)	70 (158)
	26 (79)	70 (158)
	26,7 (80.06)	70 (158)
	32 (90)	70 (158)

### 6.3 Stop flange

Stop flange	Thermowell - Ø Holding tube - Ø mm (inch)	c mm (inch)
	15 (59)	55 (131)
	22 (72)	70 (158)
	26 (79)	70 (158)
	26,7 (80.06)	70 (158)
	32 (90)	70 (158)

#### Ceramic thermowells (TSH220/250)

Stop flange with counter flange	Ceramic thermowell Ø mm (inch)	Holding tube Ø mm (inch)	c mm (inch)
	15 (59)	22 (72)	70 (158)
	16 (61)	22 (72)	70 (158)
	24 (75)	32 (90)	70 (158)
	26 (79)	32 (90)	70 (158)

## 6.4 Welded standard flanges

When selecting a welded flange, keep in mind that the installation length must be listed in the order and cannot be changed.

With the SensyTemp TSH210 temperature sensor, the flange can be welded onto any position on the thermowell. The following applies for installation length U:

$U_{min.} = 100 \text{ mm}$ ,  $U_{max.} = N - 50 \text{ mm}$ .

$U_{min.} = 3.94 \text{ inch}$ ,  $U_{max.} = N - 1.97 \text{ inch}$ .

For SensyTemp TSH220 and SensyTemp TSH250 temperature sensors, the flange is welded on the holding tube, which limits installation length:

- TSH220:  $U_{min.} = N - K$ ,  $U_{max.} = N - 50 \text{ mm}$
- TSH220:  $U_{min.} = N - K$ ,  $U_{max.} = N - 1.97 \text{ inch}$
- TSH250, design AK - P und AK - P - MP:  $U_{min.} = N - K$ ,  
 $U_{max.} = N - 50 \text{ mm}$
- TSH250, design AK-P und AK - P - MP:  $U_{min.} = N - K$ ,  
 $U_{max.} = N - 1.97 \text{ inch}$
- TSH250, design BK - PS:  $U_{min.} = N - K + 50$ ,  $U_{max.} = N - 50 \text{ mm}$
- TSH250, design BK - PS:  $U_{min.} = N - K + 50$ ,  $U_{max.} = N - 1.97 \text{ inch}$

ABB uses stainless steel 1.4571 (AISI 316 TI) as standard material.

The following standard flange sizes are available:

EN1092-1, Form B1	DN 32 / PN 6
	DN 40 / PN 40
	DN 50 / PN 40
ANSI / ASME B16.5, Form RF	1.5" / 150 lbs.
	2" / 150 lbs.

## 7 Thermowell / inner tube

### Thermowell functions

- Protect the thermocouple from contamination by aggressive media
- Replacement or recalibration of the measuring unit without process interruption

Depending on the medium and temperature, several different materials are available.

The thermowells are divided into two categories:

- Thermowells made of metal (SensyTemp TSH210)
- Thermowells made of ceramics (SensyTemp TSH220 / SensyTemp TSH250)

### Functions of the inner tube

- Additional protection for the thermocouple from contamination by aggressive media, especially with precious metal thermocouples
- Additional protection of thermocouples at high temperatures
- Support thermowell at high temperatures

For inner tubes, gas-tight ceramic tubes are used:

- Ceramic C610: as standard inner tube for base metal thermocouples
- Ceramic C799 of high purity aluminum oxide. We recommend generally using inner tubes made of C799 with precious metal thermocouples to prevent contamination of thermocouples.



### Important

When selecting the insertion and nominal lengths, ABB recommends that you refer to the standard lengths. This ensures cost benefits and short delivery times based on proper parts inventory. Ceramic thermowells or inner tubes are available in diameters of maximal lengths of 1000 mm (39.37 inch) to 2000 mm (78.74 inch).

When selecting the installation length, take into consideration potential temperature increases at the connection head (see Chapter "Holding tubes")

**7.1 SensyTemp TSH210 temperature sensor**

					Base metal - thermocouples		Precious metal - thermocouples				
Design	Thermowell	Thermowell - Ø mm (inch)	Ceramic Inner tube	Thermowell - Ø mm (inch)	Insulating rod - Ø mm (inch)	Thermocouple wire - Ø mm (inch)	Insulating rod - Ø mm (inch)	Thermocouple wire - Ø mm (inch)			
AM	1.4571	22 x 2 (0.87 x 0.08)	-		10,5 (0.41)	2,5 (0.10)					
	1.4749	26 x 4 (1.02 x 0.16)									
	1.4841	22 x 2 (0.87 x 0.08)									
		32 x 2 (1.26 x 0.08)									
	Kanthal AF	22 x 2 (0.87 x 0.08)									
	Inconel 601	26,7 x 2,9 (1.05 x 0.11)									
AMK	1.4571	22 x 2 (0.87 x 0.08)	C610	16 x 2 (0.63 x 0.08)	10,5 (0.41)	2,5 (0.10)	8,5 (0.33)	0,5 (0.02)			
	1.4749		C799	15 x 2,5 (0.59 x 0.10)	-						
		26 x 4 (1.02 / 0.16)	C610	16 x 2 (0.63 x 0.08)	10,5 (0.41)	2,5 (0.10)					
			C799	15 x 2,5 (0.59 x 0.10)	-						
		1.4841	22 x 2 (0.87 x 0.08)	C610	16 x 2 (0.63 x 0.08)	10,5 (0.41)			2,5 (0.10)		
	C799			15 x 2,5 (0.59 x 0.10)	-						
	32 x 2 (1.26 x 0.08)		C610	16 x 2 (0.63 x 0.08)	10,5 (0.41)	2,5 (0.10)					
			C799	15 x 2,5 (0.59 x 0.10)	-						
	Kanthal AF	22 x 2 (0.87 x 0.08)	C610	16 x 2 (0.63 x 0.08)	10,5 (0.41)	2,5 (0.10)					
			C799	15 x 2,5 (0.59 x 0.10)	-						
	Inconel 601	26,7 x 2,9 (1.05 x 0.11)	C610	16 x 2 (0.63 x 0.08)	10,5 (0.41)	2,5 (0.10)					
			C799	15 x 2,5 (0.59 x 0.10)	-						
	BM	1.4571	15 x 2 (0.59 x 0.08)	-		6,5 (0.26)			1,38 (0.05)	-	
		1.4749									
		1.4841									
	BMK	1.4571	15 x 2 (0.59 x 0.08)	C610	10 x 1,5 (0.39 x 0.06)	6,5 (0.26)			1,38 (0.05)	5,5 (0.22)	0,5 (0.02)
		1.4749		C799	10 x 2 (0.39 x 0.06)	-					
				C610	10 x 1,5 (0.39 x 0.06)	6,5 (0.26)			1,38 (0.05)		
1.4841		C799		10 x 2 (0.39 x 0.06)	-						



**7.2 SensyTemp TSH220 temperature sensor**

						Base metal - thermocouples		Precious metal - thermocouples			
Design	Thermo well	Thermo-well Ø mm (inch)	Ceramic Inner tube	Inner tube Ø mm (inch)	Holding tube - Ø / Standard length K mm (inch)	Insulating rod Ø mm (inch)	Thermocouple wire Ø mm (inch)	Insulating rod Ø mm (inch)	Thermocouple wire Ø mm (inch)		
AK	C530	26 x 4 (1.02 x 0.16)	-		32 x 2 / 200 (1.26 x 0.08 / 7.87)	10,5 (0.41)	2,5 (0.10)	-			
	C610	16 x 2 (0.63 x 0.08)			22 x 2 / 150 (0.87 x 0.08 / 5.91)						
		24 x 2,5 (0.94 x 0.10)			32 x 2 / 200 (1.26 x 0.08 / 7.87)						
	C799	15 x 2,5 (0.59 x 0.10)			22 x 2 / 150 (0.87 x 0.08 / 5.91)	-					
		24 x 3 (0.94 x 0.12)			32 x 2 / 200 (1.26 x 0.08 / 7.87)						
	AKK	C530			26 x 4 (1.02 x 0.16)	C610	16 x 2 (0.63 x 0.08)	32 x 2 / 200 (1.26 x 0.08 / 7.87)	10,5 (0.41)	2,5 (0.10)	8,5 (0.33)
C799			15 x 2,5 (0.59 x 0.10)								
C610		16 x 2 (0.63 x 0.08)	C610	10 x 1,5 (0.39 x 0.06)	22 x 2 / 150 (0.87 x 0.08 / 5.91)	-		5,5 (0.22)			
			C799	10 x 2 (0.39 x 0.08)							
		24 x 2,5 (0.94 x 0.10)	C610	16 x 2 (0.63 x 0.08)	32 x 2 / 200 (1.26 x 0.08 / 7.87)			10,5 (0.41)	2,5 (0.10)	8,5 (0.33)	
			C799	15 x 2,5 (0.59 x 0.10)				-			
C799		15 x 2,5 (0.59 x 0.10)	C799	8 x 1,5 (0.31 x 0.06)	22 x 2 / 150 (0.87 x 0.08 / 5.91)	-		4,0 (0.16)			
		24 x 3 (0.94 x 0.12)		15 x 2,5 (0.59 x 0.10)	32 x 2 / 200 (1.26 x 0.08 / 7.87)	-		8,5 (0.33)			
BK		C610	10 x 1,5 (0.39 x 0.06)	-		15 x 2 / 80 (0.59 x 0.08 / 3.15)	6,5 (0.26)	1,38 (0.05)	5,5 (0.22)		
		C799	8 x 1,5 (0.31 x 0.06)				-		4,0 (0.16)		
	10 x 2 (0.39 x 0.08)		-				5,5 (0.22)				

### 7.3 SensyTemp TSH250 temperature sensor

							Precious metal thermocouples	
Design	Pt sleeve	Ø Pt sleeve mm (inch)	Thermowell	Thermowell - Ø mm (inch)	Intermediate tube - Ø mm (inch)	Holding tube - Ø / Standard length K mm (inch)	Insulating rod - Ø mm (inch)	Thermocouple wire - Ø mm (inch)
AK-P	FKS-PtRh 10 %	9,1 x 0,5 (0.36 x 0.02)	C799	8 x 1,5 (0.31 x 0.06)	15 x 2	22 x 2 / 150	4,0 (0.16)	0,5 (0.02)
AK-P-MP					(0.59 x 0.08)	(0.87 x 0.08 / 5.91)		
BK-PS					-	15 x 2 / 150 (0.59 x 0.08 / 5.91)		

## i

### Important

SensyTemp TSH250 temperature sensors are used in high temperature applications, especially in the glass industry for measuring temperature in glass melting. Because of the high temperatures and aggressive substances, ceramic thermowells with a platinum finish are used. Use of platinum in reducing atmospheres is not typically recommended. With the high temperatures found, e.g., in glass melting, coarse grains may form in the platinum, resulting in textural damage. This can quickly lead to cracks in components. Use of fine grain stabilization (also known as dispersion hardening) eliminates this risk. Finely dispersed oxide is incorporated in the metallic matrix of each individual crystallite. This ensures that the cold solidified state of the metal, with its high mechanical strength values, is maintained even at high temperatures approaching the melting point.

For this reason, ABB uses a fine grain stabilized (FGS) platinum-rhodium alloy (FGS-PtRh 10 %).

Since pure platinum is very soft, components made of pure platinum lose their strength and form stability at temperatures from 700 °C ... 1000° C (1292 ... 1832 °F). As a result, platinum is hardened by adding small amounts of rhodium to achieve higher form stability, increased chemical resistance, and longer service life. The mechanical, thermal and corrosive resistance increases as the percentage of rhodium is increased. On the other hand, rhodium has a high market price. A content of 10 % rhodium has shown itself to provide a good compromise between service life and purchase cost.

## 7.4 Thermowell materials

The following table provides an overview of the main thermowell materials as well as their properties and application areas.

All information is not binding and does not represent guaranteed properties. Even minor variations in process parameters can considerably influence the resistance. They therefore must be checked closely for each application. We recommend that for special applications you contact your ABB partner.

	Material	Max. temperature depressurized in air		Strengths	Weaknesses	Areas of application
		°C	°F			
TSH210 / metal thermowells	1.0305 (St 35.8)	550	1022	Average resistance to nitrogenous and oxygen-deficient gases	Low resistance to sulfurous gases	Tempering furnaces, zinc smelting 480 °C (896 °F)
	1.4571 (AISI 316 Ti / X6CrNiMoTi17-12-2)	800	1472	Average resistance to nitrogenous and oxygen-deficient gases	Low resistance to sulfurous gases	Tempering furnaces, chemically aggressive steams, with the exception of hydrochloric acid and sulfur dioxide steams
	1.4762 (AISI 446 / X10CrAl24)	1150	2102	Very high resistance to sulfurous gases	Low resistance to nitrogenous gases, Tubes with longitudinal seam weld -> Risk of cracks resulting from embrittlement	Reheating and hardening furnaces with sulfurous and carboniferous gases, exhaust gas channels, zinc smelting 480 °C (896 °F)
	1.4749 (~AISI 446 / X18CrN28)	1150	2102	Very high resistance to sulfurous gases	Low resistance to nitrogenous gases	Reheating and hardening furnaces with sulfurous and carboniferous gases, exhaust gas channels, zinc smelting 480 °C (896 °F)
	1.4841 (AISI 314 / X15CrNiSi25-20)	1150	2102	High resistance to nitrogenous and oxygen-deficient gases	Low resistance to sulfurous gases	Industrial furnaces, combustion chambers, air-circulation furnaces, petrochemicals, cyan baths, Aluminum smelting 700 °C (1292 °F), Lead smelting 700 °C 1292 °F, Copper-zinc alloys 900 °C (1952 °F)
	Inconel 600 (2.4816 / NiCr15Fe)	1150	2102	Good oxidation resistance at temperatures up to 1050 °C (1922 °F) and excellent resistance to stress corrosion cracking based on high nickel content.	Very low resistance to sulfurous gases	Industrial furnaces
	Inconel 601 (2.4851 / NiCr23Fe)	1200	2192	Good resistance to aggressive gases and high temperatures in oxidizing atmospheres up to 1150 °C (2102 °F).	Low resistance to sulfurous gases	Industrial furnaces
	Kanthal AF (1.4767)	1350	2462	High resistance to sulfurous gases, high resistance to wear and tear, high thermal resistance	Low resistance to nitrogenous gases	Industrial furnaces, waste incineration, glass industry, ceramics and cement industry

	Material	Max. temperature depressurized in air		Strengths	Weaknesses	Areas of application
		°C	°F			
TSH220 / Ceramic thermowells	Ceramic C530 (Al <sub>2</sub> O <sub>3</sub> > 70 %)	1500	2732	Very good resistance to temperature fluctuations	Fine porous, not gas-tight, impact sensitive	Industrial furnaces, use of thermowell with gas-tight inner tube
	Ceramic C610 (Al <sub>2</sub> O <sub>3</sub> > 60 %)	1600	2912	gas-tight, high fire resistance, average resistance to temperature fluctuations	Low Al <sub>2</sub> O <sub>3</sub> purity, non-resistant to alkali steams, impact sensitive	Gas-tight furnaces, diffusion furnaces, industrial furnaces, Use as gas-tight inner tube
	Ceramic C799 (Al <sub>2</sub> O <sub>3</sub> > 99,7 %)	1800	3272	Very gas-tight, high fire resistance, resistant to acids and alkali, resistant to superheated steam, high bending strength	Low resistance to temperature fluctuations, impact sensitive	Industrial furnaces, furnaces with shielding gas, glass tank furnaces, flue-gas desulfurization systems, cement industry, Use as gas-tight inner tube
	Ceramic AL23 (Al <sub>2</sub> O <sub>3</sub> > 99.7 %)	1950	3542	More fine-grained than C799, highest Al <sub>2</sub> O <sub>3</sub> purity, strength and gas-tightness at high temperatures, resistant to hydrofluoric acids and alkali metal oxide steams	Average resistance to temperature fluctuations, impact sensitive	Industrial furnaces, furnaces with shielding gas, glass tank furnaces, flue-gas desulfurization systems, cement industry, Use as gas-tight inner tube
	SSiC (pressureless sintered silicon carbide)	1600	2912	Very gas-tight, very good resistance to temperature fluctuations, very good oxidation resistance, very good resistance to acids and alkali,	impact sensitive	Garbage and residuals incineration
TSH250	Ceramic C799 (Al <sub>2</sub> O <sub>3</sub> > 99 %) with Pt sleeve	1500	2732	Very gas-tight, high fire resistance, resistant to acids and alkali, resistant to superheated steam, high bending strength	Low resistance to temperature fluctuations, impact sensitive	Glass melting






## 8 Transmitter

Installing a transmitter has the following advantages:

- Reduces cost due to less wiring expense
- Stronger sensor signal at measuring point and conversion to standard signal (also increases interference immunity)
- SIL2 with appropriately classified transmitter.

The output signal of a temperature sensor is determined by selecting the corresponding transmitter.

The following output signals are available:

Signal	Transmitter		
	Model	SIL level	Data sheet
4 ... 20 mA, programmable	TH01 		3KDE115080 R1003
4 ... 20 mA, HART	TH02 	SIL2 acc. to IEC61508 / IEC61511	10/11-8.19
4 ... 20 mA, HART extended diagnostics	TTH300 	SIL2 acc. to IEC61508, TÜV certified	DS/TTH300
PROFIBUS PA	TF12 		10/11-8.26
FOUNDATION Fieldbus	TF02 		10/11-8.25



### Important

For additional information, refer to the documentation on transmitters.

## 9 Approvals

### 9.1 Explosion protection approvals

Temperature sensors in the SensyTemp TSH200 series are used applications above 600 °C (1112 °F). For temperatures above 450 °C (842 °F), an Ex zone may not be present.

Temperature sensors in the SensyTemp TSH200 series are therefore not constructed for use in potentially explosive areas. They may only be used in safe areas.

To connect temperature sensors to intrinsically safe devices (e.g., head-mounted transmitters), ABB provides a manufacturer's declaration that certifies the SensyTemp TSH200 series for use in intrinsically safe electrical circuits.



### Important

Special solutions for use in potentially explosive areas are available upon request for actual applications. This requires special designs, which can significantly affect price and delivery time. In case of questions, please contact your ABB partner.

### 9.2 GOST approvals

The TSH temperature sensors are equipped with the following metrological approvals:

- GOST Russia
- GOST Kazakhstan
- GOST Ukraine

## 10 Tests and certificates

To increase the safety and accuracy of your processes, ABB provides a number of mechanical and electrical tests. The results of these tests are certified in accordance with EN 10204.

The following certificates acc. to EN 10204 are provided for temperature sensors in the SensyTemp TSH200 series:

- Certificate of compliance with the order 2.1
- Acceptance test certificate 3.1 for the following checks:
  - Visual, metric and functional checks of temperature sensor
  - Reference measurement for calibrating thermocouple
  - Material confirmation for thermowell material upon request
  - Air-tight at thermowell
- Acceptance test certificate 3.2 is available upon request

For measurements requiring extremely high accuracy, ABB can calibrate the temperature sensor at its own DKD calibration lab.

When DKD calibration is performed, a separate certificate is provided for each temperature sensor.

Reference measurements and DKD calibrations are performed on the thermocouple or, if applicable, on the transmitter.

To obtain accurate measurements, observe the minimum length for thermocouple:

- For temperatures above 450 °C (842 °F): 450 ... 500 mm (17.72 ... 19.69 inch)

These are recommended values. If in doubt, your ABB partner is available for on-site assistance.

For reference measurements and DKD calibration, individual characteristics of the temperature sensor can be calculated and a separate transmitter can be programmed based on freestyle characteristics.

Adjusting the transmitter to the sensor characteristics can considerably improve the measuring accuracy of the temperature sensor. When doing so, perform measurements at a minimum of three different temperatures.

## 11 Precious metal

### Precious metal costs

Precious metals are subject to considerable fluctuations in market price. As a result, the price for precious metal is based on the price on the current day. The net price of the precious metal is included as a separate item. It is subject to confirmation and in case of a contract may differ from the offer price.

### Precious metal recycling

ABB accepts the return of old platinum for reprocessing. After successful reprocessing, we provide a credit note that corresponds to the amount of platinum processed.

Your ABB partner is available to discuss the procedure.

## 12 Additional information

### 12.1 Delivery times

Typical delivery times for small ( $\leq 10$  units) to medium ( $\leq 50$  units) quantities and standard models are 5 ... 20 days, depending on configuration.

### 12.2 Supplementary documents

Device		Data sheet
<b>Temperature transmitter for sensor head mounting</b>		
TH01, TH01-Ex	4 ... 20 mA configurable	3KDE115080R1003
TH02, TH02-Ex	4 ... 20 mA, HART	10/11-8.19
TF12, TF12-Ex	PROFIBUS PA	10/11-8.26
TF02, TF02-Ex	FOUNDATION Fieldbus	10/11-8.25
TTH300	4 ... 20 mA, HART extended diagnostics	DS/TTH300
<b>Field-mounted temperature transmitters with LCD display</b>		
TTF300	4 ... 20 mA, HART extended diagnostics	DS/TTF300
<b>Interchangeable measuring insets</b>		
SensyTemp TSA101		DS/TSA101

### 12.3 Information about ordering information.

The order codes cannot be combined in any order with each other. For questions regarding installation feasibility, contact your ABB partner.

### 13 Ordering information

#### 13.1 SensyTemp TSH210

Straight Thermocouple SensyTemp TSH210	Variant digit No.	1	7	8	9	10	11	12	13	14	15	16	17	18	Code				
	Catalog No.	TSH210-																	
<b>Explosion Protection / Approvals</b>																			
Without		Y 0																	
Manufacturer's declaration for use in safe areas with connection to intrinsic safety electronic (e.g. transmitter)		K 2																	
GOST Russia - Metrological Approval		G 1																	
GOST Kazakhstan - Metrological Approval		G 3																	
GOST Ukraine - Metrological Approval		G 5																	
<b>Thermocouple Design</b>																			
With metal thermowell (Form AM acc. to EN 50446)		A 1																	
With metal thermowell and ceramic inner tube (Form AMK acc. to EN 50446)		A 2																	
With metal thermowell (Form BM acc. to EN 50446)		B 1																	
With metal thermowell and ceramic inner tube (Form BMK acc. to EN 50446)		B 2																	
<b>Material Thermowell / Inner Tube</b>																			
1.4749 (446) / Without inner tube		H 1 0																	
1.4749 (446) / Ceramic C610		H 1 1																	
1.4749 (446) / Ceramic C799		H 1 2																	
1.4841 (314) / Without inner tube		H 3 0																	
1.4841 (314) / Ceramic C610		H 3 1																	
1.4841 (314) / Ceramic C799		H 3 2																	
1.4571 (316Ti) / Without inner tube		S 2 0																	
1.4571 (316Ti) / Ceramic C610		S 2 1																	
Kanthal AF (1.4767) / Without inner tube		H 5 0																	
Kanthal AF (1.4767) / Ceramic C610		H 5 1																	
Kanthal AF (1.4767) / Ceramic C799		H 5 2																	
Inconel 601 / Without inner tube		N 6 0																	
Inconel 601 / Ceramic C610		N 6 1																	
Inconel 601 / Ceramic C799		N 6 2																	
<b>Thermowell Diameter</b>																			
15 x 2 mm (0.59 x 0.08 in.)		M 1																	
22 x 2 mm (0.87 x 0.08 in.)		M 2																	
26 x 4 mm (1.02 x 0.16 in.)		M 3																	
26.7 x 2.9 mm (1.05 x 0.11 in.)		M 6																	
32 x 2 mm (1.26 x 0.08 in.)		M 8																	
<b>Nominal Length</b>																			
N = 355 mm (13.98 in.)		N 1																	
N = 500 mm (19.69 in.)		N 2																	
N = 710 mm (27.95 in.)		N 3																	
N = 1000 mm (39.37 in.)		N 4																	
N = 1400 mm (55.12 in.)		N 5																	
N = 2000 mm (78.74 in.)		N 6																	
Acc. to customer specification		Z 9																	

Continued on next page

Straight Thermocouple SensyTemp TSH210	Variant digit No.	1	7	19	20	21	22	23	24	25	26	27	28	29	Code
	Catalog No.	TSH210-													
<b>Process Connection</b>															
No fitting		Y	0	0											
Adjustable stop flange, cast steel		A	0	8											
Adjustable stop flange and counter Flange, cast Steel		A	0	9											
Adjustable threaded fitting G 1/2 A, carbon steel		A	1	1											
Adjustable threaded fitting G 3/4 A, carbon steel		A	1	2											
Adjustable threaded fitting G 1 A, carbon steel		A	1	3											
Adjustable threaded fitting G 1-1/4 A, carbon steel		A	1	4											
Adjustable threaded fitting 1/2 in. NPT, carbon steel		A	1	6											
Adjustable threaded fitting 3/4 in. NPT, carbon steel		A	1	7											
Adjustable threaded fitting 1 in. NPT, carbon steel		A	1	8											
Adjustable threaded fitting 1-1/4 in. NPT, carbon steel		A	1	9											
Welded flange (1.4571 (AISI 316 Ti))	1)														
DN 32 PN 6, Form B1 acc. to EN 1092-1		F	5	1											
DN 40 PN 10 ... PN 40, Form B1 acc. to EN 1092-1		F	5	3											
DN 50 PN 25 ... PN 40, Form B1 acc. to EN 1092-1		F	5	4											
1-1/2 in. 150 lbs., Form RF acc. to ANSI / ASME B16.5		F	5	6											
2 in. 150 lbs., Form RF acc. to ANSI / ASME B16.5		F	5	7											
<b>Thermocouple Type / Diameter</b>															
1 x Type K - wire diameter 2.5 mm (0.10 in.)		K	1												
2 x Type K - wire diameter 2.5 mm (0.10 in.)		K	2												
1 x Type J - wire diameter 2.5 mm (0.10 in.)		J	1												
2 x Type J - wire diameter 2.5 mm (0.10 in.)		J	2												
1 x Type N - wire diameter 2.5 mm (0.10 in.)		N	1												
2 x Type N - wire diameter 2.5 mm (0.10 in.)		N	2												
1 x Type K - wire diameter 1.38 mm (0.05 in.)		K	5												
2 x Type K - wire diameter 1.38 mm (0.05 in.)		K	6												
1x Type J - wire diameter 1.38mm (0.05 in.)		J	5												
2 x Type J - wire diameter 1.38 mm (0.05 in.)		J	6												
1 x Type N - wire diameter 1.38 mm (0.05 in.)		N	5												
2 x Type N - wire diameter 1.38 mm (0.05 in.)		N	6												
1 x Type S - wire diameter 0.5 mm (0.02 in.)		S	1												
2 x Type S - wire diameter 0.5 mm (0.02 in.)		S	2												
1 x Type R - wire diameter 0.5 mm (0.02 in.)		R	1												
2 x Type R - wire diameter 0.5 mm (0.02 in.)		R	2												
1 x Type B - wire diameter 0.5 mm (0.02 in.)		B	1												
2 x Type B - wire diameter 0.5 mm (0.02 in.)		B	2												
<b>Sensor Accuracy</b>															
Extended accuracy (EN 60584 / IEC 584)									T	1					
Standard accuracy (EN 60584 / IEC 584)									T	2					
<b>Connection Head Type / Material</b>															
AUZ / Aluminium, hinged cover											A	1			
AUZH / Aluminium, high cover, hinged											A	2			
AUS / Aluminium hinged cover with snap lock											A	4			
A / Aluminium											A	6			
BUZ / Aluminium, hinged cover											B	1			
BUZH / Aluminium, high cover, hinged											B	2			
BUS / Aluminium, hinged cover with snap lock											B	4			
B / Aluminium											B	6			
<b>Transmitter</b>															
Without transmitter, measuring inset with ceramic terminal block													Y	1	
TH01 / TH01-Ex, programmable, output signal 4 ... 20 mA													P	1	
TH02 / TH02-Ex, programmable, output signal 4 ... 20 mA, HART													H	1	
TTH300, programmable, output signal 4 ... 20 mA, HART													H	4	
TF12 / TF12-Ex, programmable, output PROFIBUS PA													F	1	
TF02 / TF02-Ex, programmable, output FOUNDATION Fieldbus													F	3	

1) Please specify immersion length



**Additional ordering information**

<b>Straight Thermocouple SensyTemp TSH210</b>	<b>Code</b>			
<b>Additional Tag Plate</b> Stainless steel	I1			
<b>Certificates</b> Declaration of compliance with the order 2.1 acc. to EN 10204 Inspection certificate 3.1 acc. to EN 10204 for visual, dimensional and functional test Inspection certificate 3.1 acc. to EN 10204 for sensor calibration, single thermocouple Inspection certificate 3.1 acc. to EN 10204 for sensor calibration, double thermocouple DKD sensor calibration, single thermocouple, separate calibration certificate per thermometer DKD sensor calibration, double thermocouple, separate calibration certificate per thermometer	C4 C6 CF CG CK CL			
<b>Test Temperatures</b> 400 °C / 752 °F 700 °C / 1292 °F 1000 °C / 1832 °F 400 and 700 °C / 752 and 1292 °F 400 and 1000 °C / 752 and 1832 °F 700 and 1000 °C / 1292 and 1832 °F 400, 700 and 1000 °C / 752, 1292 and 1832 °F Specify test points in °C or °F	GA GB GC GD GE GF GG GZ			
<b>Cable Entry Options</b> 1 x 1/2 in. NPT, without cable gland	U2			
<b>Documentation Language</b> German Italian Spanish French English	M1 M2 M3 M4 M5			
<b>Measuring Range</b> 0 ... 600 °C (32 ... 1112 °F) 0 ... 800 °C (32 ... 1472 °F) 0 ... 1000 °C (32 ... 1832 °F) 0 ... 1200 °C (32 ... 2192 °F) 0 ... 1400 °C (32 ... 2552 °F) 0 ... 1600 °C (32 ... 2912 °F) 0 ... 1800 °C (32 ... 3272 °F) Others	AJ AK AL AM AN AP AR AZ			

2)

2) Please specify measuring range: start value, end value and measuring unit

**13.2 SensyTemp TSH220**

Straight Thermocouple SensyTemp TSH220	Variant digit No.	1 - 7	8	9	10	11	12	13	14	15	16	17	18	Code				
	Catalog No.	TSH220-																
<b>Explosion Protection / Approvals</b>																		
Without																		
Manufacturer's declaration for use in safe areas with connection to intrinsic safety electronic (e.g. transmitter)																		
GOST Russia - Metrological Approval																		
GOST Kazakhstan - Metrological Approval																		
GOST Ukraine - Metrological Approval																		
<b>Thermocouple Design</b>																		
With ceramic thermowell (Form AK acc. to EN 50446)																		
With ceramic thermowell and ceramic inner tube (Form AKK acc. to EN 50446)																		
With ceramic thermowell (Form BK acc. to EN 50446)																		
<b>Material Thermowell / Inner Tube</b>																		
Ceramic C530 / Without inner tube																		
Ceramic C530 / Ceramic C610																		
Ceramic C530 / Ceramic C799																		
Ceramic C610 / Without inner tube																		
Ceramic C610 / Ceramic C610																		
Ceramic C610 / Ceramic C799																		
Ceramic C799 / Without inner tube																		
Ceramic C799 / Ceramic C799																		
<b>Thermowell Diameter</b>																		
8 x 1.5 mm (0.31 x 0.06 in.)																		
10 x 1.5 mm (0.39 x 0.06 in.)																		
10 x 2 mm (0.39 x 0.08 in.)																		
15 x 2.5 mm (0.59 x 0.10 in.)																		
16 x 2 mm (0.63 x 0.08 in.)																		
24 x 2.5 mm (0.94 x 0.10 in.)																		
24 x 3 mm (0.94 x 0.12 in.)																		
26 x 4 mm (1.02 x 0.16 in.)																		
<b>Nominal Length</b>																		
N = 355 mm (13.98 in.)																		
N = 500 mm (19.69 in.)																		
N = 710 mm (27.95 in.)																		
N = 1000 mm (39.37 in.)																		
N = 1400 mm (55.12 in.)																		
N = 2000 mm (78.74 in.)																		
Acc. to customer specification																		

Continued on next page

Straight Thermocouple SensyTemp TSH220	Variant digit No.	1	7	19	20	21	22	23	24	25	26	27	28	29	Code
	Catalog No.	TSH220-													
<b>Support Tube Material</b>															
Stainless steel 1.4571 (AISI 316Ti)		S	2												
Heat resistant steel 1.4841		H	3												
<b>Support Tube Length</b>															
K = 80 mm (3.15 in.)							K	2							
K = 150 mm (5.91 in.)							K	4							
K = 200 mm (7.87 in.)							K	5							
Acc. to customer specification							Z	9							
Stainless steel 1.4571 (AISI 316Ti)							Z	9							
Acc. to customer specification							Z	9							
<b>Process Connection</b>															
No fitting							Y	0	0						
Adjustable stop flange, cast steel							A	0	8						
Adjustable stop flange and counter Flange, cast Steel							A	0	9						
Adjustable threaded fitting G 1/2 A, carbon steel							A	1	1						
Adjustable threaded fitting G 3/4 A, carbon steel							A	1	2						
Adjustable threaded fitting G 1 A, carbon steel							A	1	3						
Adjustable threaded fitting G 1-1/4 A, carbon steel							A	1	4						
Adjustable threaded fitting 1/2 in. NPT, carbon steel							A	1	6						
Adjustable threaded fitting 3/4 in. NPT, carbon steel							A	1	7						
Adjustable threaded fitting 1 in. NPT, carbon steel							A	1	8						
Adjustable threaded fitting 1-1/4 in. NPT, carbon steel							A	1	9						
Welded flange (1.4571 (AISI 316 Ti))															
DN 32 PN 6, Form B1 acc. to EN 1092-1							F	5	1						
DN 40 PN 10 ... PN 40, Form B1 acc. to EN 1092-1							F	5	3						
DN 50 PN 25 ... PN 40, Form B1 acc. to EN 1092-1							F	5	4						
1-1/2 in. 150 lbs., Form RF acc. to ANSI / ASME B16.5							F	5	6						
2 in. 150 lbs., Form RF acc. to ANSI / ASME B16.5							F	5	7						
<b>Thermocouple Type / Diameter</b>															
1 x Type K - wire diameter 2.5 mm (0.10 in.)											K	1			
2 x Type K - wire diameter 2.5 mm (0.10 in.)											K	2			
1 x Type J - wire diameter 2.5 mm (0.10 in.)											J	1			
2 x Type J - wire diameter 2.5 mm (0.10 in.)											J	2			
1 x Type N - wire diameter 2.5 mm (0.10 in.)											N	1			
2 x Type N - wire diameter 2.5 mm (0.10 in.)											N	2			
1 x Type K - wire diameter 1.38 mm (0.05 in.)											K	5			
2 x Type K - wire diameter 1.38 mm (0.05 in.)											K	6			
1 x Type J - wire diameter 1.38 mm (0.05 in.)											J	5			
2 x Type J - wire diameter 1.38 mm (0.05 in.)											J	6			
1 x Type N - wire diameter 1.38 mm (0.05 in.)											N	5			
2 x Type N - wire diameter 1.38 mm (0.05 in.)											N	6			
1 x Type S - wire diameter 0.5 mm (0.02 in.)											S	1			
2 x Type S - wire diameter 0.5 mm (0.02 in.)											S	2			
1 x Type R - wire diameter 0.5 mm (0.02 in.)											R	1			
2 x Type R - wire diameter 0.5 mm (0.02 in.)											R	2			
1 x Type B - wire diameter 0.5 mm (0.02 in.)											B	1			
2 x Type B - wire diameter 0.5 mm (0.02 in.)											B	2			
<b>Sensor Accuracy</b>															
Extended accuracy (EN 60584 / IEC 584)													T	1	
Standard accuracy (EN 60584 / IEC 584)													T	2	

Continued on next page

1) Please specify immersion length

Straight Thermocouple SensyTemp TSH220	Variant digit No.	1	7	30	31	32	33	Code			
	Catalog No.	TSH220-									
<b>Connection Head Type / Material</b>											
AUZ / Aluminium, hinged cover		A	1								
AUZH / Aluminium, high cover, hinged		A	2								
AUS / Aluminium hinged cover with snap lock		A	4								
A / Aluminium		A	6								
BUZ / Aluminium, hinged cover		B	1								
BUZH / Aluminium, high cover, hinged		B	2								
BUS / Aluminium, hinged cover with snap lock		B	4								
B / Aluminium		B	6								
<b>Transmitter</b>											
Without transmitter, measuring inset with ceramic terminal block		Y	1								
TH01 / TH01-Ex, programmable, output signal 4 ... 20 mA		P	1								
TH02 / TH02-Ex, programmable, output signal 4 ... 20 mA, HART		H	1								
TTH300, programmable, output signal 4 ... 20 mA, HART		H	4								
TF12 / TF12-Ex, programmable, output PROFIBUS PA		F	1								
TF02 / TF02-Ex, programmable, output FOUNDATION Fieldbus		F	3								

**Additional ordering information**

<b>Additional Tag Plate</b> Stainless steel	I1			
<b>Certificates</b> Declaration of compliance with the order 2.1 acc. to EN 10204 Inspection certificate 3.1 acc. to EN 10204 for visual, dimensional and functional test Inspection certificate 3.1 acc. to EN 10204 for sensor calibration, single thermocouple Inspection certificate 3.1 acc. to EN 10204 for sensor calibration, double thermocouple DKD sensor calibration, single thermocouple, separate calibration certificate per thermometer DKD sensor calibration, double thermocouple, separate calibration certificate per thermometer	C4 C6 CF CG CK CL			
<b>Test Temperatures</b> 400 °C / 752 °F 700 °C / 1292 °F 1000 °C / 1832 °F 400 and 700 °C / 752 and 1292 °F 400 and 1000 °C / 752 and 1832 °F 700 and 1000 °C / 1292 and 1832 °F 400, 700 and 1000 °C / 752, 1292 and 1832 °F Specify test points in °C or °F	GA GB GC GD GE GF GG GZ			
<b>Cable Entry Options</b> 1 x 1/2 in. NPT, without cable gland	U2			
<b>Documentation Language</b> German Italian Spanish French English	M1 M2 M3 M4 M5			
<b>Measuring Range</b> 0 ... 600 °C (32 ... 1112 °F) 0 ... 800 °C (32 ... 1472 °F) 0 ... 1000 °C (32 ... 1832 °F) 0 ... 1200 °C (32 ... 2192 °F) 0 ... 1400 °C (32 ... 2552 °F) 0 ... 1600 °C (32 ... 2912 °F) 0 ... 1800 °C (32 ... 3272 °F) Others <sup>2)</sup>	AJ AK AL AM AN AP AR AZ			

2) Please specify measuring range: start value, end value and measuring unit

**13.3 SensyTemp TSH250**

Straight Thermocouple SensyTemp TSH250	Variant digit No.	1 - 7	8	9	10	11	12	13	14	15	16	17	18	Code			
	Catalog No.	TSH250-															
<b>Explosion Protection / Approvals</b>																	
Without		<b>Y 0</b>															
Manufacturer's declaration for use in safe areas with connection to intrinsic safety electronic (e.g. transmitter)		<b>K 2</b>															
GOST Russia - Metrological Approval		<b>G 1</b>															
GOST Kazakhstan - Metrological Approval		<b>G 3</b>															
GOST Ukraine - Metrological Approval		<b>G 5</b>															
<b>Thermocouple Design</b>																	
With ceramic thermowell																	
and precious metal sleeve (ABB-Form AK-P)		<b>P 1</b>															
screwed precious metal sleeve (ABB-Form AK-PS)		<b>P 2</b>															
and precious metal sleeve, 3-point Thermoelemnet (ABB-Form AK-P-MP)		<b>P 3</b>															
<b>Material Thermowell</b>																	
Ceramic C799 with platinum sleeve FKS-PtRh10%		<b>C 7 4</b>															
<b>Thermowell Diameter</b>																	
9.1 x 0.5 mm (0.36 x 0.02 in.)		<b>P 1</b>															
<b>Nominal Length</b>																	
N = 500 mm (19.69 in.)		<b>N 2</b>															
N = 710 mm (27.95 in.)		<b>N 3</b>															
N = 1000 mm (39.37 in.)		<b>N 4</b>															
N = 1400 mm (55.12 in.)		<b>N 5</b>															
Acc. to customer specification		<b>Z 9</b>															

Continued on next page

Straight Thermocouple		Variant digit No.	1 - 7	19	20	21	22	23	24	25	26	27	28	29	Code			
SensyTemp TSH250		Catalog No.	TSH250-															
<b>Support Tube Material</b>																		
Stainless steel 1.4571 (AISI 316Ti)																		
Heat resistant steel 1.4841																		
<b>Support Tube Length</b>																		
K = 150 mm (5.91 in.)																		
Acc. to customer specification																		
Stainless steel 1.4571 (AISI 316Ti)																		
Acc. to customer specification																		
Heat resistant steel 1.4841																		
<b>Length of Platinum sleeve (PL)</b>																		
PL = 100 mm (3.94 in.)																		
PL = 150 mm (5.91 in.)																		
PL = 200 mm (7.87 in.)																		
acc. to Customer Specification																		
<b>Process Connection</b>																		
No fitting																		
Adjustable stop flange, cast steel																		
Adjustable stop flange and counter Flange, cast Steel																		
Adjustable threaded fitting G 1/2 A, carbon steel																		
Adjustable threaded fitting G 3/4 A, carbon steel																		
Adjustable threaded fitting G 1 A, carbon steel																		
Adjustable threaded fitting 1/2 in. NPT, carbon steel																		
Adjustable threaded fitting 3/4 in. NPT, carbon steel																		
Adjustable threaded fitting 1 in. NPT, carbon steel																		
Welded flange (1.4571 (AISI 316 Ti))																		
DN 32 PN 6, Form B1 acc. to EN 1092-1																		
DN 40 PN 10 ... PN 40, Form B1 acc. to EN 1092-1																		
DN 50 PN 25 ... PN 40, Form B1 acc. to EN 1092-1																		
1-1/2 in. 150 lbs., Form RF acc. to ANSI / ASME B16.5																		
2 in. 150 lbs., Form RF acc. to ANSI / ASME B16.5																		
<b>Thermocouple Type / Diameter</b>																		
1 x Type S - wire diameter 0.5mm (0.02 in.)																		
2 x Type S - wire diameter 0.5mm (0.02 in.)																		
1 x Type R - wire diameter 0.5mm (0.02 in.)																		
2 x Type R - wire diameter 0.5mm (0.02 in.)																		
1 x Type B - wire diameter 0.5mm (0.02 in.)																		
2 x Type B - wire diameter 0.5mm (0.02 in.)																		
Multipoint-thermocouple 3 x Type S - wire diameter 0.5mm (0.02 in.)																		
Multipoint-thermocouple 3 x Type R - wire diameter 0.5mm (0.02 in.)																		
Multipoint-thermocouple 3 x Type B - wire diameter 0.5mm (0.02 in.)																		

Continued on next page

- 1) Please specify immersion length
- 2) Please specify measuring points M1, M2, M3

Straight Thermocouple SensyTemp TSH250	Variant digit No.	1	7	30	31	32	33	34	35	Code					
	Catalog No.	TSH250-													
<b>Sensor Accuracy</b>															
Extended accuracy (EN 60584 / IEC 584)											T	1			
Standard accuracy (EN 60584 / IEC 584)											T	2			
<b>Connection Head Type / Material</b>															
AUZ / Aluminium, hinged cover											A	1			
AUZH / Aluminium, high cover, hinged											A	2			
AUS / Aluminium hinged cover with snap lock											<b>A</b>	<b>4</b>			
A / Aluminium											A	6			
BUZ / Aluminium, hinged cover											B	1			
BUZH / Aluminium, high cover, hinged											B	2			
BUS / Aluminium, hinged cover with snap lock											B	4			
B / Aluminium											B	6			
<b>Transmitter</b>															
Without transmitter, measuring inset with ceramic terminal block											Y	1			
TH01 / TH01-Ex, programmable, output signal 4 ... 20 mA											P	1			
TH02 / TH02-Ex, programmable, output signal 4 ... 20 mA, HART											H	1			
TTH300, programmable, output signal 4 ... 20 mA, HART											H	4			
TF12 / TF12-Ex, programmable, output PROFIBUS PA											F	1			
TF02 / TF02-Ex, programmable, output FOUNDATION Fieldbus											F	3			

**Additional ordering information**

<b>Additional Tag Plate</b> Stainless steel	I1			
<b>Certificates</b>				
Declaration of compliance with the order 2.1 acc. to EN 10204	C4			
Inspection certificate 3.1 acc. to EN 10204 for visual, dimensional and functional test	C6			
Inspection certificate 3.1 acc. to EN 10204 for sensor calibration, single thermocouple	CF			
Inspection certificate 3.1 acc. to EN 10204 for sensor calibration, double thermocouple	CG			
DKD sensor calibration, single thermocouple, separate calibration certificate per thermometer	CK			
DKD sensor calibration, double thermocouple, separate calibration certificate per thermometer	CL			
<b>Test Temperatures</b>				
400 °C / 752 °F	GA			
700 °C / 1292 °F	GB			
1000 °C / 1832 °F	GC			
400 and 700 °C / 752 and 1292 °F	GD			
400 and 1000 °C / 752 and 1832 °F	GE			
700 and 1000 °C / 1292 and 1832 °F	GF			
400, 700 and 1000 °C / 752, 1292 and 1832 °F	GG			
Specify test points in °C or °F	GZ			
<b>Cable Entry Options</b>				
1 x 1/2 in. NPT, without cable gland	U2			
<b>Documentation Language</b>				
German	M1			
Italian	M2			
Spanish	M3			
French	M4			
English	M5			
<b>Measuring Range</b>				
0 ... 600 °C (32 ... 1112 °F)	AJ			
0 ... 800 °C (32 ... 1472 °F)	AK			
0 ... 1000 °C (32 ... 1832 °F)	AL			
0 ... 1200 °C (32 ... 2192 °F)	AM			
0 ... 1400 °C (32 ... 2552 °F)	AN			
0 ... 1600 °C (32 ... 2912 °F)	AP			
0 ... 1800 °C (32 ... 3272 °F)	AR			
Others	AZ			

3)

3) Please specify measuring range: start value, end value and measuring unit

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