Technical information
TI 249T/02/en
60018851

RTD temperature sensor omnigrad S TST 266

Thermometer with EEx d certification Lamination nipple and/or 3 elements coupling Thermowell made from a metal bar

The Omnigrad S TST 266 is an industrial thermometer with a Pt 100 thermoresistance, developed for the use in the chemical, petrochemical and energy industries but suitable also for other generic applications.
The TST 266 is supplied with EEx d certification, in compiance with European standards EN 50014 and EN 50018, and is therefore particularly suitable also for industrial areas with potentially explosive environments.
The unit is usually fitted on pipes or tanks by means of threaded or flanged process connection.
The TST 266, which is available in several standard versions and different configurations, can also be configured with specific dimensions and characteristics depending on process requirements.

Features and benefits

- Several types of process connection
- Thermowell available in several materials
- Material certification in accordance with 3.1.B, NACE or PMI
- Transmitters with 2-wire technology (PCP 4...20 mA, HART®, PROFIBUS-PA®)
- Customisable immersion length
- Thermowells compliant with standard ENI and Montedison, made of a bar, also of a significant length
- Head/thermowell connection fitting in SS 304 (nipple + 3 elements coupling + nipple)
- Explosion-proof enclosure with EEx d certification (explosion-proof) and lamination coupling on the insert
- Mineral oxide replaceable insert (MgO)
- Pt 100 sensing element with class B and A (DIN EN 60751)

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Areas of application

The TST 266 can also be used in generic industrial applications but is particularly suitable for EEx d certified application like:
- chemical industry
- petrochemical industry
- energy industry
- gas processing industry.

Function and system design

Measuring principle

In RTD (Resistance Temperature Detector) thermometers, the sensing element consists of an electrical resistance with value of 100 ohm at 0°C (called Pt 100, in compliance with standard DIN EN 60751) which increases at higher temperatures according to a coefficient characteristic of the resistor material (platinum). In industrial thermometers compliant with the DIN EN 60751 standard, the value of this coefficient is $\alpha = 3.85*10^{-3}\ °C^{-1}$, calculated between 0 and 100°C.

Equipment architecture

The TST 266 thermometer with thermoresistance comprises:
- an EEx d certified aluminium housing
- an insert with thermoresistance Pt 100, insulated with mineral oxide (MgO), with oversheath and terminals on a ceramic support
- lamination nipple and 3 elements coupling
- thermowell made from a bar with threaded or flanged process connection.

Dimensions are determined as follows (fig. 1):
- N = length of the head/thermowell connection fitting
- A = total length of the thermowell
- U = immersion length of the thermowell
- T = length of the extension neck of the thermowell
- ØDf = diameter of the internal hole of the thermowell
- ØD1 = diameter of the extension neck of the thermowell
- ØQ1 = diameter of the area below the thermowell process connection
- ØQ2 = diameter of the lower side of the thermowell.

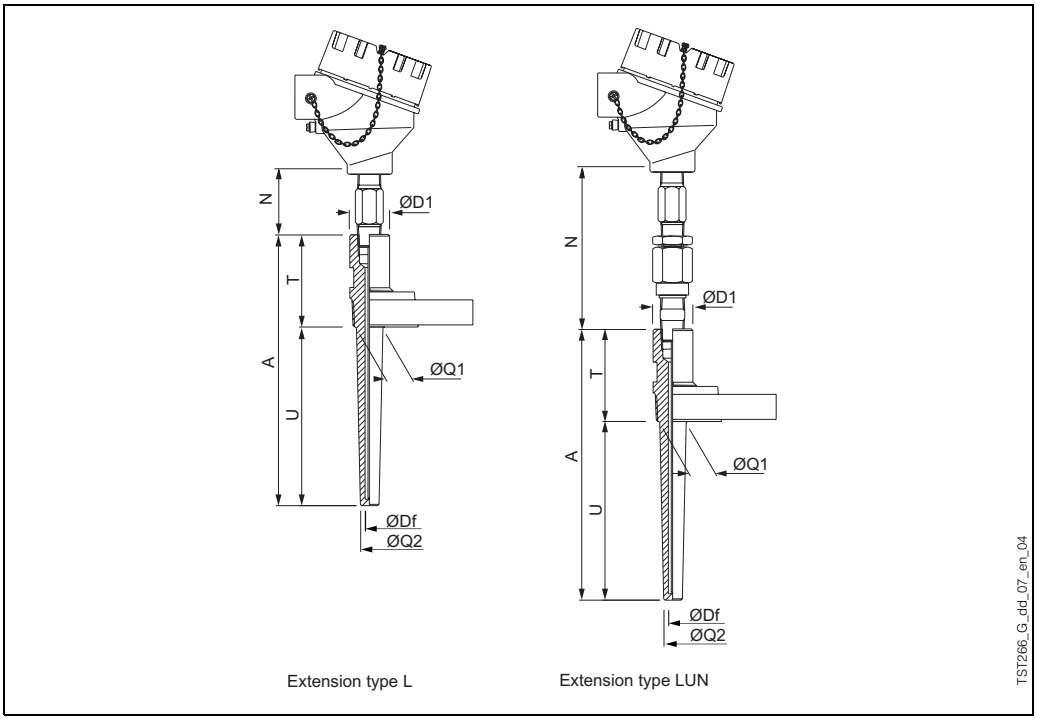


Fig. 1: Overall dimensions

Material

Housing: treated and painted aluminium alloy.
Measuring insert: external sheath in SS 316L/1.4404.
Head/thermowell connection: SS 304/1.4301.
Thermowell: SS 316/1.4401, SS 316L/1.4404, Hastelloy® C276/2.4819, Monel® 400/2.4360, Inconel® 600/2.4816.

Weight

From 1.5 to 5 Kg for standard options.

Electronics

The required type of output signal can be obtained by choosing the correct head-mounted transmitter.
Endress+Hauser supplies "state-of-the-art" transmitters (the iTEMP® series) built in 2-wire technology and with 4…20 mA output signal, HART® or PROFIBUS-PA®. All transmitters can be easily programmed using a personal computer and the ReadWin® 2000 public domain software (for transmitters 4…20 mA and HART®) or the Commuwin II software (for PROFIBUS-PA® transmitters). HART® transmitters can also be programmed with the hand-held operating module DXR 275 (Universal HART® Communicator).
For more detailed information on the transmitters, see the related documentation (codes TI at the end of this document).
If no head transmitter is used, it is also possible to connect the thermoresistance to a remote transmitter DIN-rail.

Performance

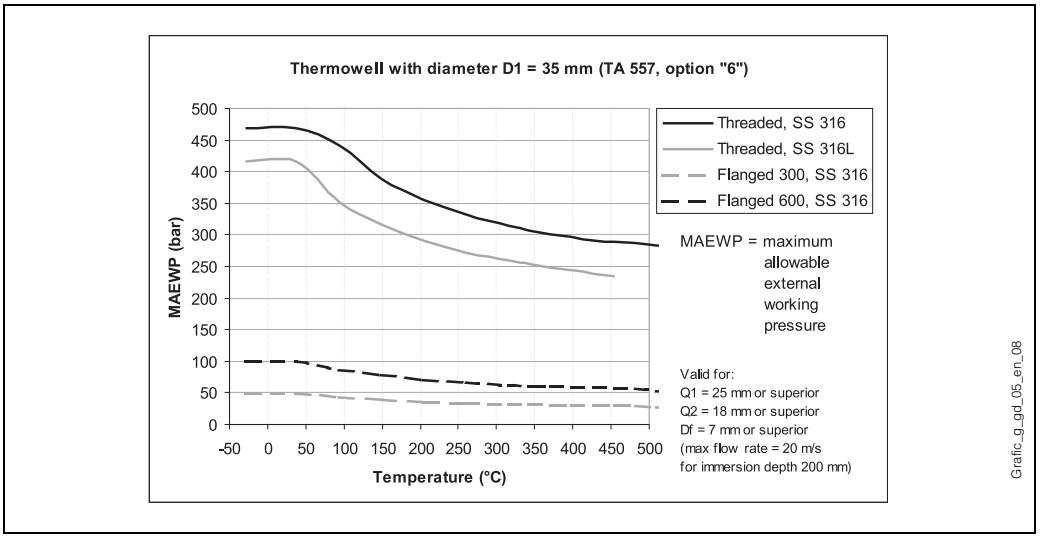
Operating conditions

Ambient temperature

- Metal head with terminal block and without transmitter -40÷130°C
- Metal head without terminal block and with transmitter -40÷85°C

Process temperature
Same of measurement range (see below).

Maximum process pressure
The pressure values that the thermowell can withstand at different temperatures, are shown in the following graphs, which can be used for some reference configurations:



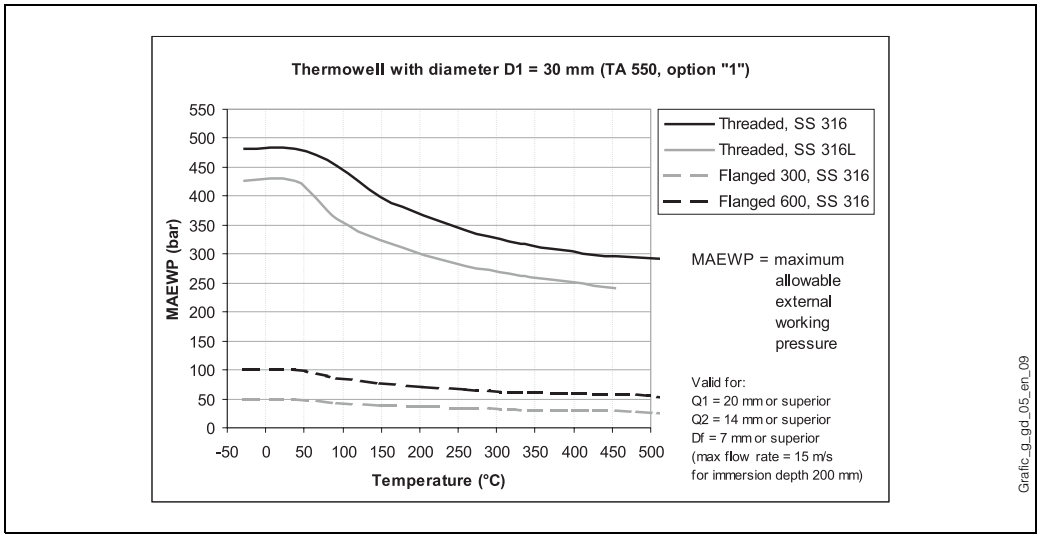


Fig. 2: Pressure/Temperature graphs

Maximum flow rate
The maximum flow rate tolerated by the thermowell decreases as the immersion length increases (U).
The methods used to verify the resistance of thermowells with pressure, temperature and flow rate data can also be compliant with those indicated in standard ASME/ANSI PTC 19.3. For assistance on resistance tests, please contact the E+H Customer Service Department.

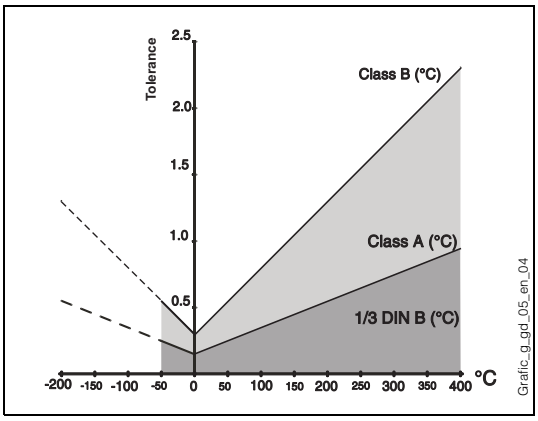
Shock and vibration resistance
According to DIN EN 60751 — 3 g peak / 10÷500 Hz

Accuracy

Maximum probe error
- cl. B
  $3\sigma = 0.30+0.0050|t|$
- cl. A
  $3\sigma = 0.15+0.0020|t|$

(|t|=absolute temperature value in °C)

Transmitter maximum error
See the corresponding documentation (codes are shown at the end of this document).



Measurement range

-50…400°C

Response time

Tests in water at 0.4 m/s (according to DIN EN 60751; temperature variation from 23 to 33°C), only on the RTD thermometer insert:
- t_{50} — 3.5 s
- t_{90} — 8 s

Insulation

Insulation resistance between the terminals and the probe sheath (in accordance with DIN EN 60751, test voltage 250 V) — ≥ 100 MΩ at 25°C; ≥ 10 MΩ at 300°C

Self heating

Negligible when the E+H iTEMP® transmitters are employed.

Installation

The Omnigrad S TST 266 can be installed on pipes or tanks by means of threaded or flanged connections. The counterparts for process connections and gaskets, when required, are not supplied with the sensor and must be purchased separately by the user.
The immersion length must take into account all the parameters of the thermometer and the process to measure. If the immersion is too low, an error may be generated in the temperature recorded due to the lower temperature of the process fluid near to the walls and heat transfer, which takes place through the sensor stem. The incidence of such an error can be not negligible if there is a big difference between the process temperature and the ambient temperature. To prevent measuring errors of this kind, it is advisable to use thermowells with a small diameter and an immersion length (U) of at least 100÷150 mm.
In small section ducts the tubing's axis must be reached and preferibly slightly exceeded by the tip of the probe (see fig. 3A). Insulation of the outer part of the sensor reduces the effect produced by a low immersion. Alternatively, it is also possible to adopt a tilted installation (see fig. 3B-3D).
As far as corrosion is concerned, the base material for parts in contact with the fluid is able to withstand the most common corrosive agents up to the highest temperatures. Even the nipples and 3 elements coupling supplied with the connection fitting of the instrument are able to withstand a wide range of aggressive substances.
For further information on specific applications, contact the E+H Customer Service Department.
Disassembled components of the sensors must be reassembled with the recommended clamping torques in order to ensure the appropriate IP protection class within the sensor-housing coupling.

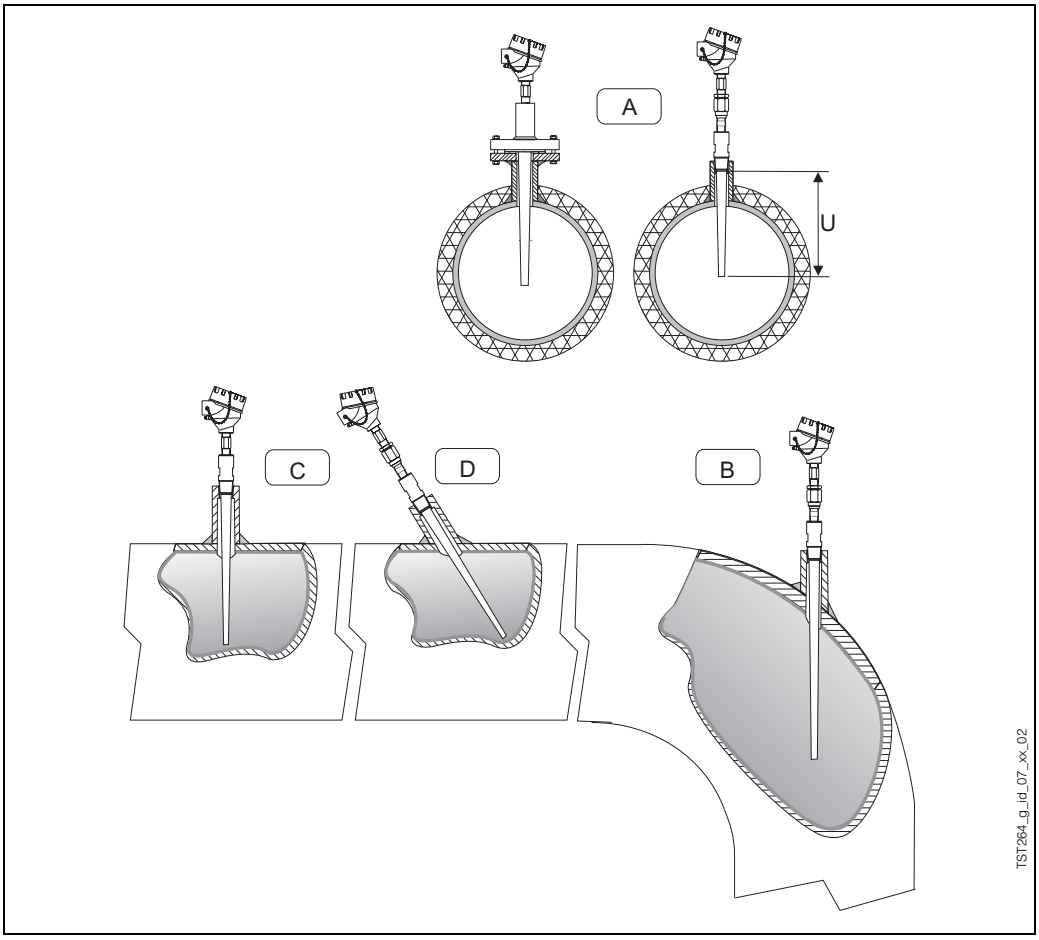


Fig. 3: Installation on pipes and tanks by means of flanged or threaded process connections

System components

Housing

The protection housing, commonly referred to as "connection head"; is used to contain and protect the terminal block or the transmitter, and to join the electric connections to the mechanical component.
The head used for the TST 266 is compliant with DIN 43729 (form B) and EN 50014/50018 standards (EEx certification for explosion-proof instruments).
The matching of the head with the extension below the head and the cover (threaded) ensures an IP66 class of protection.
The head also has a chain to connect the body to the cover, which facilitates the use of the instrument during the maintenance on systems.
The single or double electrical cable input has M20x1.5, 1/2" NPT or 3/4" NPT threading.

Head transmitter

Available head transmitters include (see also section "Electronics"):

- TMT 180 PCP 4…20 mA
- TMT 181 PCP 4…20 mA
- TMT 182 Smart HART®
- TMT 184 PROFIBUS-PA®.

The TMT 180 and TMT 181 are transmitters that can be programmed by means of a PC. The TMT 180 is also available in an enhanced accuracy version (0.1°C vs. 0.2°C) with an operating temperature range of -50...250°C.
The TMT 180 can also have a fixed measurement range (the limit values of the range must be specified by the customer in order phase).
The TMT 182 output consists of 4…20 mA and HART® superimposed signals.

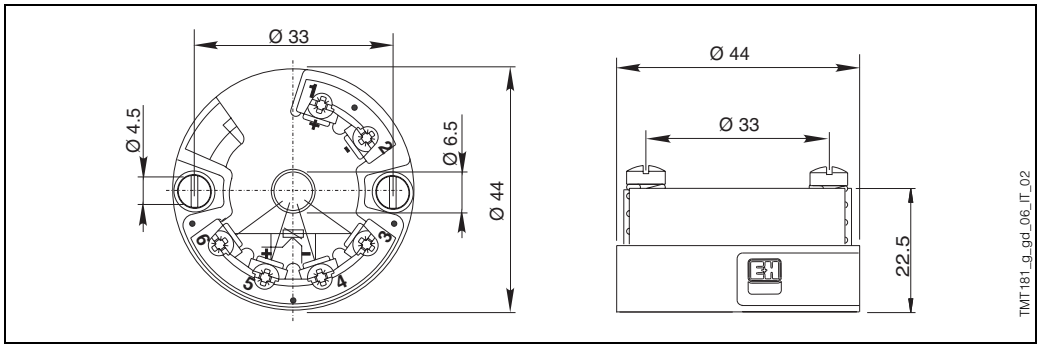


Fig. 4: TMT 180 - 181 - 182

In the TMT 184, with a PROFIBUS-PA® output signal, the communication address can be set via software or by means of a mechanical dip-switch (the configuration must be specified by the customer in order phase).

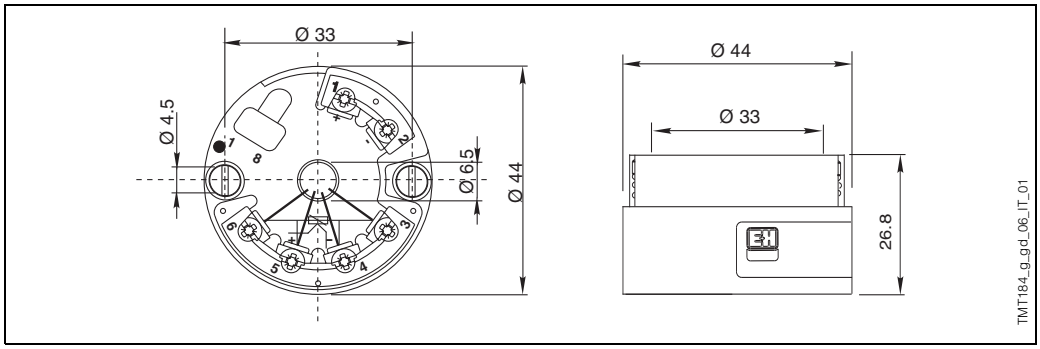
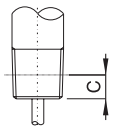
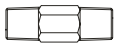
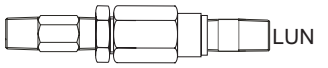


Fig. 5: TMT 184

Extension neck

The extension neck is the part between the thermowell and the transmitter housing. To prevent the process temperature from overheating the area of the transmitter, a special extension "neck" is inserted between the sensor, exposed to high temperature processes, and the transmitter. This enables to limit the operating temperature of the transmitter.
The neck is usually constituted by a tube assembled to hydraulic hardware (nipples or joints) that is suitable to allow the adjustment of the sensor to the thermowell.
The standard lengths (N) and the versions of the extension neck can be selected among the following options:
– 52 mm (only 1/2" NPT, type L)
– 148 mm (nipple+3 elements coupling+nipple, type LUN).

Threaded thermowell connections					
Type	**Thread**	**Length N (mm)**	**C (mm)**	**Detail**	**Type of neck**
Male	1/2" NPT	52	8	 ConNPT_G_dd_09_XX_01	 nckLxx_g_gd_15_xx_01
		148			 nckLUN_g_gd_15_xx_02

Attention! * This neck is available only for 1/2" NPT threads

"LUN" connections enable to orient the housing of the transmitter.
As illustrated by the chart in figure 6, the length of the sensor + thermowell extension may influence the temperature in the head. It is necessary that this temperature is kept within the limit values defined in the paragraph "Operating conditions".
In addition to the standard versions listed above, it is also possible to order the extension neck by specifying the desired length (see "Sales structure" chart).

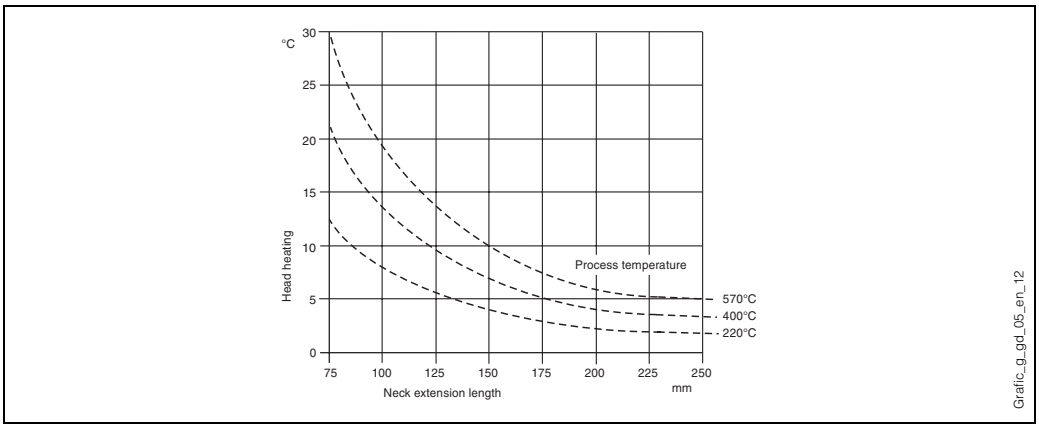


Fig. 6: Heating of the head caused by the process temperature

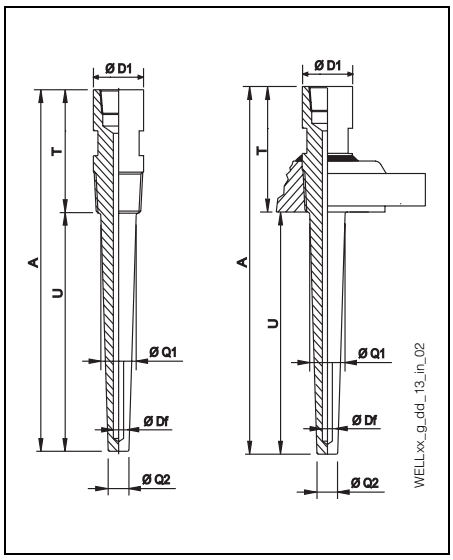
Process connection

Standard process connections differ in that they can be threaded or flanged:
- threaded connections in the same material of the thermowell:
  3/4" NPT, 1" NPT.
- flanged connections in SS 316 or A 105:
  slip-on 1" ANSI 150, 300, 600 RF
  slip-on 1"1/2 ANSI 150, 300, 600 RF
  slip-on 2" ANSI 300, 600 RF.

Flanges with standard finishing 125-250 AARH, is bolted and welded to the rear of the thermowell neck.
On request, it is possible to select also different materials, finishings and connections.

Thermowell

The thermowell is the component of the TST 266 that must tolerate most of the mechanical stress transmitted by the process.
It is made from a round bar and supplied in different materials and dimensions, according the chemical/physical characteristics of the process: corrosion, temperature, pressure and speed of the fluid.



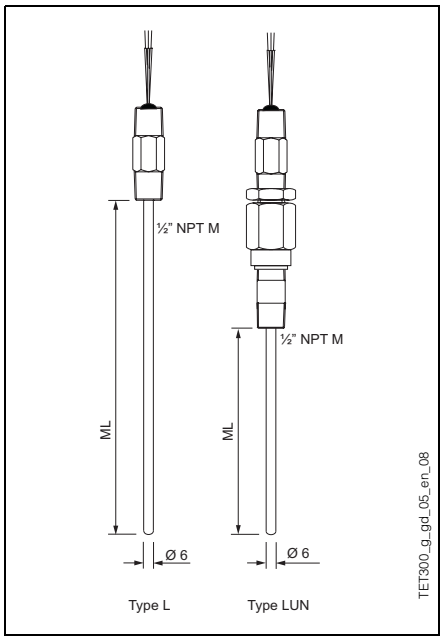
The thermowell consists of three parts:
–the extension neck (indicated as T), usually with a cylindrical shape (and standard diameters of 30 or 35 mm and lengths of 70/100 mm), represents the external part of the thermowell and is connected with the head of the probe by means of a neck (usually a nipple)
–the immersed part (identified as U), with a conical or cylindrical shape (the standard diameter of the area below the fitting is 20 or 25 mm), is situated next to the process connection in direct contact with the process fluid
–the threaded or flanged process connection represents the part inserted between the extension and the immersed part and guarantees the mechanical and hydraulic sealing of the thermometer and plant.
The external finishing of the thermowell stem is available with a standard value of Ra < 1.6 µm (different finishes are available on request).

Fig. 7: Thermowell with threaded or flanged process connection

⚠ Warning! The total standard length (A) of the thermowell must never exceed 1300 mm (that represents the maximum drilling limit; higher lengths are available only on request).

Probe

The measuring probe (generally Pt 100) of sensor TST 266 consists of a 6 mm diameter thermometric insert (TET 300) whose stem is made in MgO compressed by SS 316L/1.4404 (also called mineral insulated cable).



To improve heat transmission, the insert tip is pushed, by means of a spring system, to the inside bottom of the thermowell (to order separately).
The insert is always supplied with lamination nipple and/or 3 elements coupling.
In case of spare parts, length ML must be calculated depending on the thermowell total length, using the formula: ML = A-11.

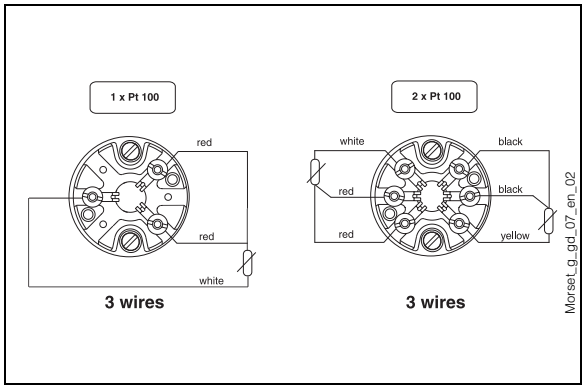


Fig. 8: Measuring probe

Certificates & Approvals

Ex approval

Certificate CESI 03 ATEX 114, 1/2 GD IIC EEx d T5/T6.

PED approval

The Pressure Equipment Directive (97/23/CE) is respected. As paragraph 2.1 of Article 1 is not applicable to this kind of instrument, the marking CE is not mandatory for TST 266 models used for generic applications.

Material certification

The material certification can be selected directly in the sales structure and is available in different typologies. Certificate 3.1.B includes a statement that contains all the documents related to the material employed for the manufacture of each thermowell, along with a marking, consisting in a code punched on the thermowell, that guarantees the traceability of the product.
In the sales structure are also available other certification related to materials which integrate the 3.1.B:

- 3.1.C certification
- NACE MR 0175 certification
- PMI certification.

Further details

Maintenance

The TST 266 does not require specific maintenance.

Delivery time

For small orders (5÷10 units) and standard options, the delivery time is 10 working days.

Ordering information

Sales structure

TST 266	Neck length N, material and type of connection			
	1	52 mm	SS304	type L 1/2" NPT-M
	2	148 mm	SS304	type LUN 1/2" NPT-M
	9	Extension length to specify		

		Type and class of insert		
	H	1	Pt 100	class A, 3 wires
	L	2	Pt 100	class A, 3 wires
	Y	Type and class to specify		

			Type of electrical connection	
		2	Flying wires	
		3	Ceramic terminal block	

				Thermowell dimensions: est. "T", diam. D1, Df, Q1, Q2, finishing	
			1	70 mm = T, D1 = 30 mm, Df = 7 mm, Q1 = 20 mm, Q2 = 14 mm, finishing 1,6 micron	
			6	100 mm = T, D1 = 35 mm, Df = 7 mm, Q1 = 25 mm, Q2 = 18 mm, finishing 1,6 micron	
			9	... mm = T, D1 = ... mm, Df = ... mm, Q1= ... mm, Q2 = ... mm, finishing to specify	

					Immersion length "U" (100 - 1200 mm)	
				X	... mm immersion length to specify	
				Y	... mm special immersion length	

						Thermowell material	
					C	Thermowell material AISI 316-W 1.4401	
					D	Thermowell material AISI 316L-W 1.4404	
					H	Thermowell material Hastelloy® C276-W 2.4819	
					K	Thermowell material Inconel® 600-W 2.4816	
					M	Thermowell material Monel® 400-W 2.4360	
					Y	Thermowell material to specify	

							Process connection		
						1	Threaded	3/4" NPT-M	
						2	Threaded	1" NPT-M	
						3	Slip-on 1"	ANSI 150 RF A 105	
						4	Slip-on 1"	ANSI 150 RF SS 316	
						5	Slip-on 1"	ANSI 300 RF A 105	
						6	Slip-on 1"	ANSI 300 RF SS 316	
						7	Slip-on 1"	ANSI 600 RF A 105	
						8	Slip-on 1"	ANSI 600 RF SS 316	
						A	Slip-on 1"1/2	ANSI 150 RF A 105	
						B	Slip-on 1"1/2	ANSI 150 RF SS 316	
						C	Slip-on 1"1/2	ANSI 300 RF A 105	
						D	Slip-on 1"1/2	ANSI 300 RF SS 316	
						E	Slip-on 1"1/2	ANSI 600 RF A 105	
						F	Slip-on 1"1/2	ANSI 600 RF SS 316	
						Q	Slip-on 2"	ANSI 300 RF A 105	
						R	Slip-on 2"	ANSI 300 RF SS 316	
						S	Slip-on 2"	ANSI 600 RF A 105	
						T	Slip-on 2"	ANSI 600 RF SS 316	
						Y	Process connection to specify		

								Flange finishing	
							1	Finishing not requested	
							2	Standard finishing 125-250 AARH	
							9	Finishing to specify	

									Certifications	
								A	Not requested	
								G	3.1.B EN10204, with stamping, for wetted parts	
								E	3.1.B EN10204, + NACE MR 0175	
								C	3.1.C EN10204,	
								F	3.1.B EN10204, + PMI	
								Y	Certification to specify	

											Head cable entry	
											A	Head cable entry: single 1/2” NPT
											C	Head cable entry: double 1/2” NPT
											B	Head cable entry: single 3/4” NPT
											D	Head cable entry: double 3/4” NPT
											E	Head cable entry: single M20x1.5
											F	Head cable entry: double M20x1.5

											Built-in head transmitter	
											0	Without built-in head transmitter
											2	Fixed range TMT 180-A21, from...to...°C - accuracy 0.2K, span limit: -200...650°C
											3	Fixed range TMT 180-A22, from...to...°C - accuracy 0.1K, span limit: -50...250°C
											4	Programmable TMT 180-A11, from..to...°C - accuracy 0.2K, span limit: -200...650°C
											5	Programmable TMT 180-A12, from...to...°C - accuracy 0.1K, span limit: -50...250°C
											P	Programmable TMT 181-A, from... o...°C, PCP, 2-wire, insulated
											R	Programmable TMT 182-A, from...to...°C, HART®, 2-wire, insulated
											S	Programmable TMT 182-A, from...to...°C, PROFIBUS-PA®, 2-wire, insulated
											1	Built-in head transmitter THT1, to be ordered separately

TST266-												Complete order code

Supplementary documentation

❑ General technical information on TST thermometers	TI 088T/02/en
❑ Temperature transmitter - iTEMP® PA TMT 180	TI 088R/09/en
❑ Temperature transmitter - iTEMP® PCP TMT 181	TI 070R/09/en
❑ Temperature transmitter - iTEMP® HART® TMT 182	TI 078R/09/en
❑ Temperature transmitter - iTEMP® PA TMT 184	TI 079R/09/en
❑ Insert Pt 100 - Omnigrad TET 300	TI 226T/02/en
❑ Safety instruction for use in hazardous area	XA 007T/02/z1
❑ E+H Laboratory. Calibration certifications for industrial thermometers. ***RTD and thermocouples***	TI 236T/02/en

Subject to modification

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