

Technical Information

iTHERM TT151

Bar stock thermowell for a wide range of heavy duty industrial applications



Application

- Protects the temperature sensor against physical and chemical stress
- Highly robust design for challenging process conditions
- Pressure range up to 500 bar (7 252 psi)
- For use in pipes, vessels or tanks
- Easier maintenance and recalibration of the measuring point (sensor can be replaced without interrupting the process)

Your benefits

- TT151 is an industry standard thermowell manufactured from round barstock
- Extension, immersion length and total length can be chosen according to process requirements
- Wide range of dimensions, materials and process connections available

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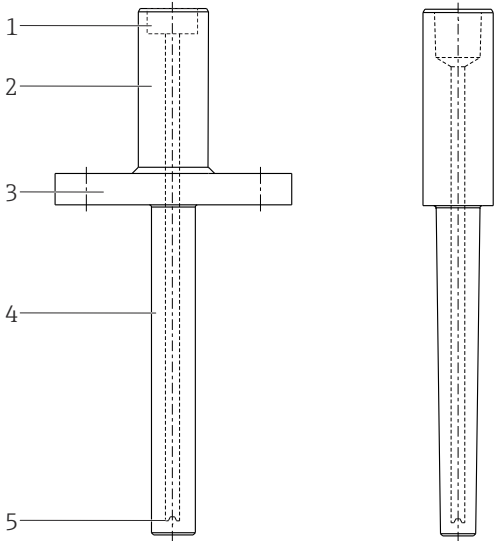
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Function and system design

Equipment architecture

The thermowell design is based on DIN 43772 or ASME B40.9 and additionally it is available as a universal version that can be configured flexibly. The thermowell guarantees a good resistance to typical industrial processes. It comprises a full material bar stock with a root diameter from 9 to 50 mm. The tip can be straight, tapered or stepped. The thermowell can be fitted to a pipe or vessel in the system using a selection of commonly used flanged process connection, thread or weld-in versions.

Modular design

Design		Options
	1: Thermometer connection	Female thread
	2: Lagging	Extension, which cannot be removed from the thermowell, allows space for installation, especially if a flange is used, and can protect the terminal head and electronics module from the heat in the process.
	3: Process connection	Connection piece on process side. Can be any type of thread, flange, weld in or socket weld and must be dimensioned to withstand the process pressure, temperature and media.
	4: Thermowell	The part of the thermowell that is inserted into the process. Available in a variety of diameters and materials to meet a wide range of applications. The material and strength selected must be such that it can withstand the static and dynamic load caused by the process conditions and is resistant to chemicals, mechanical shock and vibrations.
	5: Thermowell tip	Various tips are available. For thermowells used in pipes with a small diameter, a reduced or tapered thermowell tip can be selected to reduce the flow resistance. Reduced tips also mean a faster response time, while a specially designed tip ensures the fastest response.

Installation

Mounting location

The thermowells can be installed in pipelines, tanks or vessels.

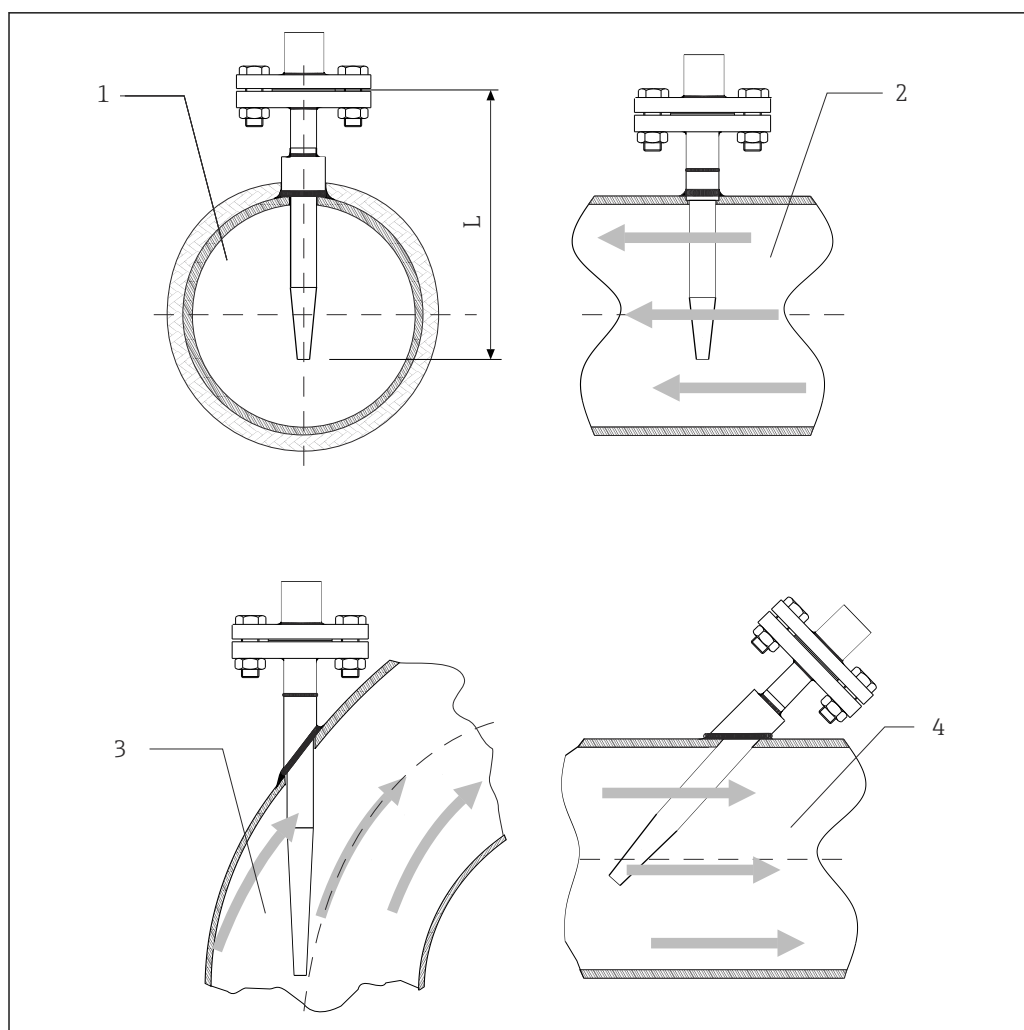
Orientation

No restrictions. However, self-draining in the process should be guaranteed depending on the application.

Installation instructions

The immersion length of the thermometer can influence the accuracy. If the immersion length is too short, this can lead to measurement errors caused by heat conduction through the process connection. If installing in a pipe, the immersion length should ideally correspond to half of the pipe diameter. Although the installation position may vary according to requirements, the measuring element must be completely exposed to the medium and must not be shielded by the nozzle. In pipes with a small diameter, a pipe expander can be mounted around the measuring point to ensure a sufficient immersion length.

Installation possibilities: Pipes, tanks or other plant components



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1 Installation examples

1 - 2 In pipes with a small cross-section, the sensor tip should reach or extend slightly past the center axis of the pipe ($=L$).

3 - 4 Slanted installation.

 In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to project well into the process so that it extends past the pipe axis. Another possibility is to install the thermometer at an angle (4). When determining the immersion length or installation depth, all the parameters of the thermometer and of the medium to be measured must be taken into account (e.g. flow velocity, process pressure).

The use of iTHERM QuickSens inserts is recommended for immersion lengths $U < 70 \text{ mm}$ (27.6 in).

 The counterpieces for the process connections and the seals or sealing rings are not included in the scope of supply for the thermometer.

Process

Process temperature range

Depends on the type of thermowell and material used, maximum -200 to $+1100 \text{ }^{\circ}\text{C}$ (-328 to $+2012 \text{ }^{\circ}\text{F}$).

Process pressure range

The maximum possible process pressure depends on various influencing factors, such as the design, process connection and process temperature. For information on the maximum possible process pressures for the individual process connections, see the 'Process connection' section. → 20

 It is possible to verify the mechanical loading capacity as a function of the installation and process conditions using the online TW Sizing Module for thermowells included in the Endress+Hauser Applicator software. See 'Accessories' section. → 31

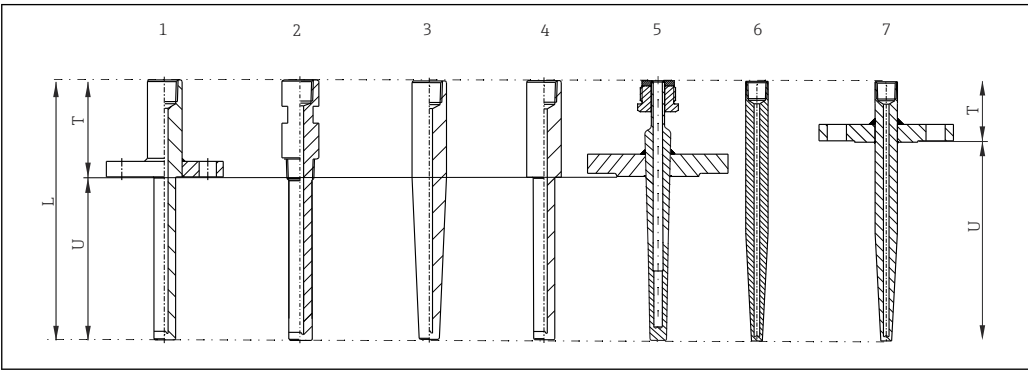
Permitted flow velocity depending on the immersion length and process medium

The maximum flow velocity tolerated by the thermowell diminishes with increasing thermowell immersion length exposed to the stream of the fluid. In addition, it depends on the shape and size of the thermowell, the process connection, the medium type, process temperature and process pressure.

Process connection	Standard	Max. process pressure
Weld in version / socket weld	-	≤ 500 bar (7 252 psi)
Flange	EN1092-1 or ISO 7005-1	Depending on the flange pressure rating PNxx: 20, 40, 50 or 100 bar at 20 °C (68 °F)
	ASME B16.5	Depending on the flange pressure rating 150, 300, 600, 900/1500 or 2500 psi at 20 °C (68 °F)
	JIS B 2220	Depending on the flange pressure rating 10K
Thread	ISO 965-1 / ASME B1.13M ISO 228-1 ANSI B1.20.1 DIN EN 10226-1 / JIS B 0203	140 bar (2 031 psi) at +40 °C (+140 °F) 85 bar (1 233 psi) at +400 °C (+752 °F)

Mechanical construction

Design, dimensions



 2 Typical ASME, UNIVERSAL, NAMUR and DIN design and references

- 1 Flanged, references acc. ASME/universal
- 2 Threaded, references acc. ASME/universal
- 3 Weld in, references acc. ASME/universal
- 4 Socket Weld, references acc. ASME/universal
- 5 Flanged, references acc. NAMUR
- 6 Weld in, references acc. DIN
- 7 Flanged, references acc. DIN

All dimensions are in mm (in). The design of the thermometer depends on the thermowell version:

Thermowells based on ASME:

- ANSI Flanges
- NPT Threads
- Socket weld and weld in

Thermowells based on DIN:

- EN Flanges
- M or G Threads
- Socket weld and weld in

Universal:

- ANSI, EN or ISO Flanges
- M, G, R or NPT Threads
- Socket weld and weld in

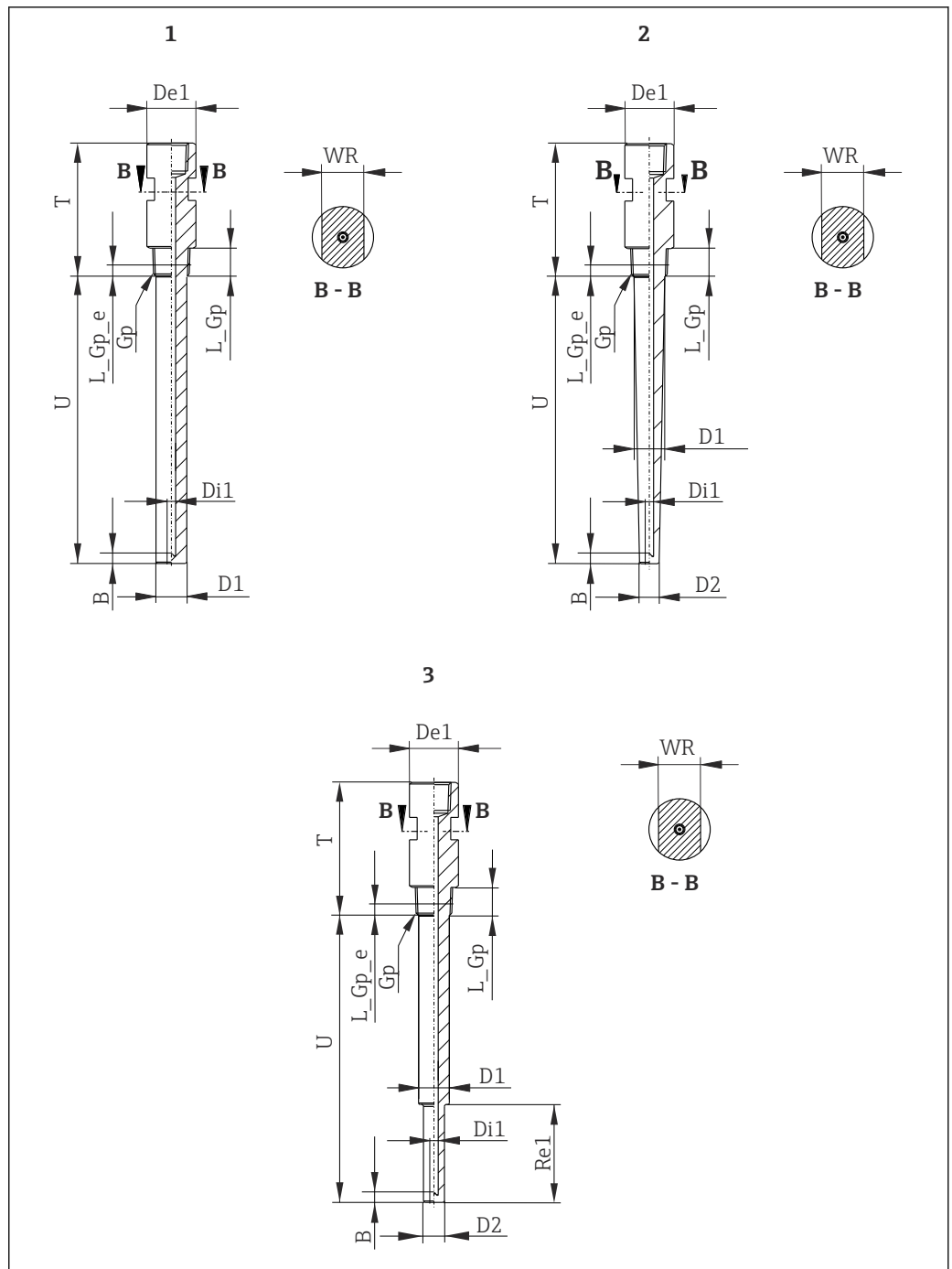


Some dimensions, such as the immersion length U for example, are variable values and are therefore indicated as items in the following dimensional drawings.

Variable dimensions:

Item	Description
L	Thermowell length (U+T)
L_Gp	Thread length (complete thread length)
L_Gp_e	Thread engagement length
Gp	Process connection thread
B	Thermowell base thickness (default value 6mm - optional other thickness available)
T	Length of thermowell lagging
U	Immersion length
D1	Root diameter
D2	Tip diameter
C1	Length of the tapered part
Re1	Reduced tip length
Di1	Bore diameter
Di2	Bore diameter tip
De1	Lagging diameter
Ge1	Thermometer connection thread

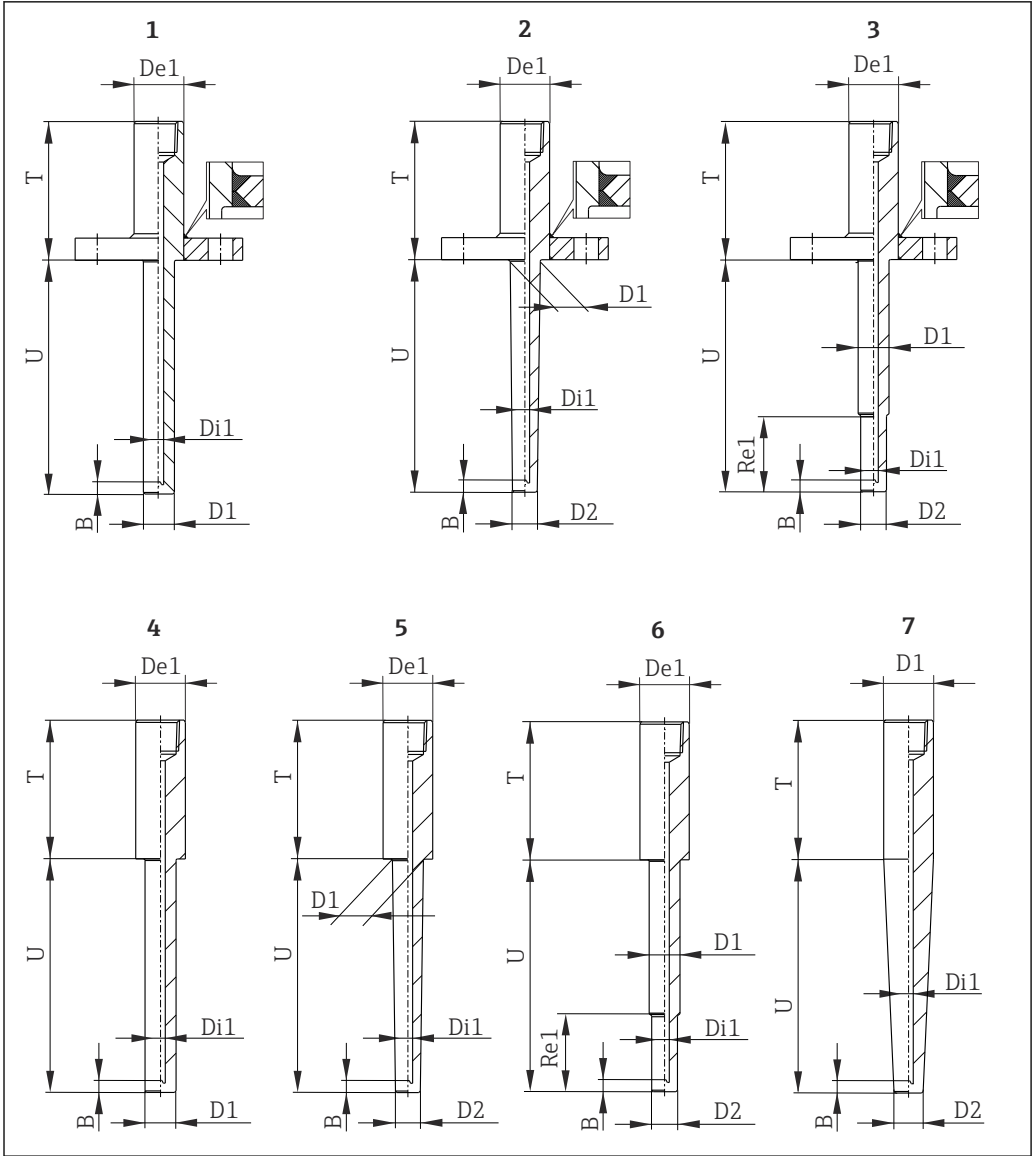
Thermowells based on ASME B40.9



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3 Thermowells based on ASME B40.9

- 1 Straight-Shank Threaded Thermowell; lagging with spanner flats (optional hexagonal lagging available)
- 2 Tapered-Shank Threaded Thermowell; lagging with spanner flats (optional hexagonal lagging available)
- 3 Step-Shank Threaded Thermowell; lagging with spanner flats (optional hexagonal lagging available)



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4 Thermowells based on ASME B40.9

- 1 Straight-Shank Flanged Thermowell (optional full penetration welding available)
- 2 Tapered-Shank Flanged Thermowell (optional full penetration welding available)
- 3 Stepped-Shank Flanged Thermowell (optional full penetration welding available)
- 4 Straight-Shank Socket Weld
- 5 Tapered-Shank Socket Weld
- 6 Step-Shank Socket Weld
- 7 Tapered-Shank Weld In Thermowell

Thermowells based on ASME B40.9			
	Threaded	Flanged	Socket Weld /Tapered-Shank Weld In
Thermometer connection	■ ½" NPT ■ ½" NPSC ■ ½" NPSM		

Thermowells based on ASME B40.9			
Process connection size	■ ½" NPT ■ ¾" NPT ■ 1" NPT	■ ANSI 1" from Cl. 150 to Cl. 600 ■ ANSI 1 - ½" from Cl. 150 to Cl. 2500 ■ ANSI 2" from Cl. 150 to Cl. 2500	■ Ø18 mm ■ Ø24 mm ■ Ø26 mm ■ Ø27 mm ■ Ø28 mm ■ Ø30 mm ■ Ø32 mm ■ Ø35 mm ■ Ø40 mm ■ Ø45 mm ■ Ø50 mm ■ Ø26.7 mm (¾ in) ■ Ø33.4 mm (1 in) ■ Ø42.2 mm (1 ¼ in) ■ Ø48.3 mm (1 ½ in)
Process connection material	■ 316 ■ 316L ■ 316Ti ■ 347 ■ 310 ■ Alloy 600 ■ Alloy C276 ■ 10CrMo9-10 ■ 13CrMo4-5 ■ A105 ■ C22.8	■ 316 ■ 316L ■ 316Ti ■ 310 ■ Alloy C276 ■ Alloy C276>316L ■ Alloy 600>316L ■ A105	■ 316 ■ 316L ■ 316Ti ■ 347 ■ 310 ■ Alloy 600 ■ Alloy C276 ■ 10CrMo9-10 ■ 13CrMo4-5 ■ A105 ■ C22.8
Bar material		■ 316 ■ 316L ■ 316Ti ■ 310 ■ 347 ■ Alloy 600 ■ Alloy C276 ■ A105 ■ C22.8	

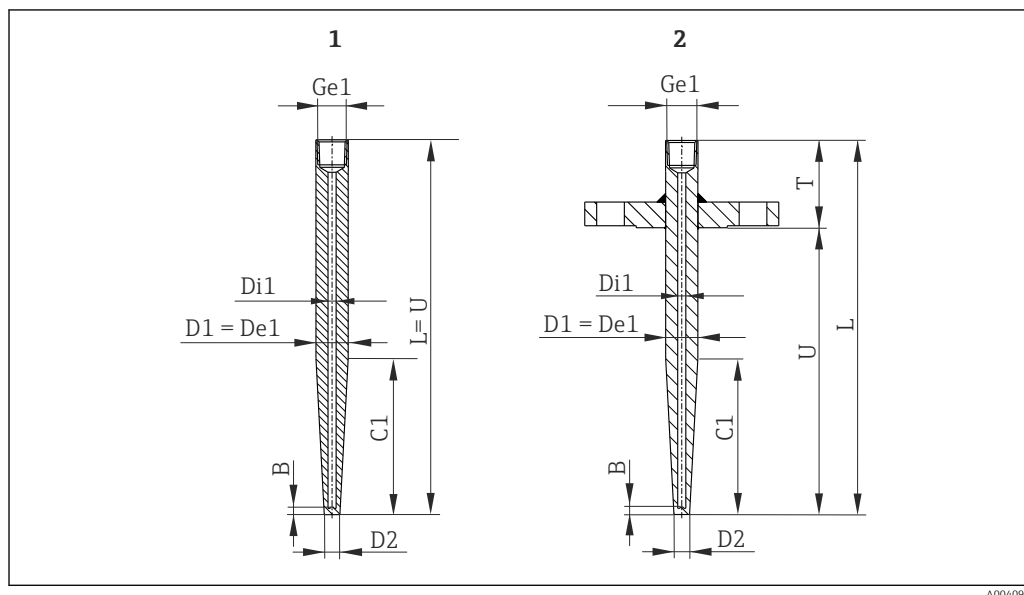
Dimensions		
	Straight-Shank & Tapered Thermowells	Step-Shank Thermowells
Immersion length	64 to 609 mm	127 to 609 mm
Lagging length	75 to 300 mm	75 to 300 mm
Lagging diameter	18 to 50 mm	18 to 50 mm
Root diameter	16 to 46.5 mm	■ for tip diameter 12.7 mm: 16 to 25.4 mm ■ for tip diameter 22.2 mm: 25.4 to 38 mm
Tip diameter	9.2 to 46.5 mm or identical to root diameter	12.7 mm or 22.2 mm
Bore diameter	■ 3.5 mm ■ 6.5 mm ■ 7 mm ■ 8 mm ■ 9.5 mm ■ 10 mm	6.5 mm
Roughness	0.8 µm	0.8 µm
Stepped length	-	76 to 365 mm
Tip thickness	Default value 6 mm; optional 5 to 12 mm	

TT151 is based on ASME B40.9 but allows higher flexibility as in ASME B40.9 specified. In the following table are the main deviations listed.

Dimensions:	All dimensions are based on metric
Tolerances:	According to ISO 2768-mK, if not other specified

Terminology and definitions:	According to E+H Standard
Standard dimensions:	TT151 offers a wider range of dimensions as mentioned in standard ASME B40.9
ASME PTC-19.3:	TT151 design fulfils the limitations of ASME PTC-19.3
Threads:	TT151 offers a wider range of threads as mentioned in standard ASME B40.9
Flanges:	TT151 offers a wider range of flanges as mentioned in standard ASME B40.9
Thermowell construction:	Based on ASME B40.9
Materials:	TT151 offers a wider range of materials as mentioned in standard ASME B40.9
Stem finish (for thermowell section in contact with medium):	$Ra \leq 0.76 \mu m$ (30 μin)
ASME B40.9 Nonmandatory Appendix for naval shipboard application:	TT151 doesn't consider the appendix

Thermowells based on DIN 43772 form 4 and 4F



5 Thermowells based on DIN 43772 form 4 and 4F

- 1 Weld In Thermowell based on DIN 43772 form 4
 2 Weld In Thermowell based on DIN 43772 form 4F

Thermowells based on DIN 43772		
	Form 4 (Weld In)	Form 4F (Flanged)
Thermometer connection	■ M14x1.5 ■ M18x1.5 ■ M20x1.5 ■ M27x2 ■ G 1/2" ■ G 3/4"	
Process connection size	■ Ø18 mm ■ Ø24 mm ■ Ø26 mm ■ Ø32 mm	■ EN or ISO flanges DN25 from PN16 to PN100 ■ EN or ISO flanges DN40 PN40 ■ EN or ISO flanges DN50 from PN40 to PN63 ■ EN or ISO flanges DN80 PN6

Thermowells based on DIN 43772		
Process connection material	■ 316 ■ 316L ■ 316Ti ■ 347 ■ 310 ■ Alloy 600 ■ Alloy C276	■ 316 ■ 316L ■ 316Ti ■ Alloy C276>316L ■ Alloy 600>316L ■ A105
Bar material	■ 10CrMo9-10 ■ 13CrMo4-5 ■ 16Mo3 ■ A105 ■ C22.8 ■ Duplex S32205 ■ Titan Gr2	■ 316 ■ 316L ■ 316Ti ■ 310 ■ 347 ■ Alloy 600 ■ Alloy C276 ■ A105 ■ C22.8 ■ Duplex S32205
Tip thickness	Default value 6 mm; optional 4 to 12 mm	
Roughness	Default value 1.6 µm; optional 0.76 µm	
Tolerances wetted part	■ +0/-0.15 for L≤410 ■ +0/-0.2 for L>410 ■ on demand tolerance according DIN43772 can be ordered	

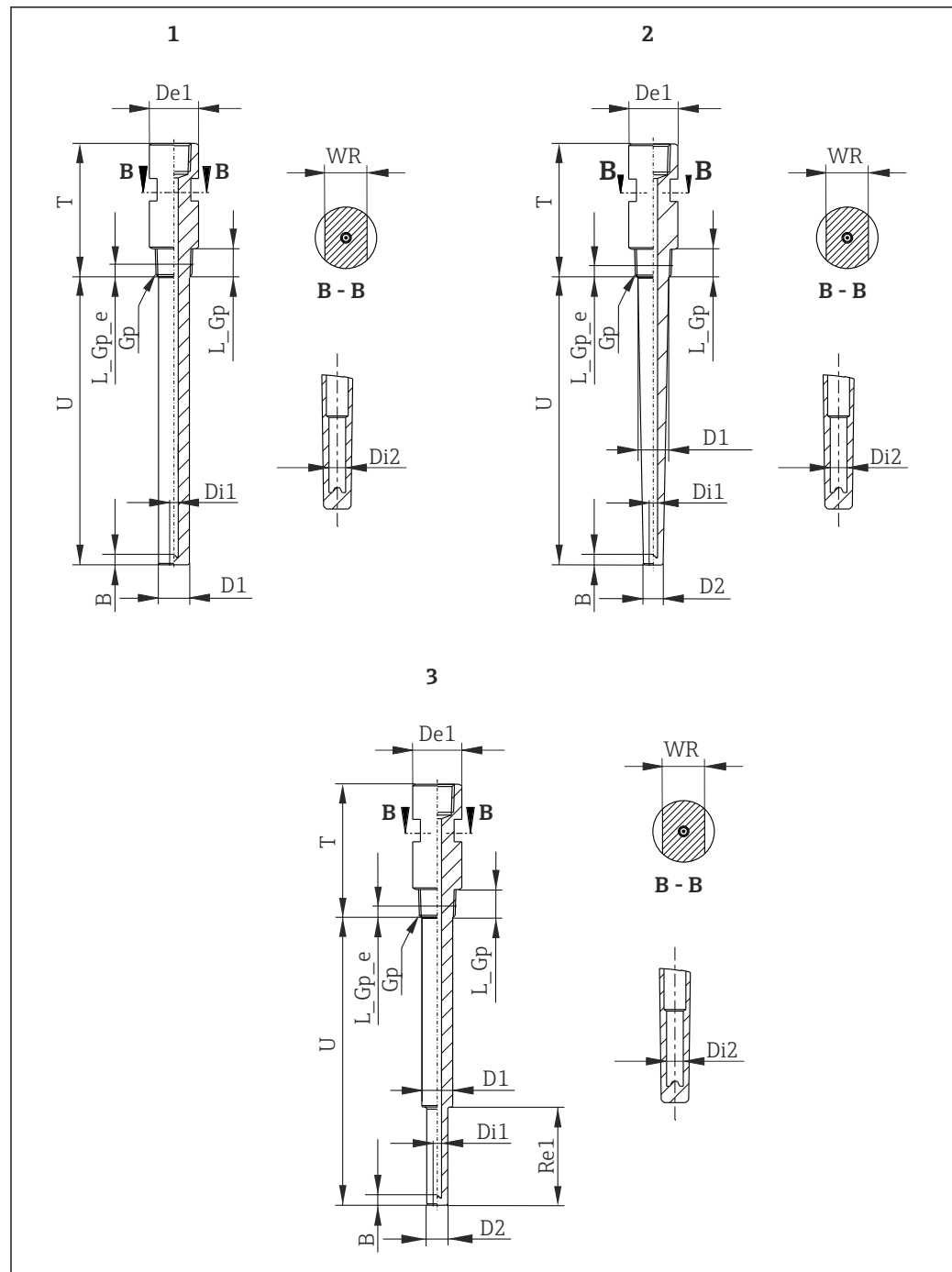
Thermowell dimensions based on DIN 43772 Form 4/4F					
Thermometer connection	D1	D2	Di1	Length combinations	
				Form 4	Form 4F
M14x1.5	18 mm	9 mm	3.5 mm ¹⁾	■ L = 110 mm, C 1 = 65 mm ■ L = 110 mm, C 1 = 73 mm ■ L = 140 mm, C 1 = 65 mm ■ L = 170 mm, C 1 = 133 mm ■ L = 200 mm, C 1 = 125 mm	■ L = 200 mm, U = 130 mm, C1 = 65 mm ■ L = 260 mm, U = 190 mm, C1 = 125 mm ■ L = 410 mm, U = 340 mm, C1 = 275 mm
M18x1.5	24 mm	12.5 mm	7 mm		
M20x1.5 or G ½"	26 mm	12.5 mm	7 mm		
		15 mm	9 mm		
M27 x 2 or G ¾"	32 mm	17 mm	11 mm		
		19 mm	13 mm		
		20 mm	14 mm		

1) For L>110mm a stepped bore is used (6.5>3.5mm)

TT151 is based on DIN 43772 form 4/4F but allows higher flexibility as in DIN 43772 specified. In the following table are the main deviations listed.

Terminology and definitions:	According to E+H Standard
Materials:	TT151 offers a wider range of materials as mentioned in DIN 43772
Tolerances wetted part Form 4:	■ +0/-0.15 for L≤410 ■ +0/-0.2 for L>410 ■ on demand tolerance according DIN43772 can be ordered
Tolerances wetted part Form 4F:	■ +0/-0.15 for L≤410 ■ +0/-0.2 for L>410
Immersion length:	TT151 offers a wider range of lengths as mentioned in DIN 43772

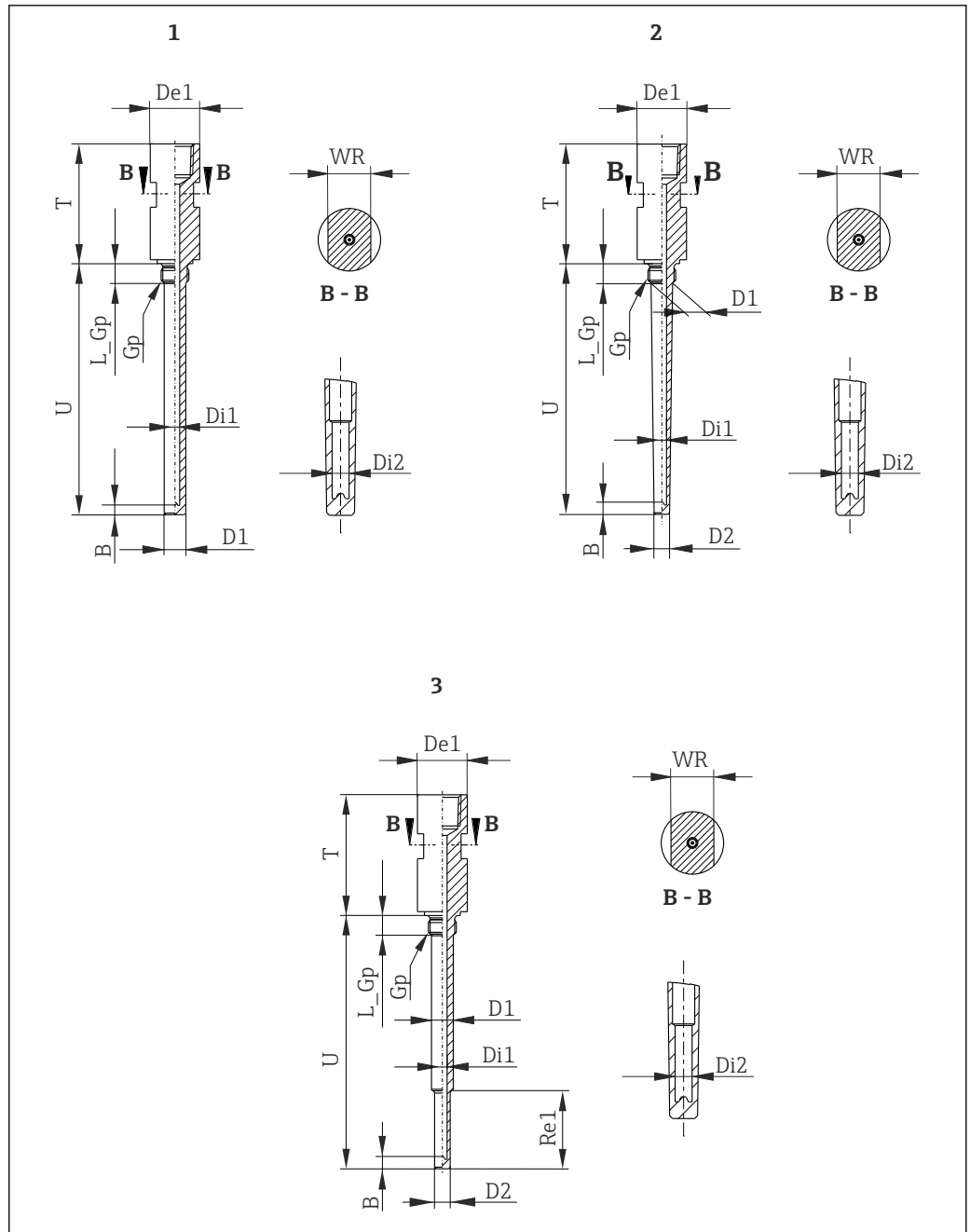
Universal Thermowells



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6 Universal Thermowells with NPT or R threads

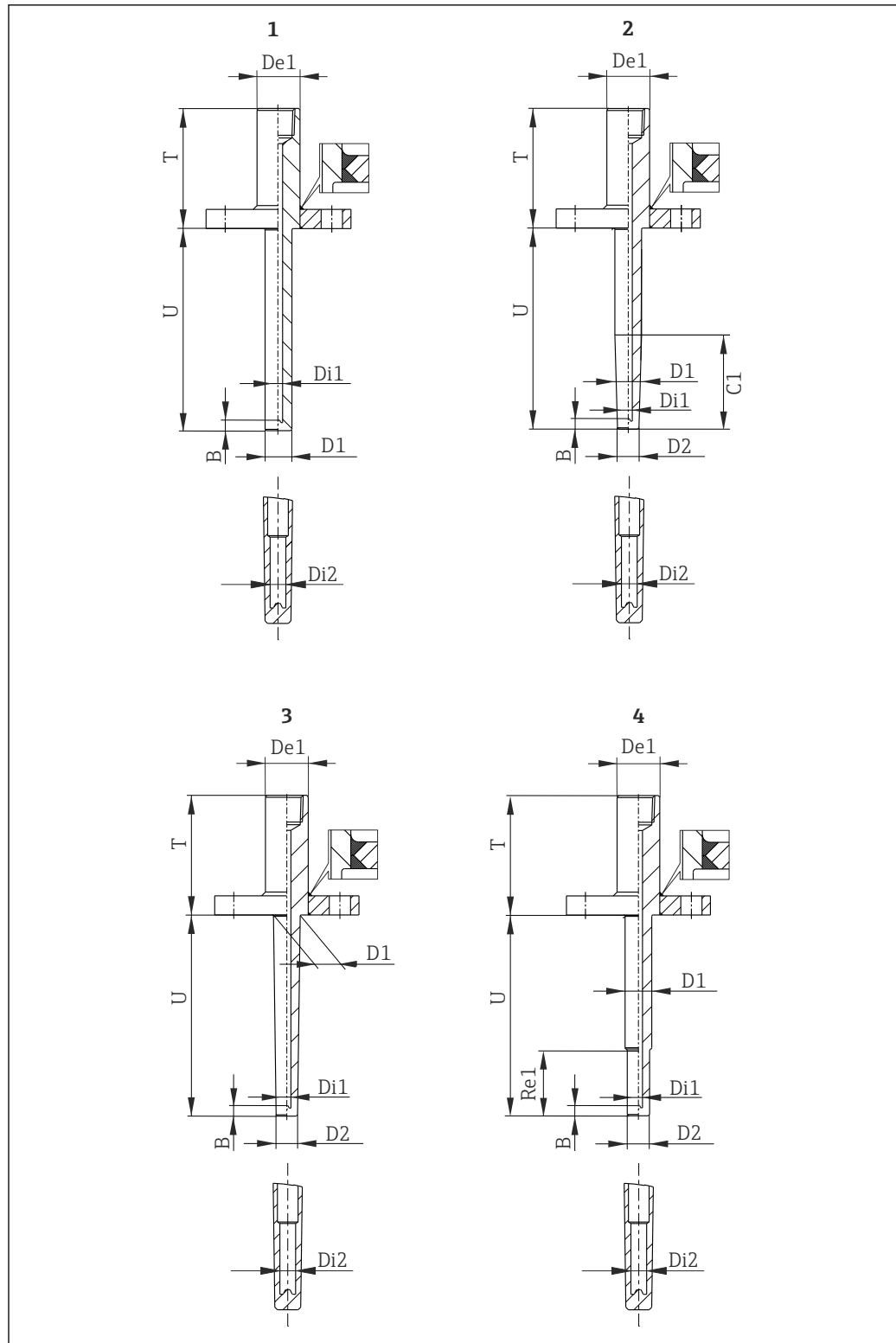
- 1 Threaded process connection and wetted part straight; lagging with spanner flats (optional hexagonal lagging available)
- 2 Threaded process connection and wetted part complete tapered; lagging with spanner flats (optional hexagonal lagging available)
- 3 Threaded process connection and wetted part partial tapered; lagging with spanner flats (optional hexagonal lagging available)



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7 Universal Thermowells with M or G threads

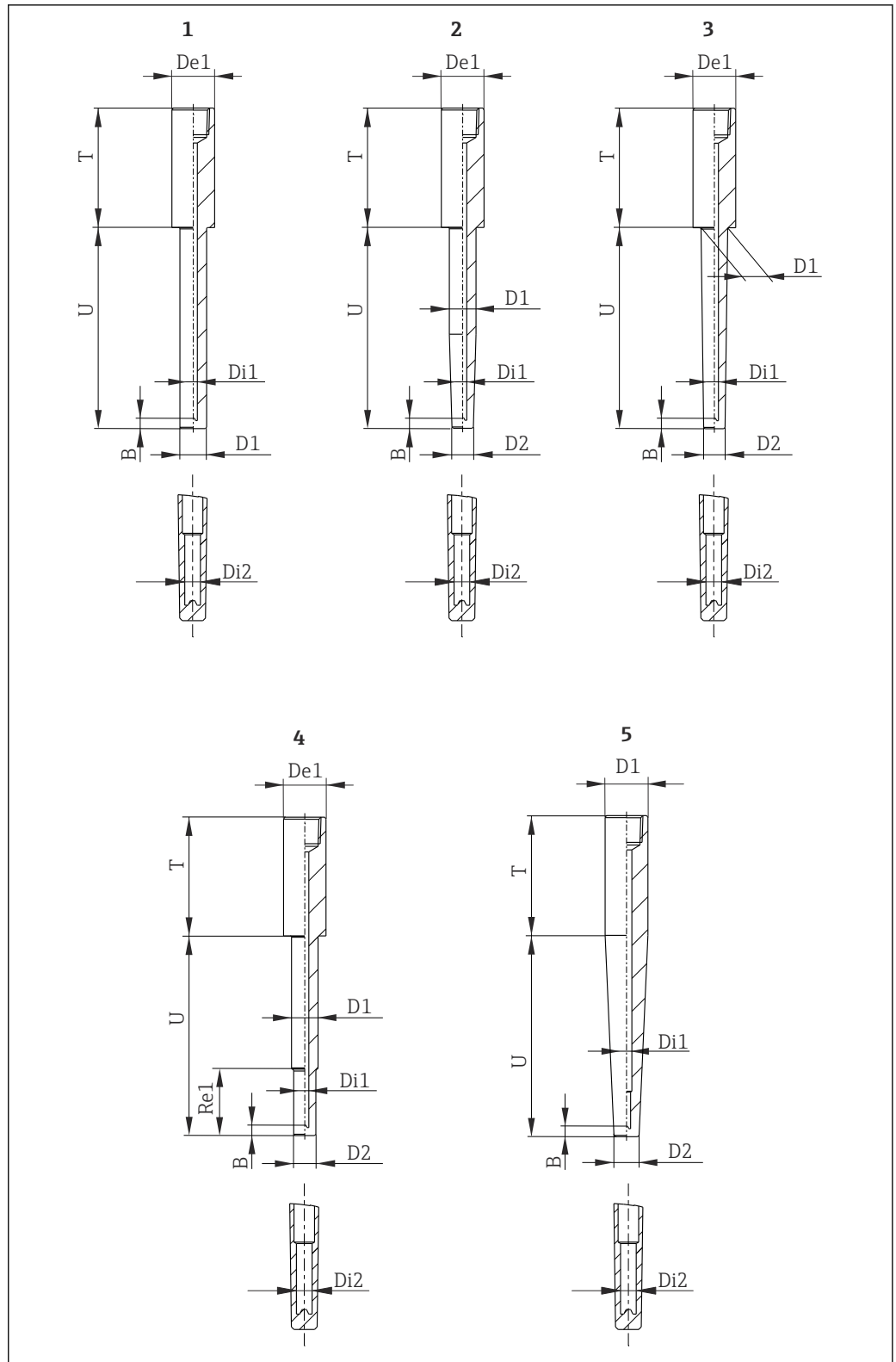
- 1 Threaded process connection and wetted part straight; lagging with spanner flats (optional hexagonal lagging available)
- 2 Threaded process connection and wetted part complete tapered; lagging with spanner flats (optional hexagonal lagging available)
- 3 Threaded process connection and wetted part partial tapered; lagging with spanner flats (optional hexagonal lagging available)



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8 Universal Thermowells

- 1 Flanged process connection and wetted part straight (optional full penetration welding available)
- 2 Flanged process connection and wetted part partial tapered (optional full penetration welding available)
- 3 Flanged process connection and wetted part tapered (optional full penetration welding available)
- 4 Flanged process connection and wetted part stepped (optional full penetration welding available)



9 Universal Thermowells

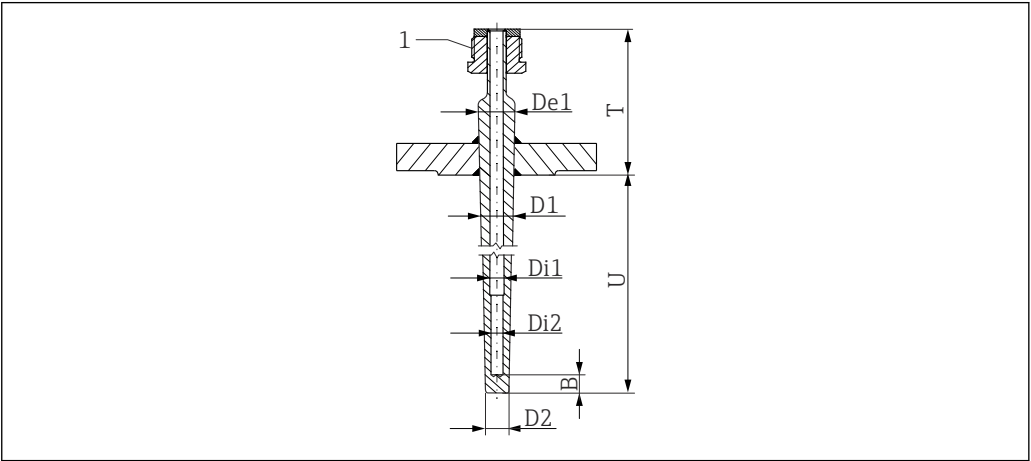
- 1 Socket weld process connection and wetted part straight
- 2 Socket weld process connection and wetted part partial tapered
- 3 Socket weld process connection and wetted part tapered
- 4 Socket weld process connection and wetted part stepped
- 5 Weld In process connection and wetted part tapered

Universal Thermowells			
	Threaded	Flanged	Socket Weld /Weld in
Thermometer connections	■ M14x1.5 ■ M18x1.5 ■ M20x1.5 ■ M27x1.5 ■ G ½" ■ G ¾" ■ ½" NPT ■ ½" NPSC ■ ½" NPSM		
Process connection size	■ M18x1.5 ■ M20x1.5 ■ M27x2 ■ M33x2 ■ G ½" ■ G ¾" ■ G 3/8" ■ G 1" ■ ½" NPT ■ ¾" NPT ■ 1" NPT ■ R ½" ■ R ¾"	■ ANSI 1" from Cl. 150 to Cl. 600 ■ ANSI 1 ½" from Cl. 150 to Cl. 2500 ■ ANSI 2" from Cl. 150 to Cl. 2500 ■ ANSI 3" from Cl. 150 ■ ANSI 4" from Cl. 300 ■ PN16 DN25 ■ PN6 DN80 ■ PN20 DN25 ■ PN40 DN25 ■ PN50 DN25 ■ PN63 DN50 ■ PN100 DN25 ■ 10K JIS 50A	■ Ø18 mm ■ Ø24 mm ■ Ø26 mm ■ Ø27 mm ■ Ø28 mm ■ Ø30 mm ■ Ø32 mm ■ Ø35 mm ■ Ø40 mm ■ Ø45 mm ■ Ø50 mm ■ Ø26.7 mm (¾ in) ■ Ø33.4 mm (1 in) ■ Ø42.2 mm (1 ¼ in) ■ Ø48.3 mm (1 ½ in)
Process connection material	■ 316 ■ 316L ■ 316Ti ■ 347 ■ 310 ■ Alloy 600 ■ Alloy C276 ■ 10CrMo9-10	■ 316 ■ 316L ■ 316Ti ■ 310 ■ Alloy C276 ■ Alloy C276 > 316L ■ Alloy 600 > 316L ■ A105	■ 316 ■ 316L ■ 316Ti ■ 347 ■ 310 ■ Alloy 600 ■ Alloy C276 ■ 10CrMo9-10
Bar material	■ 13CrMo4-5 ■ 16Mo3 ■ A105 ■ C22.8 ■ Titan Gr2	■ 316 ■ 316L ■ 316Ti ■ 310 ■ 347 ■ Alloy 600 ■ Alloy C276 ■ A105 ■ C22.8	■ 13CrMo4-5 ■ 16Mo3 ■ A105 ■ C22.8 ■ Titan Gr2
Immersion length	30 to 1500 mm ¹⁾		
Lagging length	75 to 300 mm		
Lagging diameter	Please see table → 21	9 to 50 mm	Equal to "process connection size"
Root diameter	9 to 30 mm ²⁾	9 to 50 mm	9 to 50 mm
Tip diameter	9 to 50 mm ³⁾		
Bore diameter	■ 3.5 mm ⁴⁾ ■ 6.5 mm ■ 7 mm ■ 8 mm ■ 9 mm ■ 9.5 mm ■ 10 mm ■ stepped 6.5 > 3.5 mm (length 35 mm) ■ stepped 10 > 6.5 mm (length 35 mm) ⁵⁾		
Tip thickness	■ Default value 6 mm ■ Optional 4 to 12 mm		

Universal Thermowells	
Roughness	0.76 µm or 1.6 µm
Stepped length	50 to 350 mm ⁶⁾

- 1) Maximum immersion length depends on the lagging length
- 2) Maximum root diameter depends on the process connection size
- 3) Tip diameter D2 ≤ Root diameter D1
- 4) For L>110mm a stepped bore is used (6.5>3.5mm)
- 5) Max. bore diameter depends on the tip diameter
- 6) Stepped length Re1 << Immersion length U

Thermowell based on NAMUR NE170



10 Thermowell based on NAMUR NE170

1 Sliding female nut

Thermowell based on NAMUR NE170	
Thermometer connection	M24x1.5 sliding male thread
Process connection size	- ANSI 1" from 150 lb/sq inch to 600 lb/sq inch - ANSI 1 ½" from 150 lb/sq inch to 600 lb/sq inch - ANSI 2" from 150 lb/sq inch to 600 lb/sq inch - EN PN16 DN25 - EN PN40 DN25 - EN PN40 DN40 - EN PN40 DN50
Process connection material	316 316L 316Ti - Alloy C276
Bar material	316 316L 316Ti - Alloy C276
Immersion length	30 to 610 mm
Lagging length	30 to 300 mm
Lagging diameter	20 mm, reduced to 12 mm
Root diameter	20 mm
Tip diameter	13 mm
Bore diameter	Stepped 7 > 6.1 mm (length 50 mm)

Thermowell based on NAMUR NE170	
Tip thickness	7 mm
Roughness	Default value 1.6 µm; optional 0.76 µm

Compatibility of DIN-inserts with thermowells				
Insert length	Thermowell acc. DIN 43772		Thermowell acc. NAMUR NE170	
	Form	Immersion length	Form	Immersion length
315 mm	3F1	225 mm	NF1	165 mm
375 mm	3F2	285 mm	NF2	225 mm
435 mm	3F3	345 mm	NF3	285 mm

Maximum flow velocity of process media					
Calculation standard	Form	Immersion length	Max. flow velocity		
			Water	CO2	Air
ASME PTC 19.3	NF1	165 mm	12.5 m/s	13.1 m/s	14.0 m/s
ASME PTC 19.3	NF2	225 mm	6.9 m/s	7.7 m/s	8.1 m/s
ASME PTC 19.3	NF3	285 mm	4.6 m/s	5.0 m/s	5.2 m/s
Reference value					
DIN 43772	3F1	4.2 mm	4.2 m/s	4.2 m/s	4.2 m/s

Weight 0.5 to 37 kg (1 to 82 lbs) for standard options.

Materials

Thermowell and process connections.

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant mechanical load. The maximum operating temperatures can be reduced considerably in cases where abnormal conditions such as high mechanical load occur or in aggressive media.



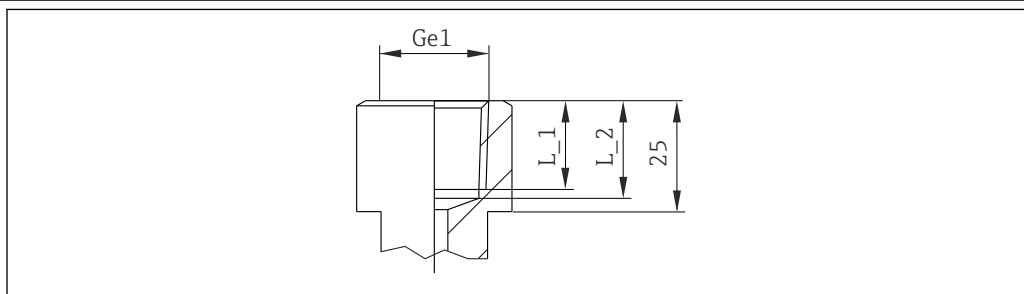
Please be aware, the maximum temperature is always also depending on the used temperature sensor!

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1 202 °F) ¹⁾	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ▪ Increased resistance to intergranular corrosion and pitting ▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °F) ¹⁾	▪ Properties comparable to AISI316L ▪ Addition of titanium means increased resistance to intergranular corrosion even after welding ▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ▪ Can only be polished to a limited extent, titanium streaks can form
AISI A105/ 1.0460	C22.8	450 °C (842 °F)	▪ Heat-resistant steel ▪ Resistant in nitrogen-containing atmospheres and atmospheres that are low in oxygen; not suitable for acids or other aggressive media ▪ Often used in steam generators, water and steam pipes, pressure vessels
Inconel600/ 2.4816	NiCr15Fe	1 100 °C (2 012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures ▪ Resistant to corrosion caused by chlorine gas and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water ▪ Not to be used in a sulfur-containing atmosphere
Hastelloy C276/ 2.4819	NiMo16Cr15W	1 100 °C (2 012 °F)	▪ A nickel-based alloy with good resistance to oxidizing and reducing atmospheres, even at high temperatures ▪ Particularly resistant to chlorine gas and chloride as well as to many oxidizing mineral and organic acids
AISI A182 F11/ 1.7335	13CrMo4-5	550 °C (1 022 °F)	▪ Low alloy, heat-resistant steel with chromium and molybdenum additions ▪ Better corrosion resistance compared to nonalloy steels, not suitable for acids and other aggressive media ▪ Often used in steam generators, water and steam pipes, pressure vessels
Titanium / 3.7035	-	600 °C (1 112 °F)	▪ A light metal with very high corrosion resistance and strength values ▪ Very good resistance to many oxidizing mineral and organic acids, saline solutions, sea water etc. ▪ Prone to fast embrittlement at high temperatures through the absorption of oxygen, nitrogen and hydrogen ▪ Compared to other metals, titanium reacts readily with many media (O₂, N₂, Cl₂, H₂) at higher temperatures and/or increased pressure ▪ Can only be used in chlorine gas and chlorinated media at comparatively low temperatures (<400 °C)

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
1.5415	16Mo3	530 °C (986 °F)	- Alloyed creep-resistant steel - Particularly well suited as pipe material for boiler construction, super heater tube, superheated steam and collecting pipe, stove and line pipes, for heat exchangers and for the purposes of oil-refining industries
Duplex S32202	X2CrNi-MoN22-5-3	300 °C (572 °F)	- Austenitic ferritic steel with good mechanical properties - High resistance to general corrosion, pitting, chlorine-induced or transgranular stress corrosion - Comparatively good resistance to hydrogeninduced stress corrosion

- 1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Please contact your Endress+Hauser sales team for further information.

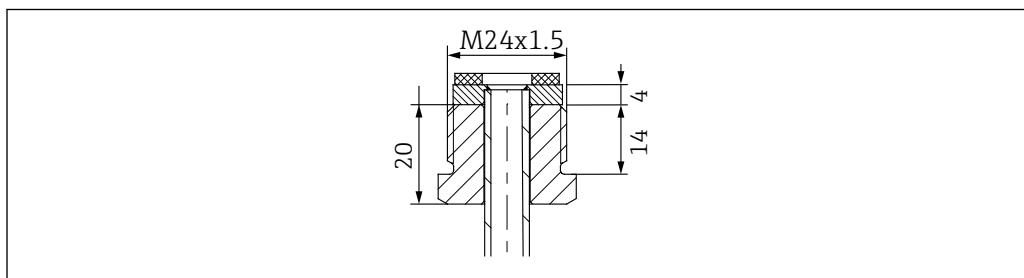
Thermometer connection



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11 Thermometer connection

Ge1	L_1	L_2	Standard/Class
M14x1.5	13 mm	16 mm	ASME B1.13M/ISO 965-1 H6
M18x1.5	13 mm	16 mm	ASME B1.13M/ISO 965-1 H6
M20x1.5	15 mm	18 mm	ASME B1.13M/ISO 965-1 H6
M27x2	17 mm	20 mm	ASME B1.13M/ISO 965-1 H6
G½"	16 mm	19 mm	ISO 228-1 A
G¾"	17 mm	20 mm	ISO 228-1 A
½" NPT/NPSC/NPSM	17 mm	20 mm	ANSI B1.20.1



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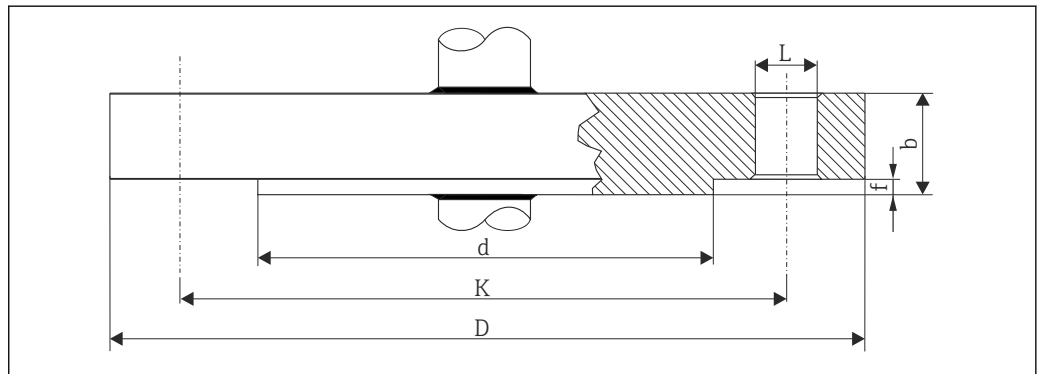
12 Sliding female thread

Process connections

Standard connections are available as weld in, socket weld, threaded connection or with flange.

Flange connection

The process connection is flanged with a double sided standard weld or a full penetration weld. The following figure shows the basic dimensions of the available flanges.



13 Flange connection

For detailed information on the flange dimensions refer to the following flange standards:

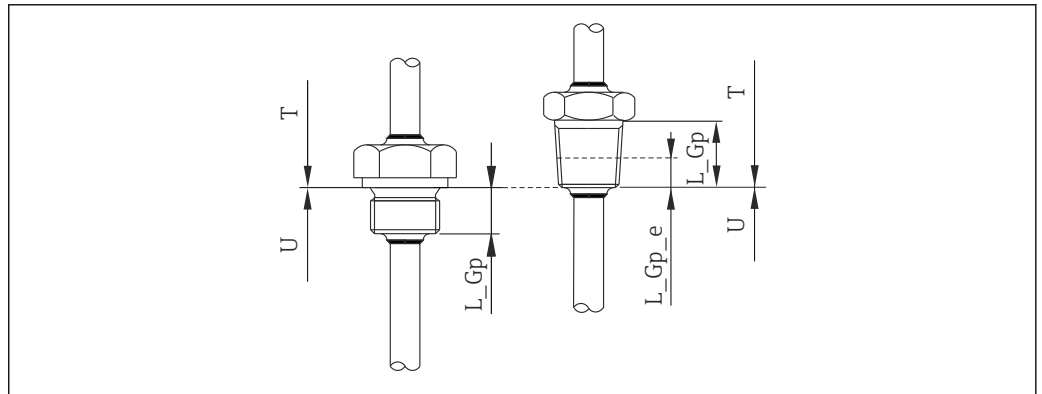
- ANSI/ASME B16.5
- ISO 7005-1
- EN 1092-1
- JIS B 2220 : 2004

The flange material should be the same as of the stem of the thermowell. Models in Alloy C276 are available as full alloy flanges or flanges in basic material SS 316L and a disc in Alloy C276 on the surface in contact with the process media.

Models in Alloy 600 are available in basic material SS 316L and a disc in Alloy 600 on the surface in contact with the process media.

Full penetration welding only in combination with lagging diameter $\varnothing$ 27 mm or $\varnothing$ 32 mm possible.

Thread connections

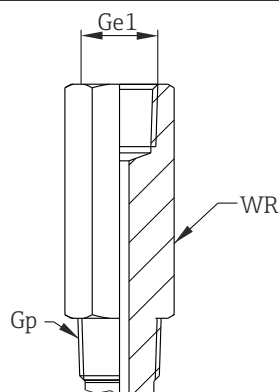


14 Threaded process connection

Version		Thread length L_Gp	Standard	Max. process pressure
M	M20x1.5	14 mm (0.55 in)	ASME B1.13M ISO 965-1 g6	Maximum static process pressure for threaded process connection: ■ 140 bar (2031 psi) at +40 °C (+140 °F) ■ 85 bar (1233 psi) at +400 °C (+752 °F)
	M18x1.5	12 mm (0.47 in)		
	M27x2	16 mm (0.63 in)		
	M33x2	18 mm (0.71 in)		

Version		Thread length L_Gp	Standard	Max. process pressure
G	G½"	15 mm (0.6 in)	ISO 228-1 A	Maximum static process pressure for threaded process connection: ■ 140 bar (2 031 psi) at +40 °C (+140 °F) ■ 85 bar (1 233 psi) at +400 °C (+752 °F)
	G1"	18 mm (0.71 in)		
	G¾"	16 mm (0.6 in)		
	G3/8"	12 mm (0.47 in)		
NPT	NPT½"	20 mm (L_Gp_e 8 mm)	ANSI B1.20.1	Maximum static process pressure for threaded process connection: ■ 140 bar (2 031 psi) at +40 °C (+140 °F) ■ 85 bar (1 233 psi) at +400 °C (+752 °F)
	NPT¾"	20 mm (L_Gp_e 8 mm)		
	NPT1"	25 mm (L_Gp_e 10 mm)		
R	R½"	20 mm (L_Gp_e 8 mm)	DIN EN 10226-1 JIS B 0203	Maximum static process pressure for threaded process connection: ■ 140 bar (2 031 psi) at +40 °C (+140 °F) ■ 85 bar (1 233 psi) at +400 °C (+752 °F)
	R¾"	20 mm (L_Gp_e 8 mm)		

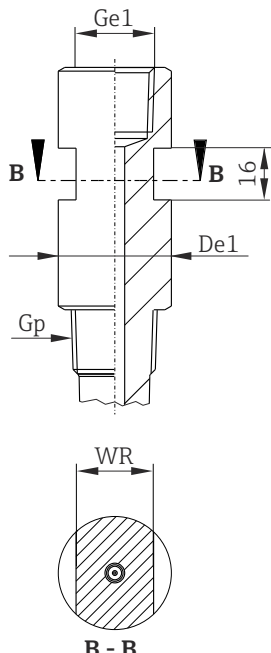
WR size matrix for threaded thermowells (hexagonal lagging)



A0040913

		Process connection size Gp (male thread)												
		M18x1.5	G3/8"	NPT½"	R ½"	M20x1.5	G½"	R¾"	NPT¾"	M27x2	G¾"	NPT1"	M33x2	G1"
Thermometer connection size Ge1 (female thread)	M14x1.5	24	24	24	24	27	27	27	27	36	36	36	41	41
	M18x1.5	24	24	24	24	27	27	27	27	36	36	36	41	41
	M20x1.5	24	24	24	24	27	27	27	27	36	36	36	41	41
	NPT½"	24	24	24	24	27	27	27	27	36	36	36	41	41
	G½"	24	24	24	24	27	27	27	27	36	36	36	41	41
	NPSC1/2	24	24	24	24	27	27	27	27	36	36	36	41	41
	NPSM1/2	24	24	24	24	27	27	27	27	36	36	36	41	41
	M27x2	36	36	36	36	36	36	36	36	36	36	36	41	41
	G¾"	36	36	36	36	36	36	36	36	36	36	36	41	41

De1 size matrix for threaded thermowells (spanner flat)

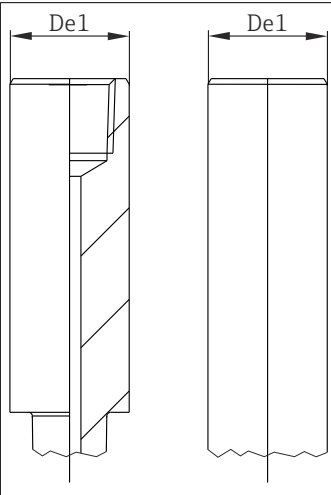


		Process connection size Gp (male thread)												
		M18x1.5	G3/8"	NPT½"	R ½"	M20x1.5	G½"	R¾"	NPT¾"	M27x2	G¾"	NPT1"	M33x2	G1"
Thermometer connection size Ge1 (female thread)	M14x1.5	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	33.4	33.4	33.4	40	40
	M18x1.5	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	33.4	33.4	33.4	40	40
	M20x1.5	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	33.4	33.4	33.4	40	40
	NPT½"	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	33.4	33.4	33.4	40	40
	G½"	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	33.4	33.4	33.4	40	40
	M27x2	30	30	30	30	30	30	30	30	33.4	33.4	33.4	40	40
	G¾"	30	30	30	30	30	30	30	30	33.4	33.4	33.4	40	40

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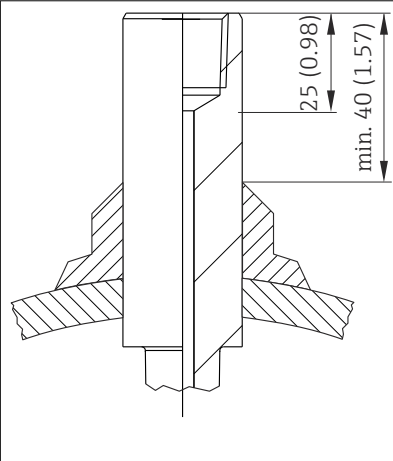
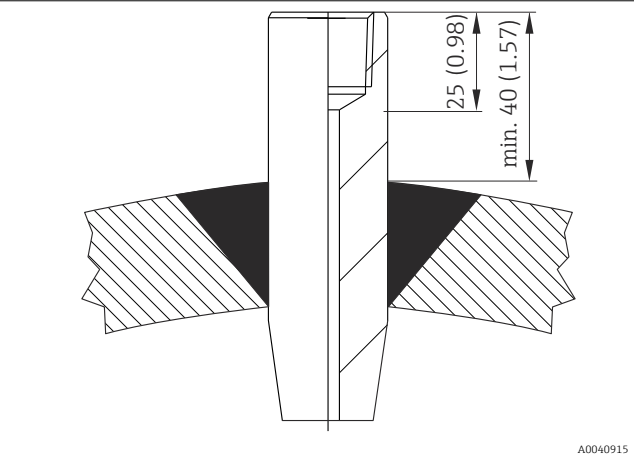
ø De1	WR
26.7/27/28	22
30	24
32/33.4/35	27
40/42.2/45	36
48.3/50	41

Weld in, socket weld

	De1 ■ ϕ 18 mm ■ ϕ 24 mm ■ ϕ 26 mm ■ ϕ 27 mm ■ ϕ 28 mm ■ ϕ 30 mm ■ ϕ 32 mm ■ ϕ 35 mm ■ ϕ 40 mm ■ ϕ 45 mm ■ ϕ 50 mm ■ ϕ 26.7 mm ($\frac{3}{4}$") ■ ϕ 33.4 mm (1") ■ ϕ 42.2 mm ($1\frac{1}{4}$") ■ ϕ 48.3 mm ($1\frac{1}{2}$")
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A0040914

Welding recommendation

	
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A0040915

Welding recommendation: Distance between welding seam and end of thermowell should be minimum 40 mm. To avoid thread deformations a dummy plug is recommended.

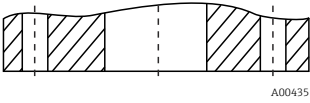
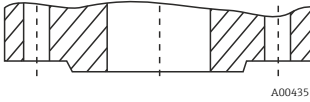
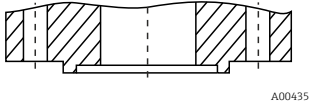
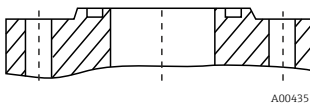
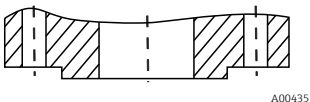
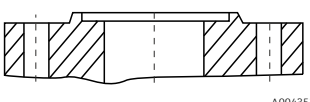
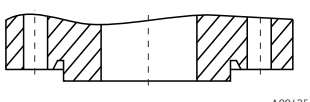
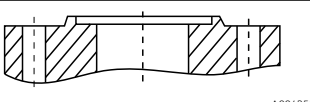
Flanges

i The flanges are supplied in stainless steel AISI 316L with material number 1.4404 or 1.4435. With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in DIN EN 1092-1 Tab.18 and under 023b in JIS B2220:2004 Tab. 5. The ASME flanges are grouped together under Tab. 2-2.2 in ASME B16.5-2013. Inches are converted into metric units (in - mm) using the factor 2.54. In the ASME standard, the metric data is rounded to 0 or 5.

Versions

- DIN flanges: German Standards Institute DIN 2527
- EN flanges: European standard DIN EN 1092-1:2002-06 and 2007
- ASME flanges: American Society of Mechanical Engineers ASME B16.5-2013
- JIS flanges: Japanese Industrial Standard B2220:2004

Geometry of sealing surfaces

Flanges	Sealing surface	DIN 2526 ¹⁾		DIN EN 1092-1		
		Shape	Rz (µm)	Shape	Rz (µm)	Ra (µm)
without raised face		A B	- 40 to 160	A ²⁾	12.5 to 50	3.2 to 12.5
with raised face		C D E	40 to 160 40 16	B1 ³⁾ B2	12.5 to 50 3.2 to 12.5	3.2 to 12.5 0.8 to 3.2
Tongue		F	-	C	3.2 to 12.5	0.8 to 3.2
Groove		N		D		
Projection		V 13	-	E	12.5 to 50	3.2 to 12.5
Recess		R 13		F		
Projection		V 14	for O-rings	H	3.2 to 12.5	3.2 to 12.5
Recess		R 14		G		

- 1) Contained in DIN 2527
2) Typically PN2.5 to PN40
3) Typically from PN63

Flanges according to the old DIN standard are compatible with the new DIN EN 1092-1 standard.
Change in pressure ratings: Old DIN standards PN64 → DIN EN 1092-1 PN63.

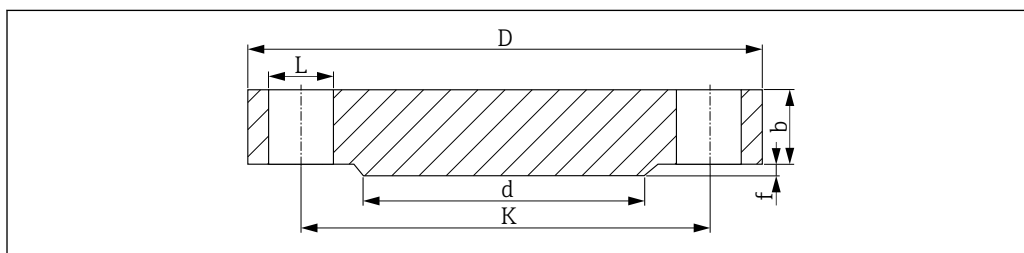
Height of raised face ¹⁾

Standard	Flanges	Height of raised face f	Tolerance
DIN EN 1092-1:2002-06	all types	2 (0.08)	0 -1 (-0.04)
DIN EN 1092-1:2007	≤ DN 32		
	> DN 32 to DN 250	3 (0.12)	0 -2 (-0.08)
	> DN 250 to DN 500	4 (0.16)	0 -3 (-0.12)
	> DN 500	5 (0.19)	0 -4 (-0.16)
ASME B16.5 - 2013	≤ Class 300	1.6 (0.06)	±0.75 (±0.03)
	≥ Class 600	6.4 (0.25)	0.5 (0.02)
JIS B2220:2004	< DN 20	1.5 (0.06) 0	-

Standard	Flanges	Height of raised face f	Tolerance
	> DN 20 to DN 50	2 (0.08) 0	
	> DN 50	3 (0.12) 0	

1) Dimensions in mm (in)

EN flanges (DIN EN 1092-1)



A0029176

15 Raised face B1

L Bore diameter
d Diameter of raised face
K Diameter of pitch circle
D Flange diameter
b Total flange thickness
f Height of raised face (generally 2 mm (0.08 in))

PN16¹⁾

DN	D	b	K	d	L	approx. kg (lbs)
25	115 (4.53)	18 (0.71)	85 (3.35)	68 (2.68)	4xØ14 (0.55)	1.50 (3.31)
32	140 (5.51)	18 (0.71)	100 (3.94)	78 (3.07)	4xØ18 (0.71)	2.00 (4.41)
40	150 (5.91)	18 (0.71)	110 (4.33)	88 (3.46)	4xØ18 (0.71)	2.50 (5.51)
50	165 (6.5)	18 (0.71)	125 (4.92)	102 (4.02)	4xØ18 (0.71)	2.90 (6.39)
65	185 (7.28)	18 (0.71)	145 (5.71)	122 (4.80)	8xØ18 (0.71)	3.50 (7.72)
80	200 (7.87)	20 (0.79)	160 (6.30)	138 (5.43)	8xØ18 (0.71)	4.50 (9.92)
100	220 (8.66)	20 (0.79)	180 (7.09)	158 (6.22)	8xØ18 (0.71)	5.50 (12.13)
125	250 (9.84)	22 (0.87)	210 (8.27)	188 (7.40)	8xØ18 (0.71)	8.00 (17.64)
150	285 (11.2)	22 (0.87)	240 (9.45)	212 (8.35)	8xØ22 (0.87)	10.5 (23.15)
200	340 (13.4)	24 (0.94)	295 (11.6)	268 (10.6)	12xØ22 (0.87)	16.5 (36.38)
250	405 (15.9)	26 (1.02)	355 (14.0)	320 (12.6)	12xØ26 (1.02)	25.0 (55.13)
300	460 (18.1)	28 (1.10)	410 (16.1)	378 (14.9)	12xØ26 (1.02)	35.0 (77.18)

1) The dimensions in the following tables are in mm (in), unless otherwise specified.

PN25

DN	D	b	K	d	L	approx. kg (lbs)
25	115 (4.53)	18 (0.71)	85 (3.35)	68 (2.68)	4xØ14 (0.55)	1.50 (3.31)
32	140 (5.51)	18 (0.71)	100 (3.94)	78 (3.07)	4xØ18 (0.71)	2.00 (4.41)
40	150 (5.91)	18 (0.71)	110 (4.33)	88 (3.46)	4xØ18 (0.71)	2.50 (5.51)
50	165 (6.5)	20 (0.79)	125 (4.92)	102 (4.02)	4xØ18 (0.71)	3.00 (6.62)
65	185 (7.28)	22 (0.87)	145 (5.71)	122 (4.80)	8xØ18 (0.71)	4.50 (9.92)

DN	D	b	K	d	L	approx. kg (lbs)
80	200 (7.87)	24 (0.94)	160 (6.30)	138 (5.43)	8xØ18 (0.71)	5.50 (12.13)
100	235 (9.25)	24 (0.94)	190 (7.48)	162 (6.38)	8xØ22 (0.87)	7.50 (16.54)
125	270 (10.6)	26 (1.02)	220 (8.66)	188 (7.40)	8xØ26 (1.02)	11.0 (24.26)
150	300 (11.8)	28 (1.10)	250 (9.84)	218 (8.58)	8xØ26 (1.02)	14.5 (31.97)
200	360 (14.2)	30 (1.18)	310 (12.2)	278 (10.9)	12xØ26 (1.02)	22.5 (49.61)
250	425 (16.7)	32 (1.26)	370 (14.6)	335 (13.2)	12xØ30 (1.18)	33.5 (73.9)
300	485 (19.1)	34 (1.34)	430 (16.9)	395 (15.6)	16xØ30 (1.18)	46.5 (102.5)

PN40

DN	D	b	K	d	L	approx. kg (lbs)
25	115 (4.53)	18 (0.71)	85 (3.35)	68 (2.68)	4xØ14 (0.55)	1.50 (3.31)
32	140 (5.51)	18 (0.71)	100 (3.94)	78 (3.07)	4xØ18 (0.71)	2.00 (4.41)
40	150 (5.91)	18 (0.71)	110 (4.33)	88 (3.46)	4xØ18 (0.71)	2.50 (5.51)
50	165 (6.5)	20 (0.79)	125 (4.92)	102 (4.02)	4xØ18 (0.71)	3.00 (6.62)
65	185 (7.28)	22 (0.87)	145 (5.71)	122 (4.80)	8xØ18 (0.71)	4.50 (9.92)
80	200 (7.87)	24 (0.94)	160 (6.30)	138 (5.43)	8xØ18 (0.71)	5.50 (12.13)
100	235 (9.25)	24 (0.94)	190 (7.48)	162 (6.38)	8xØ22 (0.87)	7.50 (16.54)
125	270 (10.6)	26 (1.02)	220 (8.66)	188 (7.40)	8xØ26 (1.02)	11.0 (24.26)
150	300 (11.8)	28 (1.10)	250 (9.84)	218 (8.58)	8xØ26 (1.02)	14.5 (31.97)
200	375 (14.8)	36 (1.42)	320 (12.6)	285 (11.2)	12xØ30 (1.18)	29.0 (63.95)
250	450 (17.7)	38 (1.50)	385 (15.2)	345 (13.6)	12xØ33 (1.30)	44.5 (98.12)
300	515 (20.3)	42 (1.65)	450 (17.7)	410 (16.1)	16xØ33 (1.30)	64.0 (141.1)

PN63

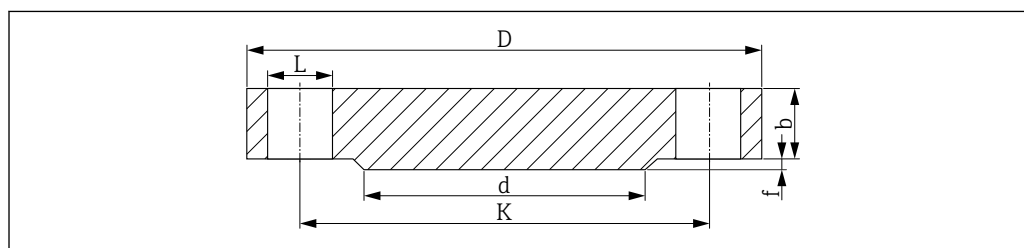
DN	D	b	K	d	L	approx. kg (lbs)
25	140 (5.51)	24 (0.94)	100 (3.94)	68 (2.68)	4xØ18 (0.71)	2.50 (5.51)
32	155 (6.10)	24 (0.94)	110 (4.33)	78 (3.07)	4xØ22 (0.87)	3.50 (7.72)
40	170 (6.69)	26 (1.02)	125 (4.92)	88 (3.46)	4xØ22 (0.87)	4.50 (9.92)
50	180 (7.09)	26 (1.02)	135 (5.31)	102 (4.02)	4xØ22 (0.87)	5.00 (11.03)
65	205 (8.07)	26 (1.02)	160 (6.30)	122 (4.80)	8xØ22 (0.87)	6.00 (13.23)
80	215 (8.46)	28 (1.10)	170 (6.69)	138 (5.43)	8xØ22 (0.87)	7.50 (16.54)
100	250 (9.84)	30 (1.18)	200 (7.87)	162 (6.38)	8xØ26 (1.02)	10.5 (23.15)
125	295 (11.6)	34 (1.34)	240 (9.45)	188 (7.40)	8xØ30 (1.18)	16.5 (36.38)
150	345 (13.6)	36 (1.42)	280 (11.0)	218 (8.58)	8xØ33 (1.30)	24.5 (54.02)
200	415 (16.3)	42 (1.65)	345 (13.6)	285 (11.2)	12xØ36 (1.42)	40.5 (89.3)
250	470 (18.5)	46 (1.81)	400 (15.7)	345 (13.6)	12xØ36 (1.42)	58.0 (127.9)
300	530 (20.9)	52 (2.05)	460 (18.1)	410 (16.1)	16xØ36 (1.42)	83.5 (184.1)

PN100

DN	D	b	K	d	L	approx. kg (lbs)
25	140 (5.51)	24 (0.94)	100 (3.94)	68 (2.68)	4xØ18 (0.71)	2.50 (5.51)
32	155 (6.10)	24 (0.94)	110 (4.33)	78 (3.07)	4xØ22 (0.87)	3.50 (7.72)

DN	D	b	K	d	L	approx. kg (lbs)
40	170 (6.69)	26 (1.02)	125 (4.92)	88 (3.46)	4xØ22 (0.87)	4.50 (9.92)
50	195 (7.68)	28 (1.10)	145 (5.71)	102 (4.02)	4xØ26 (1.02)	6.00 (13.23)
65	220 (8.66)	30 (1.18)	170 (6.69)	122 (4.80)	8xØ26 (1.02)	8.00 (17.64)
80	230 (9.06)	32 (1.26)	180 (7.09)	138 (5.43)	8xØ26 (1.02)	9.50 (20.95)
100	265 (10.4)	36 (1.42)	210 (8.27)	162 (6.38)	8xØ30 (1.18)	14.0 (30.87)
125	315 (12.4)	40 (1.57)	250 (9.84)	188 (7.40)	8xØ33 (1.30)	22.5 (49.61)
150	355 (14.0)	44 (1.73)	290 (11.4)	218 (8.58)	12xØ33 (1.30)	30.5 (67.25)
200	430 (16.9)	52 (2.05)	360 (14.2)	285 (11.2)	12xØ36 (1.42)	54.5 (120.2)
250	505 (19.9)	60 (2.36)	430 (16.9)	345 (13.6)	12xØ39 (1.54)	87.5 (192.9)
300	585 (23.0)	68 (2.68)	500 (19.7)	410 (16.1)	16xØ42 (1.65)	131.5 (289.9)

ASME flanges (ASME B16.5-2013)



A0029175

16 Raised face RF

L Bore diameter

d Diameter of raised face

K Diameter of pitch circle

D Flange diameter

b Total flange thickness

f Height of raised face, Class 150/300: 1.6 mm (0.06 in) or from Class 600: 6.4 mm (0.25 in)

Surface quality of raised face $R_a \leq 3.2$ to $6.3 \mu\text{m}$ (126 to $248 \mu\text{in}$).Class 150¹⁾

DN	D	b	K	d	L	approx. kg (lbs)
1"	108.0 (4.25)	14.2 (0.56)	79.2 (3.12)	50.8 (2.00)	4xØ15.7 (0.62)	0.86 (1.9)
1¼"	117.3 (4.62)	15.7 (0.62)	88.9 (3.50)	63.5 (2.50)	4xØ15.7 (0.62)	1.17 (2.58)
1½"	127.0 (5.00)	17.5 (0.69)	98.6 (3.88)	73.2 (2.88)	4xØ15.7 (0.62)	1.53 (3.37)
2"	152.4 (6.00)	19.1 (0.75)	120.7 (4.75)	91.9 (3.62)	4xØ19.1 (0.75)	2.42 (5.34)
2½"	177.8 (7.00)	22.4 (0.88)	139.7 (5.50)	104.6 (4.12)	4xØ19.1 (0.75)	3.94 (8.69)
3"	190.5 (7.50)	23.9 (0.94)	152.4 (6.00)	127.0 (5.00)	4xØ19.1 (0.75)	4.93 (10.87)
3½"	215.9 (8.50)	23.9 (0.94)	177.8 (7.00)	139.7 (5.50)	8xØ19.1 (0.75)	6.17 (13.60)
4"	228.6 (9.00)	23.9 (0.94)	190.5 (7.50)	157.2 (6.19)	8xØ19.1 (0.75)	7.00 (15.44)
5"	254.0 (10.0)	23.9 (0.94)	215.9 (8.50)	185.7 (7.31)	8xØ22.4 (0.88)	8.63 (19.03)
6"	279.4 (11.0)	25.4 (1.00)	241.3 (9.50)	215.9 (8.50)	8xØ22.4 (0.88)	11.3 (24.92)
8"	342.9 (13.5)	28.4 (1.12)	298.5 (11.8)	269.7 (10.6)	8xØ22.4 (0.88)	19.6 (43.22)
10"	406.4 (16.0)	30.2 (1.19)	362.0 (14.3)	323.8 (12.7)	12xØ25.4 (1.00)	28.8 (63.50)

1) The dimensions in the following tables are in mm (in), unless otherwise specified.

Class 300

DN	D	b	K	d	L	approx. kg (lbs)
1"	124.0 (4.88)	17.5 (0.69)	88.9 (3.50)	50.8 (2.00)	4xØ19.1 (0.75)	1.39 (3.06)
1¼"	133.4 (5.25)	19.1 (0.75)	98.6 (3.88)	63.5 (2.50)	4xØ19.1 (0.75)	1.79 (3.95)
1½"	155.4 (6.12)	20.6 (0.81)	114.3 (4.50)	73.2 (2.88)	4xØ22.4 (0.88)	2.66 (5.87)
2"	165.1 (6.50)	22.4 (0.88)	127.0 (5.00)	91.9 (3.62)	8xØ19.1 (0.75)	3.18 (7.01)
2½"	190.5 (7.50)	25.4 (1.00)	149.4 (5.88)	104.6 (4.12)	8xØ22.4 (0.88)	4.85 (10.69)
3"	209.5 (8.25)	28.4 (1.12)	168.1 (6.62)	127.0 (5.00)	8xØ22.4 (0.88)	6.81 (15.02)
3½"	228.6 (9.00)	30.2 (1.19)	184.2 (7.25)	139.7 (5.50)	8xØ22.4 (0.88)	8.71 (19.21)
4"	254.0 (10.0)	31.8 (1.25)	200.2 (7.88)	157.2 (6.19)	8xØ22.4 (0.88)	11.5 (25.36)
5"	279.4 (11.0)	35.1 (1.38)	235.0 (9.25)	185.7 (7.31)	8xØ22.4 (0.88)	15.6 (34.4)
6"	317.5 (12.5)	36.6 (1.44)	269.7 (10.6)	215.9 (8.50)	12xØ22.4 (0.88)	20.9 (46.08)
8"	381.0 (15.0)	41.1 (1.62)	330.2 (13.0)	269.7 (10.6)	12xØ25.4 (1.00)	34.3 (75.63)
10"	444.5 (17.5)	47.8 (1.88)	387.4 (15.3)	323.8 (12.7)	16xØ28.4 (1.12)	53.3 (117.5)

Class 600

DN	D	b	K	d	L	approx. kg (lbs)
1"	124.0 (4.88)	17.5 (0.69)	88.9 (3.50)	50.8 (2.00)	4xØ19.1 (0.75)	1.60 (3.53)
1¼"	133.4 (5.25)	20.6 (0.81)	98.6 (3.88)	63.5 (2.50)	4xØ19.1 (0.75)	2.23 (4.92)
1½"	155.4 (6.12)	22.4 (0.88)	114.3 (4.50)	73.2 (2.88)	4xØ22.4 (0.88)	3.25 (7.17)
2"	165.1 (6.50)	25.4 (1.00)	127.0 (5.00)	91.9 (3.62)	8xØ19.1 (0.75)	4.15 (9.15)
2½"	190.5 (7.50)	28.4 (1.12)	149.4 (5.88)	104.6 (4.12)	8xØ22.4 (0.88)	6.13 (13.52)
3"	209.5 (8.25)	31.8 (1.25)	168.1 (6.62)	127.0 (5.00)	8xØ22.4 (0.88)	8.44 (18.61)
3½"	228.6 (9.00)	35.1 (1.38)	184.2 (7.25)	139.7 (5.50)	8xØ25.4 (1.00)	11.0 (24.26)
4"	273.1 (10.8)	38.1 (1.50)	215.9 (8.50)	157.2 (6.19)	8xØ25.4 (1.00)	17.3 (38.15)
5"	330.2 (13.0)	44.5 (1.75)	266.7 (10.5)	185.7 (7.31)	8xØ28.4 (1.12)	29.4 (64.83)
6"	355.6 (14.0)	47.8 (1.88)	292.1 (11.5)	215.9 (8.50)	12xØ28.4 (1.12)	36.1 (79.6)
8"	419.1 (16.5)	55.6 (2.19)	349.3 (13.8)	269.7 (10.6)	12xØ31.8 (1.25)	58.9 (129.9)
10"	508.0 (20.0)	63.5 (2.50)	431.8 (17.0)	323.8 (12.7)	16xØ35.1 (1.38)	97.5 (214.9)

Class 900

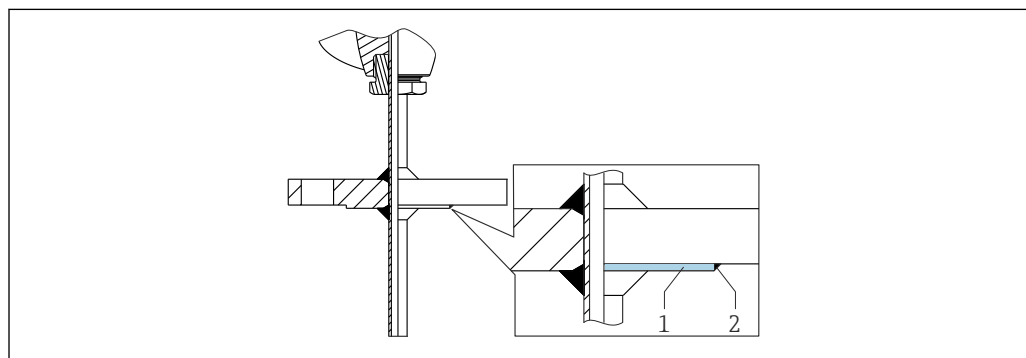
DN	D	b	K	d	L	approx. kg (lbs)
1"	149.4 (5.88)	28.4 (1.12)	101.6 (4.0)	50.8 (2.00)	4xØ25.4 (1.00)	3.57 (7.87)
1¼"	158.8 (6.25)	28.4 (1.12)	111.3 (4.38)	63.5 (2.50)	4xØ25.4 (1.00)	4.14 (9.13)
1½"	177.8 (7.0)	31.8 (1.25)	124.0 (4.88)	73.2 (2.88)	4xØ28.4 (1.12)	5.75 (12.68)
2"	215.9 (8.50)	38.1 (1.50)	165.1 (6.50)	91.9 (3.62)	8xØ25.4 (1.00)	10.1 (22.27)
2½"	244.4 (9.62)	41.1 (1.62)	190.5 (7.50)	104.6 (4.12)	8xØ28.4 (1.12)	14.0 (30.87)
3"	241.3 (9.50)	38.1 (1.50)	190.5 (7.50)	127.0 (5.00)	8xØ25.4 (1.00)	13.1 (28.89)
4"	292.1 (11.50)	44.5 (1.75)	235.0 (9.25)	157.2 (6.19)	8xØ31.8 (1.25)	26.9 (59.31)
5"	349.3 (13.8)	50.8 (2.0)	279.4 (11.0)	185.7 (7.31)	8xØ35.1 (1.38)	36.5 (80.48)
6"	381.0 (15.0)	55.6 (2.19)	317.5 (12.5)	215.9 (8.50)	12xØ31.8 (1.25)	47.4 (104.5)
8"	469.9 (18.5)	63.5 (2.50)	393.7 (15.5)	269.7 (10.6)	12xØ38.1 (1.50)	82.5 (181.9)
10"	546.1 (21.50)	69.9 (2.75)	469.0 (18.5)	323.8 (12.7)	16xØ38.1 (1.50)	122 (269.0)

Class 1500

DN	D	b	K	d	L	approx. kg (lbs)
1"	149.4 (5.88)	28.4 (1.12)	101.6 (4.0)	50.8 (2.00)	4xØ25.4 (1.00)	3.57 (7.87)
1¼"	158.8 (6.25)	28.4 (1.12)	111.3 (4.38)	63.5 (2.50)	4xØ25.4 (1.00)	4.14 (9.13)
1½"	177.8 (7.0)	31.8 (1.25)	124.0 (4.88)	73.2 (2.88)	4xØ28.4 (1.12)	5.75 (12.68)
2"	215.9 (8.50)	38.1 (1.50)	165.1 (6.50)	91.9 (3.62)	8xØ25.4 (1.00)	10.1 (22.27)
2½"	244.4 (9.62)	41.1 (1.62)	190.5 (7.50)	104.6 (4.12)	8xØ28.4 (1.12)	14.0 (30.87)
3"	266.7 (10.5)	47.8 (1.88)	203.2 (8.00)	127.0 (5.00)	8xØ31.8 (1.25)	19.1 (42.12)
4"	311.2 (12.3)	53.8 (2.12)	241.3 (9.50)	157.2 (6.19)	8xØ35.1 (1.38)	29.9 (65.93)
5"	374.7 (14.8)	73.2 (2.88)	292.1 (11.5)	185.7 (7.31)	8xØ41.1 (1.62)	58.4 (128.8)
6"	393.7 (15.50)	82.6 (3.25)	317.5 (12.5)	215.9 (8.50)	12xØ38.1 (1.50)	71.8 (158.3)
8"	482.6 (19.0)	91.9 (3.62)	393.7 (15.5)	269.7 (10.6)	12xØ44.5 (1.75)	122 (269.0)
10"	584.2 (23.0)	108.0 (4.25)	482.6 (19.0)	323.8 (12.7)	12xØ50.8 (2.00)	210 (463.0)

Thermowell material, nickel-based, with flange

If the thermowell materials Alloy600 and Alloy C276 are combined with a flange process connection, only the raised face and not the complete flange is made of the alloy for cost reasons. This is welded onto a flange with the parent material 316L. Identified in the order code by the material designation Alloy600 > 316L or Alloy C276 > 316L.



A0043523

- 1 Raised face
2 Weld

Surface roughness*Specifications for surfaces in contact with medium*

Standard surface	$R_a \leq 1.6 \mu\text{m}$ (63 μin)
Finely honed surface, buffed	$R_a \leq 0.76 \mu\text{m}$ (30 μin)

Certificates and approvals

Current certificates and approvals for the product are available via the Product Configurator at www.endress.com.

1. Select the product using the filters and search field.
2. Open the product page.

The **Configuration** button opens the Product Configurator.

Ordering information

Detailed ordering information is available for your nearest sales organization www.addresses.endress.com or in the Product Configurator under www.endress.com :

1. Click Corporate
2. Select the country
3. Click Products
4. Select the product using the filters and search field
5. Open the product page

The Configuration button to the right of the product image opens the Product Configurator.



Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ■ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. ■ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator
Configurator	Product Configurator - the tool for individual product configuration ■ Up-to-the-minute configuration data ■ Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language ■ Automatic verification of exclusion criteria ■ Automatic creation of the order code and its breakdown in PDF or Excel output format ■ Ability to order directly in the Endress+Hauser Online Shop The Configurator is available on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
W@M	Life cycle management for your plant W@M supports with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: Via the Internet: www.endress.com/lifecyclemanagement

Documentation

Operating Instructions: Thermowells for thermometers in industrial applications (BA02041T)

Technical Information:

- Modular RTD or TC Thermometer:
 - iTHERM TM131 (TI01373T)
 - iTHERM TM121 (TI01455T)
- Insert:
iTHERM TS111 (TI01014T) and iTHERM TS211 (TI01411T)



www.addresses.endress.com
