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Technical Information
iTHERM ModuLine TT151

Barstock thermowell



Metric 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

- iTHERM ModuLine TT151 is an industry standard thermowell manufactured from round barstock
- Modular design according to DIN 43772, ASME B40.9, NAMUR NE170 or flexible universal version
- Extension, immersion length and total length can be chosen according to process requirements
- Wide range of dimensions, materials and process connections available
- iTHERM TwistWell with helical design: reduces vortex-induced vibrations in high flow rate applications

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Table of contents

Function and system design 3
Equipment architecture 3
Modular design 3

Installation 3
Mounting location 3
Orientation 3
Installation instructions 3

Process 4
Process temperature range 4
Process pressure range 4

Mechanical construction 5
Design, dimensions 5
Weight 19
Materials 19
Thermometer connection 21
Process connections 21
Geometry of parts in contact with medium 32
Surface roughness 32

Certificates and approvals 32

Ordering information 33

Accessories 33
Device-specific accessories 33
Online tools 33

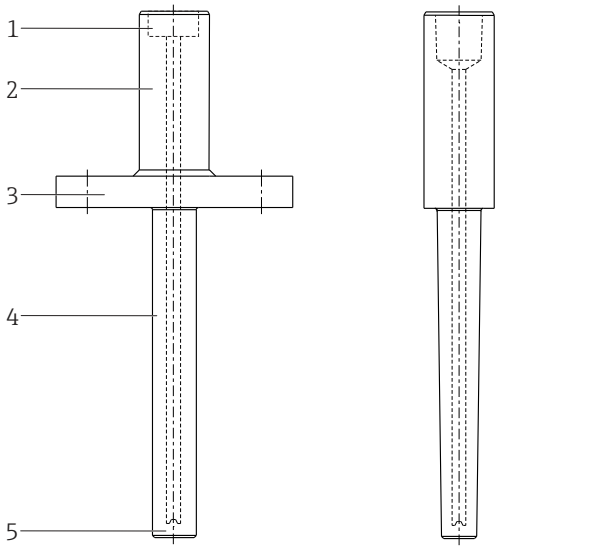
Documentation 34

Function and system design

Equipment architecture

The thermowell design is based on DIN 43772 or ASME B40.9 and it is also available as a universal version that can be configured flexibly. The thermowell guarantees a high level of resistance in 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 attached to a pipe or vessel within the system, with various process connections available for this purpose: flanged, threaded, or weld-in options.

Modular design

Design		Options
	1: Thermometer connection	Female thread
	2: Lagging	An extension that cannot be separated from the thermowell. This extension provides additional installation length when a flange is used. It also protects the terminal head and electronics module from the heat in the process.
	3: Process connection	Connection piece on process side. This can be any type of thread, flange, weld-in connection, or socket weld. The process connection must be designed to withstand the process pressure, temperature and media.
	4: Thermowell	The part of the thermowell that is immersed in the process medium. Available in a variety of diameters and materials to cover a wide range of applications. The selected material and strength must be able to withstand the static and dynamic load caused by the process conditions. They must also be resistant to chemicals, mechanical shock and vibrations.
	5: Thermowell tip	Different tip shapes are available. For thermowells used in pipes with a small diameter, a reduced or tapered thermowell tip is typically 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

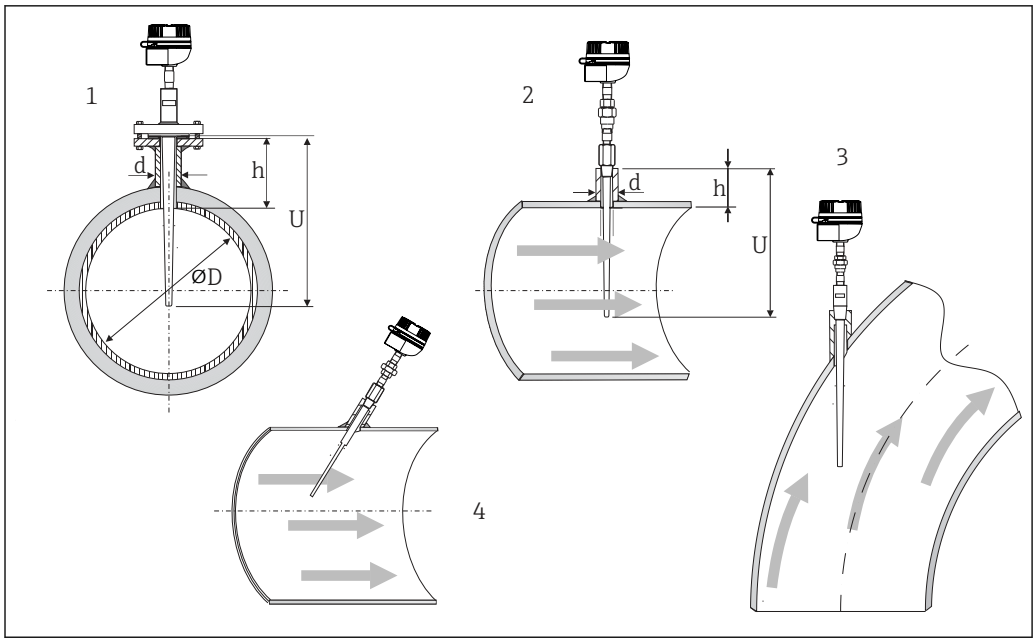
The thermowell can be installed in pipes, tanks or vessels.

Orientation

No restrictions. Self-draining in the process must be ensured, depending on the application.

Installation instructions

The immersion length of the thermometer can influence the measurement accuracy. If the immersion length is too short, this leads 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. The installation position varies according to requirements; however, in all cases the measuring element must be completely exposed to the medium and not shielded by the socket. In pipes with a small diameter, it helps to mount a pipe expander around the measuring point to ensure a sufficient immersion length.



1 Installation examples

1 - 2 In pipelines with a small cross-section, the sensor tip must be positioned so that it reaches or passes beyond the axis of the pipeline (=L).
3 - 4 Angled installation.

In pipelines with small nominal diameters, the thermometer tip must be positioned so that it extends far enough into the process and reaches or passes beyond the axis of the pipeline. Alternatively, fit the thermometer at an angle (4). The immersion length or installation depth must be determined taking into account all parameters of the thermometer and the medium to be measured, such as flow velocity or process pressure.

To achieve the best possible installation, the following rule should be observed: h ~ d; U > D/2 +h.

Use iTHERM QuickSens inserts for immersion lengths U < 70 mm (27.6 in) for optimum measurement results.

The counterpieces for the process connections and the seals or sealing rings are not supplied with the thermometer.

Process

Process temperature range

Depends on the type of thermowell and material used, maximum −200 to +1 100 °C (−328 to +2 012 °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.

The mechanical loading capacity as a function of the installation and process conditions can be verified in the "Thermowell Calculation Tool" contained in the manufacturer's 'Applicator' online tool. See "Accessories" section.

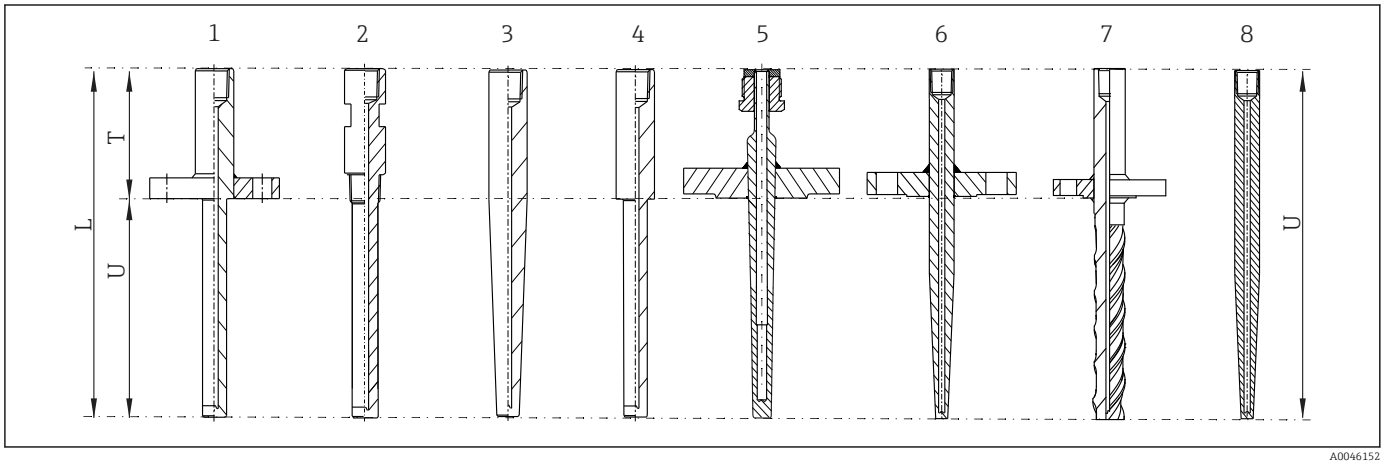
Permitted flow velocity depending on the immersion length and process medium

The maximum flow velocity tolerated by the thermowell diminishes with increasing thermowell immersion length exposed to the stream of the fluid. 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	NPS	≤ 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)
Flange	ASME B16.5	Depending on the flange pressure rating 150, 300, 600, 900/1500 or 2500 psi at 20 °C (68 °F)
Flange	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	400 bar (5 802 psi) at +400 °C (+752 °F)

Mechanical construction

Design, dimensions



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

1 Flanged, references according to ASME/universal
2 Threaded, references according to ASME/universal
3 Weld-in, references according to ASME/universal
4 Socket weld, references according to ASME/universal
5 Flanged, references according to NAMUR
6 Flanged, references according to DIN
7 Flanged, references according to iTHERM TwistWell
8 Weld-in, references according to DIN

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

Thermowells based on ASME:
- ANSI flanges
- NPT thread
- Socket weld and weld-in

Thermowells based on DIN:
- EN flanges
- M or G threads
- Socket weld and weld-in

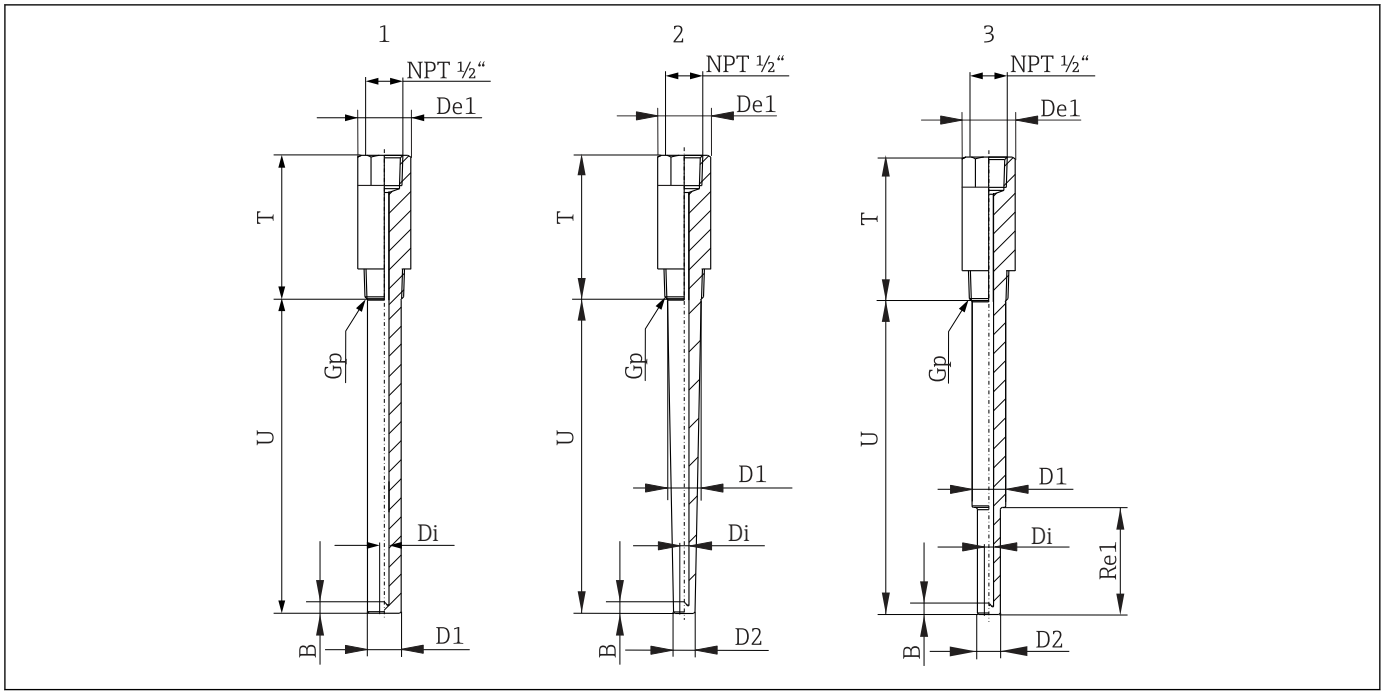
Universal:
- ANSI, EN, ISO or HG/T flange
- M, G, R or NPT threads
- Socket weld and weld-in

Some dimensions are variable values and are therefore indicated as items in the following dimensional drawings.

Variable dimensions:

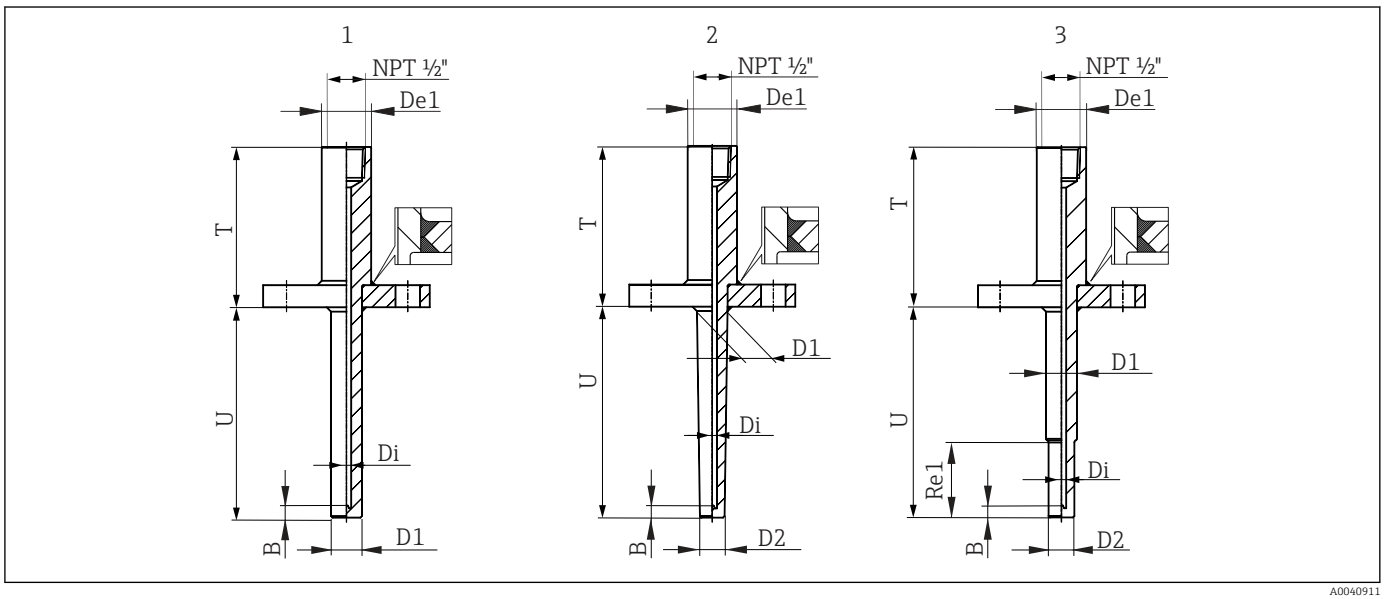
Item	Description
L	Thermowell length (U+T)
L_Gp	Thread length (complete thread length)
L_Gp_e	Thread engagement length
Gp	Process connection thread
B	Thermowell tip thickness (default value 6 mm - other thicknesses available as options)
T	Length of thermowell lagging
U	Immersion length
D1	Root diameter
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
SL	Length of the coil

Thermowells based on ASME B40.9



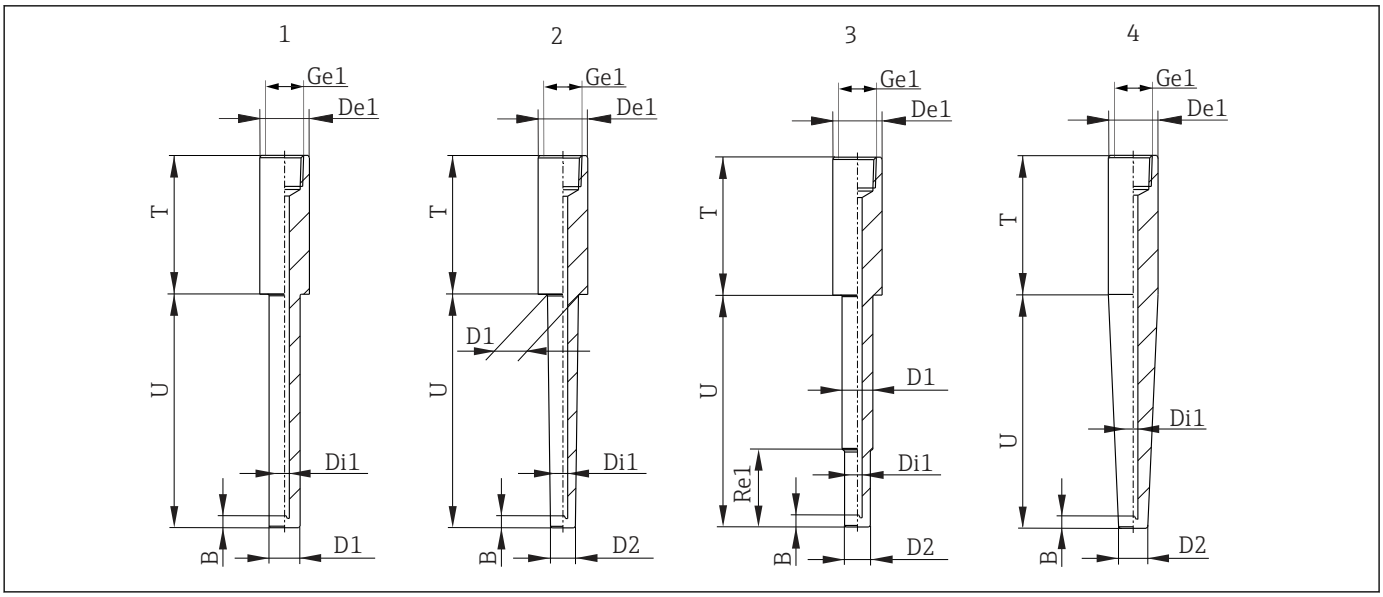
3 *Thermowells based on ASME B40.9*

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)



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 Step-shank flanged thermowell (optional full penetration welding available)



5 Thermowells based on ASME B40.9

1 Straight-shank thermowell for socket weld
2 Tapered-shank thermowell for socket weld
3 Step-shank thermowell for socket weld
4 Tapered-shank weld-in thermowell

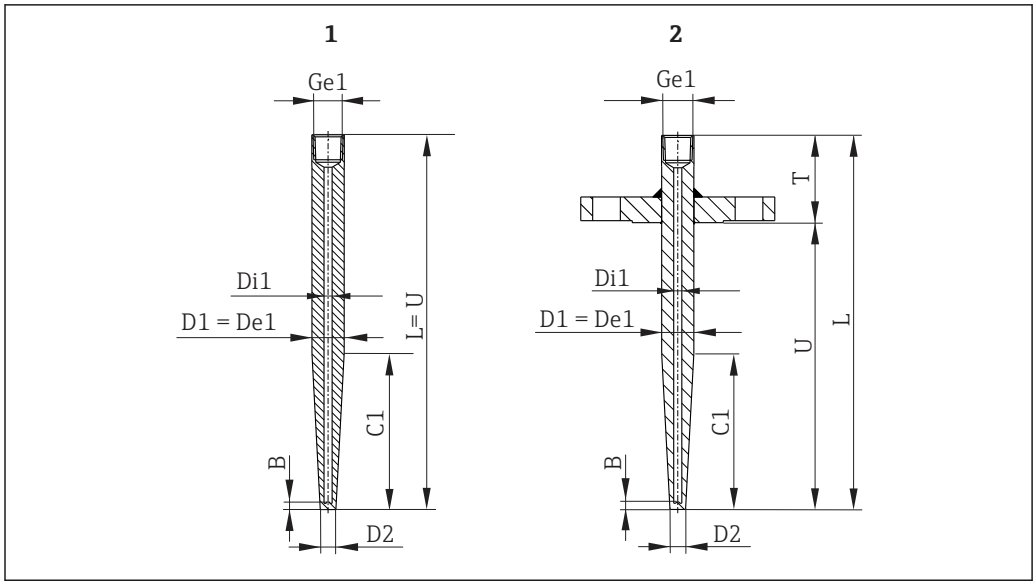
	Threaded	Flanged	For socket weld/tapered-shank weld-in
Thermometer connection Ge1	▪ ½" NPT ▪ ½" NPSC ▪ ½" NPSM		
Process connection size	▪ ½" NPT ▪ ¾" NPT ▪ 1" NPT	▪ ANSI 1" from Cl. 150 to Cl. 600 ▪ ANSI 1 - ½" from Cl. 150 to Cl. 2500 ▪ ANSI 2" from Cl. 150 to Cl. 2500	▪ Ø18 mm (0.71 in) ▪ Ø24 mm (0.94 in) ▪ Ø26 mm (1.02 in) ▪ Ø27 mm (1.06 in) ▪ Ø28 mm (1.1 in) ▪ Ø30 mm (1.18 in) ▪ Ø32 mm (1.26 in) ▪ Ø35 mm (1.38 in) ▪ Ø40 mm (1.57 in) ▪ Ø45 mm (1.77 in) ▪ Ø50 mm (1.97 in) ▪ Ø26.7 mm (NPS ¾") ▪ Ø33.4 mm (NPS 1") ▪ Ø42.2 mm (NPS 1¼") ▪ Ø48.3 mm (NPS 1½")
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 U	64 to 609 mm (2.52 to 24 in)	127 to 609 mm (5 to 24 in)
Lagging length T	70 to 300 mm (2.76 to 11.81 in)	75 to 300 mm (2.95 to 11.81 in)
Lagging diameter De1	18 to 50 mm (0.71 to 1.97 in)	18 to 50 mm (0.71 to 1.97 in)
Root diameter D1	16 to 46.5 mm (0.63 to 1.83 in)	▪ for tip diameter 12.7 mm (0.5 in): 16 to 25.4 mm (0.63 to 1 in) ▪ for tip diameter 22.2 mm (0.87 in): 25.4 to 38 mm (1 to 1.5 in)
Tip diameter D2	9.2 to 46.5 mm (0.36 to 1.83 in) or identical to root diameter	12.7 mm (0.5 in) or 22.2 mm (0.87 in)
Bore diameter Di	▪ 3.5 mm (0.14 in) ▪ 6.5 mm (0.26 in) ▪ 7 mm (0.28 in) ▪ 8 mm (0.31 in) ▪ 9.5 mm (0.37 in) ▪ 10 mm (0.39 in)	6.5 mm (0.26 in)
Roughness	Default value 1.6 µm (63 µin); optional 0.76 µm (30 µin)	Default value 1.6 µm (63 µin); optional 0.76 µm (30 µin)
Stepped length Re1	-	According to ASME PTC 19.3: Re1/U = 0 to 0.6 Example: ▪ Re1: max. 76 mm (2.99 in) for U = 127 mm (5 in) ▪ Re1: max. 365 mm (14.4 in) for U = 609 mm (24 in) Standard: 63.5 mm (2.5 in)
Tip thickness B	Default value 6 mm (0..24 in); optional 5 to 12 mm (0.2 to 0.47 in)	

The iTHERM ModuLine TT151 thermowell is based on the ASME B40.9 standard but allows higher flexibility than defined in ASME B40.9. The main deviations are listed in the following table.

Dimensions	All dimensions are based on metric.
Tolerances	According to ISO 2768-mK, if not otherwise specified.
Terminology and definitions	According to the manufacturer's standards.
Standard dimensions	Wider range of dimensions than outlined in the ASME B40.9 standard.
ASME PTC-19.3	The design fulfills the limitations of ASME PTC-19.3.
Thread	Wider range of threads than outlined in the ASME B40.9 standard.
Flanges	Wider range of flanges than outlined in the ASME B40.9 standard.
Thermowell construction	Based on ASME B40.9.
Materials	Wider range of materials than outlined in the ASME B40.9 standard.
ASME B40.9 Non-Mandatory Appendix for Naval Shipboard Application	Appendix is not taken into account.

Thermowells based on DIN 43772 form 4 and 4F



6 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

	Form 4 (weld-in)	Form 4F (flanged)
Thermometer connection Ge1	▪ M14x1.5 ▪ M18x1.5 ▪ M20x1.5 ▪ M27x2 ▪ G ½" ▪ G ¾"	
Process connection size	▪ Ø18 mm (0.71 in) ▪ Ø24 mm (0.95 in) ▪ Ø26 mm (1.02 in) ▪ Ø32 mm (1.26 in)	▪ 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
Process connection material	▪ 316 ▪ 316L ▪ 316Ti ▪ 347 ▪ 310 ▪ Alloy 600 ▪ Alloy C276 ▪ 10CrMo9-10 ▪ 13CrMo4-5 ▪ 16Mo3 ▪ A105 ▪ C22.8 ▪ Duplex S32205 ▪ Titan Gr2	▪ 316 ▪ 316L ▪ 316Ti ▪ Alloy C276>316L ▪ Alloy 600>316L ▪ A105
Bar material		▪ 316 ▪ 316L ▪ 316Ti ▪ 310 ▪ 347 ▪ Alloy 600 ▪ Alloy C276 ▪ A105 ▪ C22.8 ▪ Duplex S32205
Tip thickness B	Default value 6 mm (0.24 in); optional 4 to 12 mm (0.16 to 0.47 in)	
Roughness	Default value 1.6 µm (63 µin); optional 0.76 µm (30 µin)	
Tolerances wetted part	▪ +0/-0.15 mm (0.006 in) for L ≤ 410 mm (16.14 in) ▪ +0/-0.2 mm (0.008 in) for L > 410 mm (16.14 in) ▪ Tolerances in accordance with DIN43772 can be ordered on request	

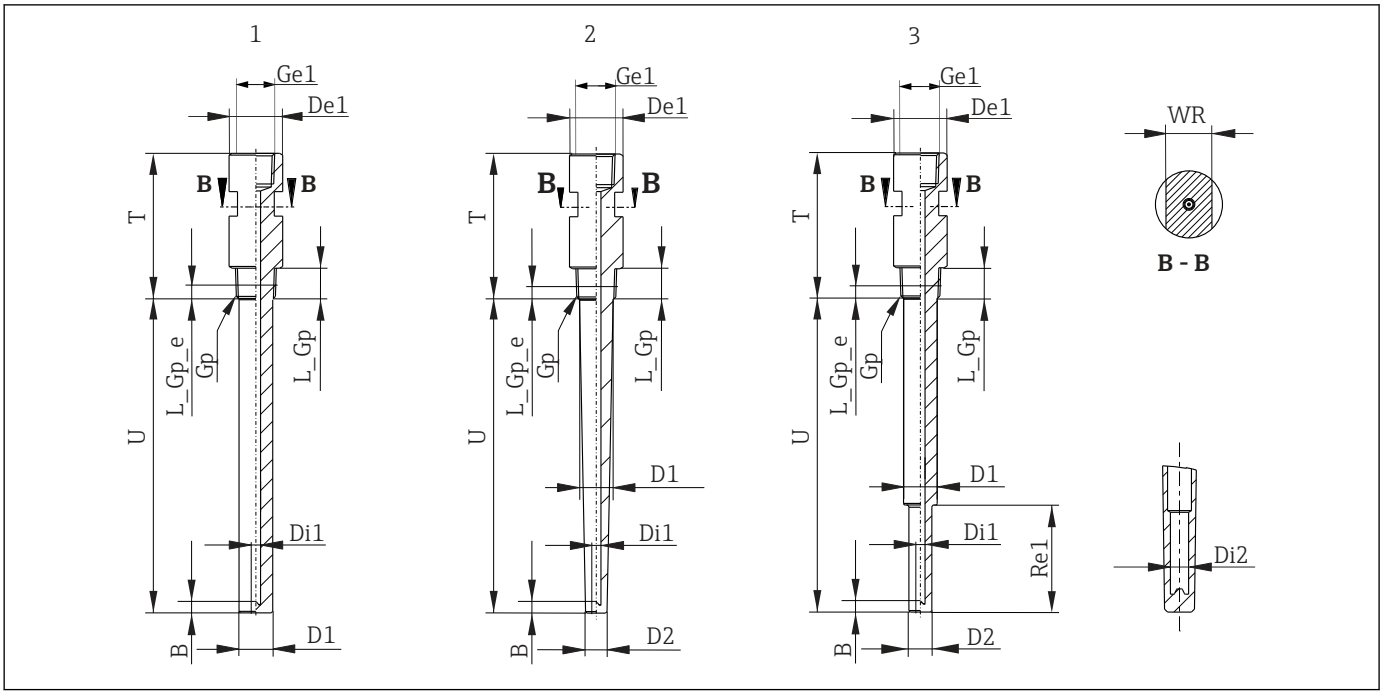
Thermometer connection Ge1	D1	D2	Di1	Length combinations	
				Form 4	Form 4F
M14x1.5	18 mm (0.71 in)	9 mm (0.35 in)	3.5 mm (0.14 in) [1]	▪ L = 110 mm (4.3 in), C1 = 65 mm (2.56 in) ▪ L = 110 mm (4.3 in), C1 = 73 mm (2.87 in) ▪ L = 140 mm (5.51 in), C1 = 65 mm (2.56 in) ▪ L = 170 mm (6.7 in), C1 = 133 mm (5.24 in) ▪ L = 200 mm (7.87 in), C1 = 125 mm (4.92 in)	▪ L = 200 mm (7.87 in), U = 130 mm (5.12 in), C1 = 65 mm (2.56 in) ▪ L = 260 mm (10.24 in), U = 190 mm (7.5 in), C1 = 125 mm (4.92 in) ▪ L = 410 mm (16.14 in), U = 340 mm (13.39 in), C1 = 275 mm (10.83 in)
M18x1.5	24 mm (0.95 in)	12.5 mm (0.49 in)	7 mm (0.28 in)		
M20x1.5 or G ½"	26 mm (1.02 in)	12.5 mm (0.49 in)	7 mm (0.28 in)		
		15 mm (0.6 in)	9 mm (0.35 in)		
M27x2 or G ¾"	32 mm (1.26 in)	17 mm (0.67 in)	11 mm (0.43 in)		
		19 mm (0.75 in)	13 mm (0.51 in)		
		20 mm (0.79 in)	14 mm (0.55 in)		

1) For L > 110 mm (4.3 in), a stepped bore is used (6.5 mm (0.26 in) > 3.5 mm (0.14 in)

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

Terminology and definitions	According to the manufacturer's standards.
Materials	Wider range of materials than specified in DIN 43772.
Tolerances wetted part Form 4	▪ +0/-0.15 mm (0.006 in) for L ≤ 410 mm (16.14 in) ▪ +0/-0.2 mm (0.008 in) for L > 410 mm (16.14 in) ▪ Tolerances in accordance with DIN43772 can be ordered on request.
Tolerances wetted part Form 4F	▪ +0/-0.15 mm (0.006 in) for L ≤ 410 mm (16.14 in) ▪ +0/-0.2 mm (0.008 in) for L > 410 mm (16.14 in)
Immersion length U	Wider range of lengths than specified in DIN 43772.

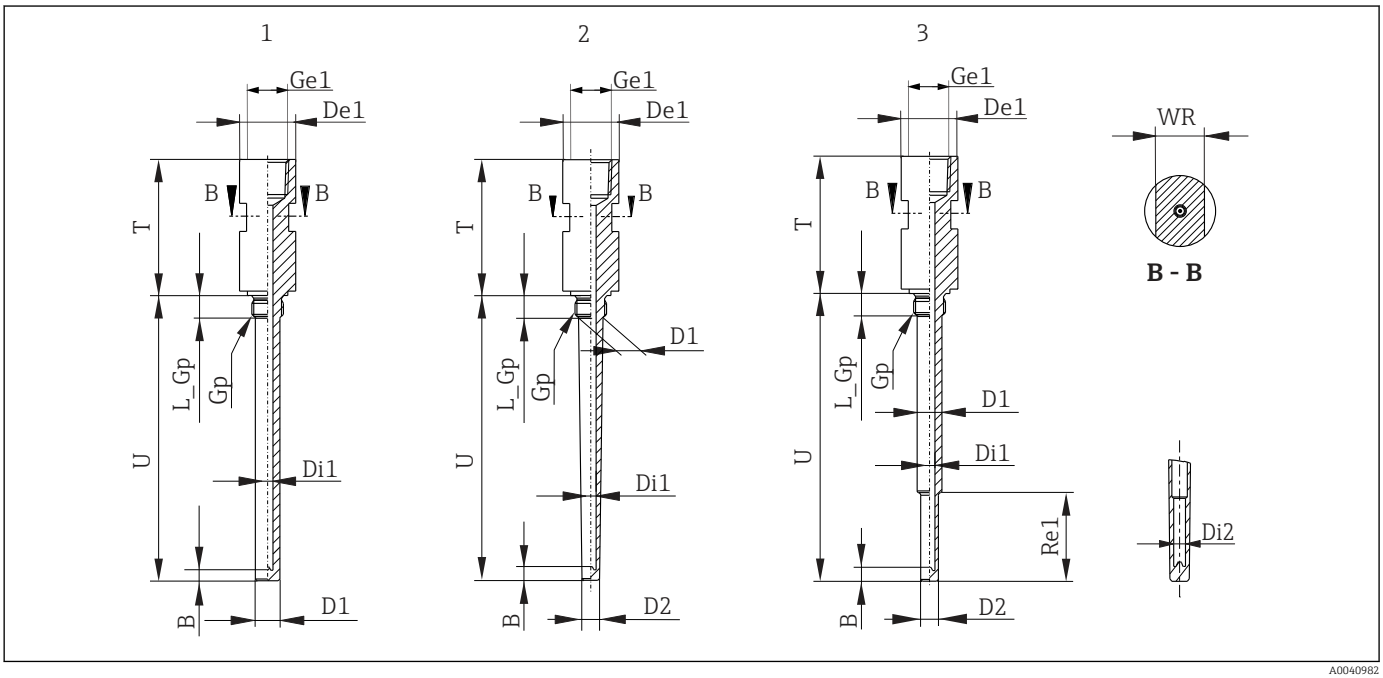
Universal thermowells



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7 Universal thermowells with NPT or R threads

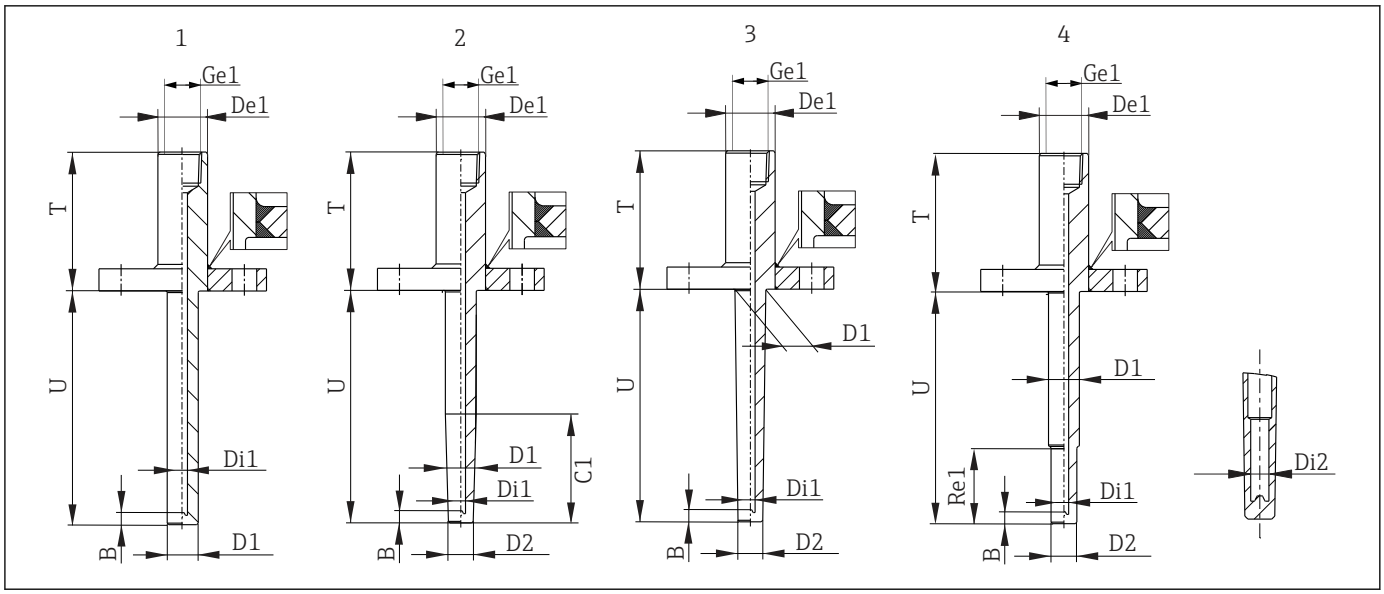
1 *Threaded process connection and wetted part straight; lagging with spanner flats (optional hexagonal lagging available)*
2 *Threaded process connection and wetted part complete tapered; lagging with spanner flats (optional hexagonal lagging available)*
3 *Threaded process connection and wetted part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



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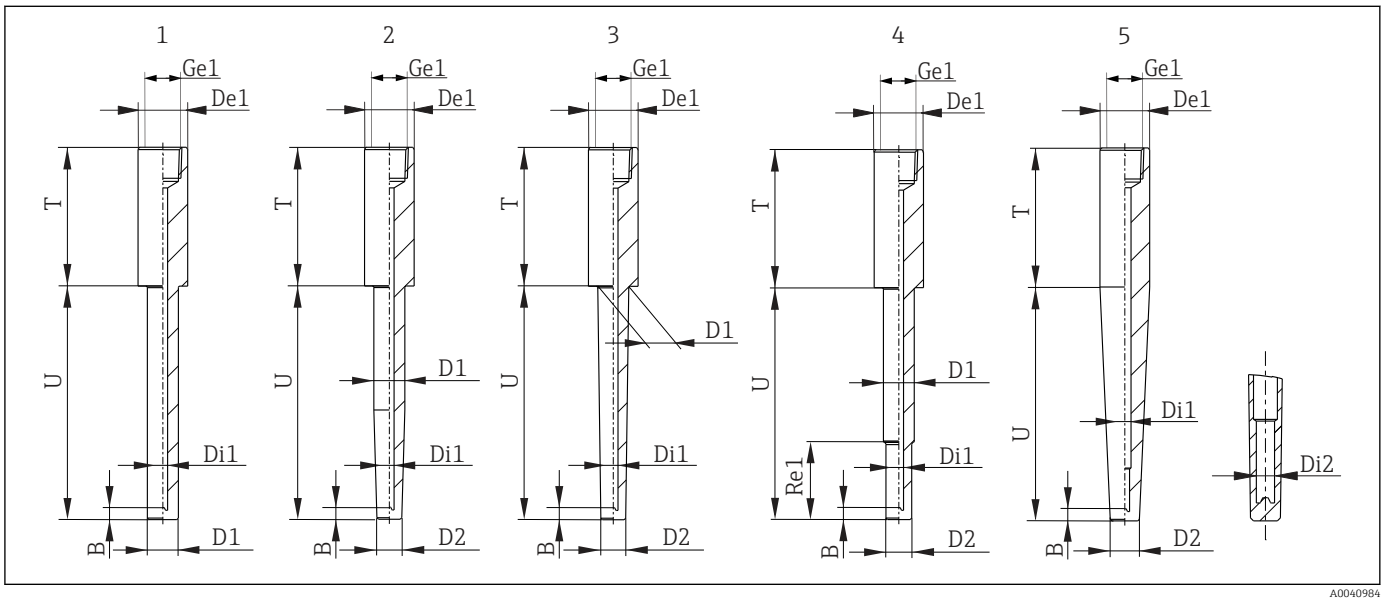
8 Universal thermowells with M or G threads

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)*



9 *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)*



10 *Universal thermowells*

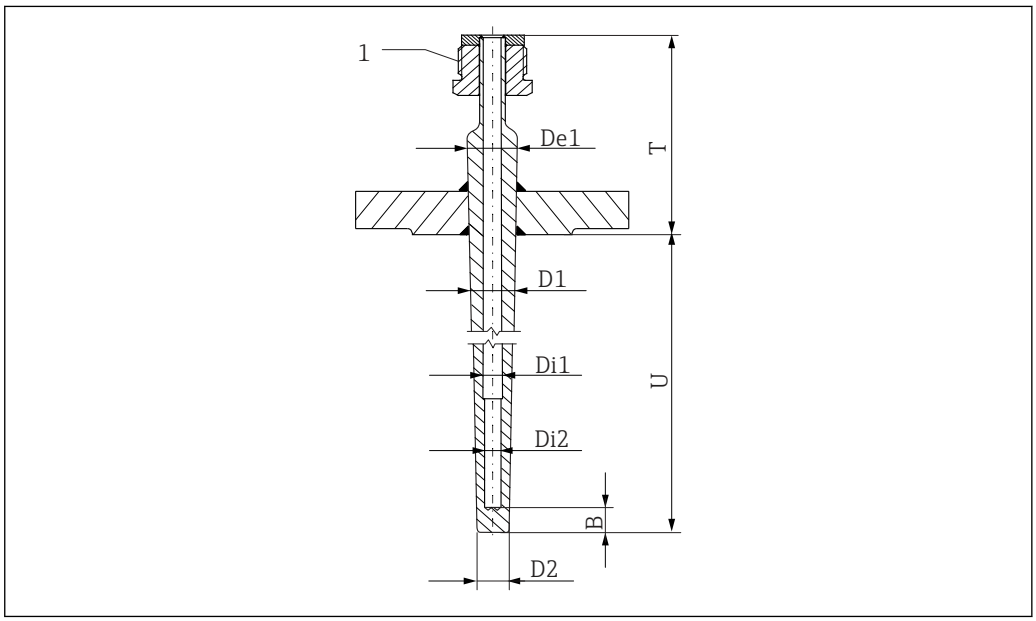
1 *Socket weld process connection and wetted part straight*
2 *Socket weld process connection and wetted part partial tapered*
3 *Socket weld process connection and wetted part tapered*
4 *Socket weld process connection and wetted part stepped*
5 *Weld-in process connection and wetted part tapered*

	Threaded	Flanged	Socket weld/Weld-in
Thermometer connections Ge1	▪ 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	▪ Ø18 mm (0.71 in) ▪ Ø24 mm (0.94 in) ▪ Ø26 mm (1.02 in) ▪ Ø27 mm (1.06 in) ▪ Ø28 mm (1.1 in) ▪ Ø30 mm (1.18 in) ▪ Ø32 mm (1.26 in) ▪ Ø35 mm (1.38 in) ▪ Ø40 mm (1.57 in) ▪ Ø45 mm (1.77 in) ▪ Ø50 mm (1.97 in) ▪ Ø26.7 mm (NPS ¾") ▪ Ø33.4 mm (NPS 1") ▪ Ø42.2 mm (NPS 1¼") ▪ Ø48.3 mm (NPS 1½")
Process connection material	▪ 316 ▪ 316L ▪ 316Ti ▪ 347 ▪ 310 ▪ Alloy 600 ▪ Alloy C276 ▪ 10CrMo9-10 ▪ 13CrMo4-5 ▪ 16Mo3 ▪ A105 ▪ C22.8 ▪ Titan Gr2	▪ 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 ▪ 16Mo3 ▪ A105 ▪ C22.8 ▪ Titan Gr2
Bar material		▪ 316 ▪ 316L ▪ 316Ti ▪ 310 ▪ 347 ▪ Alloy 600 ▪ Alloy C276 ▪ A105 ▪ C22.8	
Immersion length U	30 to 1 500 mm (1.18 to 59.1 in) [1]		
Lagging length T	70 to 300 mm (2.76 to 11.81 in)		
Lagging diameter De1	See table → 🖹 22	18 to 50 mm (0.71 to 1.97 in)	Equal to "process connection size"
Root diameter D1	9 to 30 mm (0.35 to 1.18 in) [2]	9 to 50 mm (0.35 to 1.97 in)	9 to 50 mm (0.35 to 1.97 in)
Tip diameter D2	9 to 50 mm (0.35 to 1.97 in) [3]		
Bore diameter Di	▪ 3.5 mm (0.14 in) [4] ▪ 6.5 mm (0.26 in) ▪ 7 mm (0.28 in) ▪ 8 mm (0.31 in) ▪ 9 mm (0.35 in) ▪ 9.5 mm (0.37 in) ▪ 10 mm (0.39 in) ▪ Stepped: Di1 = 6.5 mm (0.26 in) > Di2 = 3.5 mm (0.14 in), length: 35 mm (1.38 in) ▪ Stepped: Di1 = 10 mm (0.39 in) > Di2 = 6.5 mm (0.26 in), length: 35 mm (1.38 in) [5]		
Tip thickness B	Default value 6 mm (0.24 in); optional 4 to 12 mm (0.16 to 0.47 in)		

Roughness	Default value 1.6 µm (63 µin); optional 0.76 µm (30 µin)
Stepped length Re1	50 to 350 mm (1.97 to 13.78 in) [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 > 110 mm (4.3 in), a stepped bore is used (6.5 mm (0.26 in) > 3.5 mm (0.14 in)
5) The max. bore diameter depends on the tip diameter
6) Stepped length Re1 << Immersion length U

Thermowell based on NAMUR NE170



11 Thermowell based on NAMUR NE170

1 Rotatable male thread

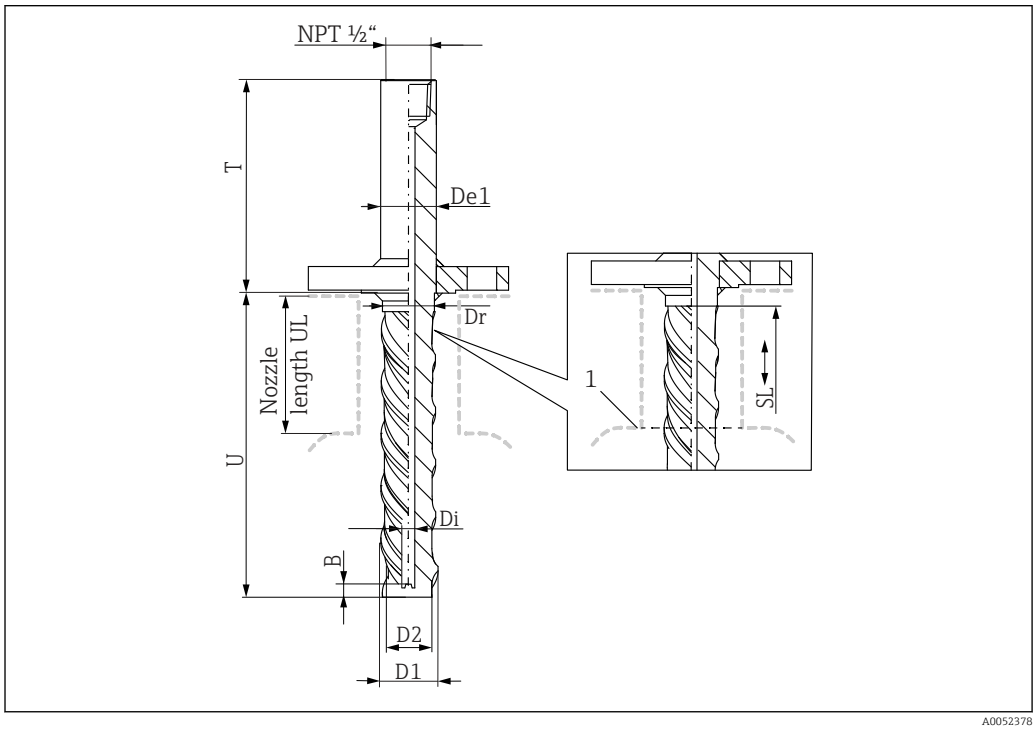
Thermometer connection	Rotatable male thread M24x1.5
Process connection size	▪ ANSI 1" from 150 lb/sq inch to 600 lb/sq inch ▪ ANSI 1 ½" from 150 lb/sq inch to 600 lb/sq inch ▪ ANSI 2" from 150 lb/sq inch to 600 lb/sq inch ▪ EN PN16 DN25 ▪ EN PN40 DN25 ▪ EN PN40 DN40 ▪ EN PN40 DN50
Process connection material	▪ 316 ▪ 316L ▪ 316Ti ▪ Alloy C276
Bar material	▪ 316 ▪ 316L ▪ 316Ti ▪ Alloy C276
Immersion length U	30 to 610 mm (1.18 to 24.02 in)
Lagging length T	142 mm (5.6 in)
Lagging diameter De1	20 mm (0.79 in), reduced to 12 mm (0.47 in)
Root diameter D1	20 mm (0.79 in)
Tip diameter D2	13 mm (0.51 in)

Bore diameter Di	Stepped: Di1 = 7 mm (0.27 in) > Di2 = 6.1 mm (0.24 in), length: 50 mm (1.97 in)
Tip thickness B	7 mm (0.27 in)
Roughness	Default value 0.76 µm (30 µin)

Compatibility of DIN-inserts with thermowells					
Inserts IL	**Thermowell acc. to DIN 43772**		**Thermowell acc. to NAMUR NE170**		**ModuLine TM151 (without thermowell, without neck pipe)**
	Form	**Immersion length U**	**Form**	**Immersion length U**	**Immersion length U**
315 mm (12.4 in)	3F1	225 mm (8.9 in)	NF1	165 mm (6.5 in)	304 mm (12 in)
375 mm (14.8 in)	3F2	285 mm (11.2 in)	NF2	225 mm (8.9)	364 mm (14.3 in)
435 mm (17.1 in)	3F3	345 mm (13.6 in)	NF3	285 mm (11.82 in)	424 mm (16.7 in)

Maximum flow velocity of process media					
Calculation standard	**Form**	**Immersion length U**	**Max. flow velocity**		
			Water	**CO2**	**Air**
ASME PTC 19.3	NF1	165 mm (6.5 in)	12.5 m/s (39.4 ft/s)	13.1 m/s (43 ft/s)	14.0 m/s (45.9 ft/s)
ASME PTC 19.3	NF2	225 mm (8.86 in)	6.9 m/s (22.6 ft/s)	7.7 m/s (25.3 ft/s)	8.1 m/s (26.6 ft/s)
ASME PTC 19.3	NF3	285 mm (11.2 in)	4.6 m/s (15.1 ft/s)	5.0 m/s (16.4 ft/s)	5.2 m/s (17.1 ft/s)
Reference value					
DIN 43772	3F1	225 mm (8.86 in)	4.2 m/s (13.8 ft/s)	4.2 m/s (13.8 ft/s)	4.2 m/s (13.8 ft/s)

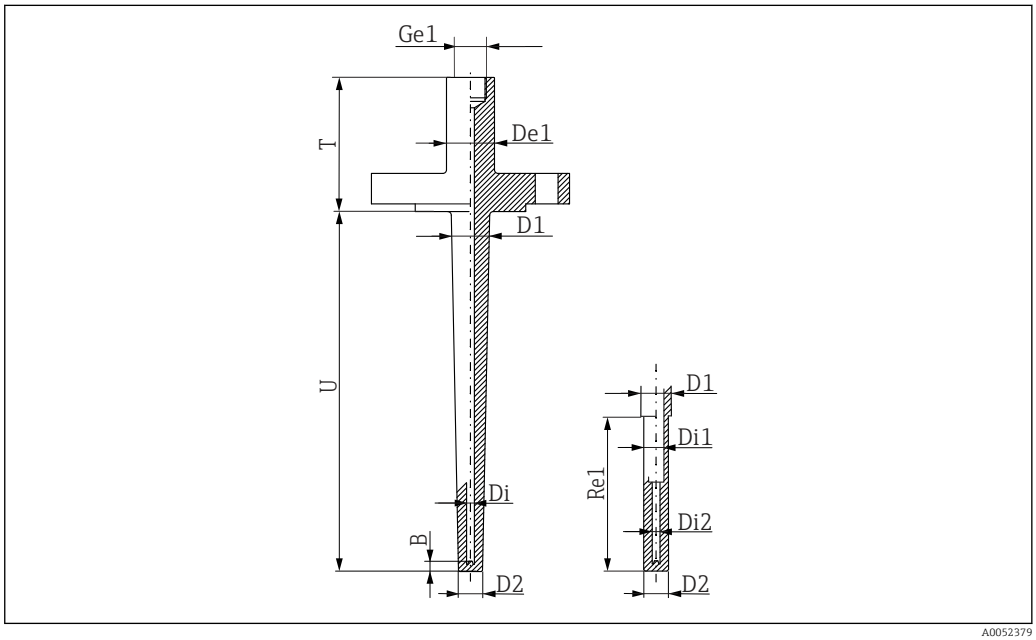
Thermowell iTHERM TwistWell



To ensure the stability of the thermowell, the coils must be positioned within the flow area. The length of the coil (SL) is factory-set to extend from at least the tip to the start of the socket (1).

Thermometer connection Ge1	▪ M18x1.5 ▪ G ½" ▪ NPT ½"		
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 PN50 DN25 ▪ EN PN40 DN40 ▪ EN PN40 DN50 ▪ EN PN63 DN50		
Process connection material	▪ 316 ▪ 316L ▪ 316Ti		
Bar material	▪ 316 ▪ 316L ▪ 316Ti		
Immersion length U	60 to 800 mm (2.36 to 31.5 in)		
Unstreamed length UL	60 to 790 mm (2.36 to 31.1 in)		
Lagging length L	70 to 300 mm (2.76 to 11.81 in)		
Lagging diameter De1	30 mm (1.18 in)	25 mm (0.98 in)	25 mm (0.98 in)
Coil diameter (root and tip) D1	30 mm (1.18 in)	25 mm (0.98 in)	22 mm (0.87 in)
Root diameter base body Dr	28 mm (1.10 in)	22 mm (0.87 in)	20 mm (0.79 in)
Tip diameter base body D2	22 mm (0.87 in)	17 mm (0.67 in)	15 mm (0.59 in)
Bore diameter Di	▪ 6.5 mm (0.26 in) ▪ 7 mm (0.28 in) ▪ Stepped: Di1 = 7 mm (0.28 in) > Di2 = 6.1 mm (0.24 in), length: 50 mm (1.97 in)		
Tip thickness B	6 mm (0.24 in)		
Roughness	0.76 µm (30 µin)		
Number of coils	3		

Forged thermowell



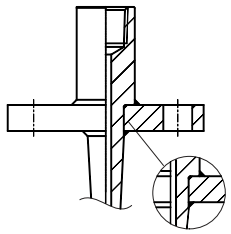
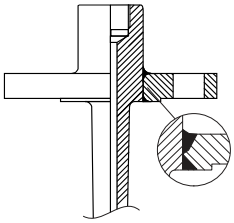
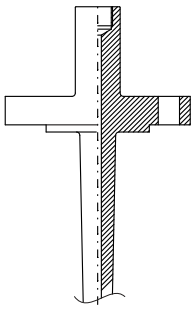
A0052379

To avoid having to use welded flanged process connections, you can opt for a forged thermowell. This offers the highest level of fatigue resistance in accordance with ASME PTC 19.3 TW. Opting for a forged thermowell means that welding seam checks and faults can be excluded. It can be used in extreme process environments.

This applies to the following thermowell versions: flanged, references acc. to ASME/Universal/DIN

Thermometer connection Ge1	▪ M14x1.5 ▪ M18x1.5 ▪ M20x1.5 ▪ M27x2 ▪ G ½" ▪ G ¾" ▪ ½" NPT ▪ ½" NPSC ▪ ½" NPSM
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 PN50 DN25 ▪ EN PN100 DN25 ▪ EN PN40 DN40 ▪ EN PN40 DN50 ▪ 10K JIS 50A
Process connection material	▪ 316 ▪ 316L
Bar material	
Immersion length U	30 to 580 mm (1.18 to 22.8 in)
Lagging length T	70 to 100 mm (2.76 to 3.93 in)
Lagging diameter De1	18 to 45 mm (0.71 to 1.77 in)
Root diameter D1	9 to 45 mm (0.35 to 1.77 in)
Tip diameter D2	
Bore diameter Di	▪ 6.5 mm (0.26 in) ▪ 7 mm (0.28 in) ▪ 8 mm (0.32 in) ▪ 9 mm (0.35 in) ▪ 9.5 mm (0.37 in) ▪ 10 mm (0.39 in) ▪ 11 mm (0.43 in) ▪ 13 mm (0.51 in) ▪ 14 mm (0.55 in) ▪ Stepped: Di1 = 6.5 mm (0.26 in) > Di2 = 3.5 mm (0.14 in), length: 35 mm (1.38 in) ▪ Stepped: Di1 = 10 mm (0.39 in) > Di2 = 6.5 mm (0.26 in), length: 35 mm (1.38 in)
Tip thickness B	Default value 6 mm (0.24 in); optional 4 to 12 mm (0.16 to 0.47 in)
Roughness	Default value 1.6 µm (63 µin); optional 0.76 µm (30 µin)
Stepped length Re1	50 to 350 mm (1.97 to 13.8 in)

Versions of flanged thermowells

Welded on both sides	With full penetration welding	Forged - not welded
 A0052792	 A0052794	 A0052702
▪ Suitable for most applications ▪ Meets requirements with an optional cost-benefit ratio	▪ Suitable for harsh application environments ▪ Stronger welded connection ▪ Higher costs	▪ Suitable for harsh application environments ▪ No welding ▪ Cost-effective alternative to a full penetration welded flange

Weight

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

Materials

Thermowell and process connections.

Note: The maximum temperature depends on the temperature sensor used.

The temperatures for continuous operation specified in the following table are 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.

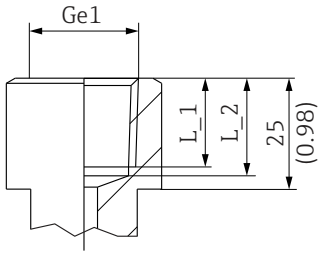
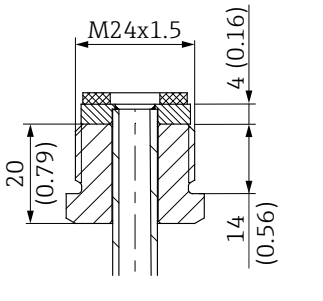
Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L	X5CrNiMo 17-12-2	650 °C (1 202 °F) [1)]	▪ Austenitic stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorinated and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °F)	▪ Properties comparable with AISI 316L ▪ 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
Alloy 600/2.4816	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 ▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water ▪ Not to be used in sulfur-containing atmospheres

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Alloy 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 347/1.4550	X6CrNiNb18-10	900 °C (1 652 °F)	▪ Austenitic stainless steel ▪ Better intercrystalline corrosion resistance in oxidizing environments ▪ Good welding properties ▪ For high-temperature applications like furnaces
AISI 310 / 1.4845	X15CrNi25-21	1 100 °C (2 012 °F)	▪ Austenitic stainless steel ▪ Generally good resistance to oxidizing and reducing atmospheres ▪ Due to the higher chromium content, good resistance to oxidizing aqueous solutions and neutral salts melting at higher temperatures ▪ Only low resistance to sulfur-containing gases
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, pressured vessels
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 non-alloy steels, not suitable for acids and other aggressive media ▪ Often used in steam generators, water and steam pipes, pressured 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 (O_2, N_2, Cl_2, H_2) at higher temperatures and/or increased pressure ▪ Can only be used in chlorine gas and chlorinated media at comparatively low temperatures (<400 °C)
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

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Duplex S32205	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 hydrogen-induced stress corrosion
1.7380	10CrMo9-10	580 °C (1076 °F)	▪ Alloyed, heat-resistant steel ▪ Particularly suitable for steam boilers, boiler parts, boiler drums, pressure vessels for apparatus constructions and similar purposes

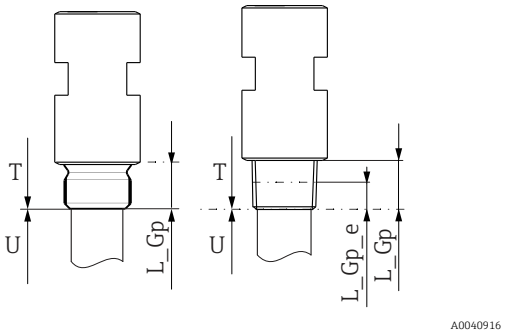
1) Can be used to a limited extent up to 800 °C (1472 °F) for low mechanical loads and in non-corrosive media. For further information, please contact the manufacturer's sales department.

Thermometer connection

Thermometer connection	Ge1	L_1	L_2	Standard/Class
 12 *Female thread*	M14x1.5	17 mm (0.67 in)	20 mm (0.79 in)	ASME B1.13M/ISO 965-1 H6
	M18x1.5			ASME B1.13M/ISO 965-1 H6
	M20x1.5			ASME B1.13M/ISO 965-1 H6
	M27x2			ASME B1.13M/ISO 965-1 H6
	G½"			ISO 228-1 A
	G¾"			ISO 228-1 A
	½" NPT/NPSC/NPSM			ANSI B1.20.1
 13 *Adjustable male thread*				

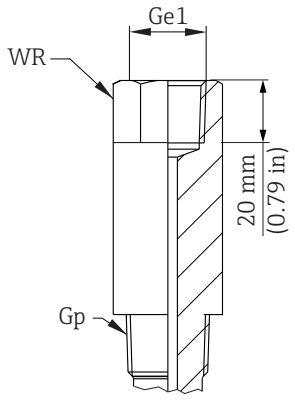
Process connections Standard connections are available as weld-in, socket weld, threaded connection or flanged versions.

Thread

Threaded process connection	Version		Thread length L_Gp	Standard	Max. process pressure
 14 *Cylindrical (left side) and conical (right side) version*	M	M20x1.5	14 mm (0.55 in)	ASME B1.13M ISO 965-1 g6	Maximum static process pressure for threaded process connection: [1] 400 bar (5 802 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)		
	G	G½"	15 mm (0.6 in)	ISO 228-1 A	
		G1"	18 mm (0.71 in)		
		G¾"	16 mm (0.6 in)		
		G3/8"	12 mm (0.47 in)		
	NPT	NPT½"	20 mm (0.79 in) L_Gp_e: 8 mm (0.32 in)	ANSI B1.20.1	
		NPT¾"	20 mm (0.79 in) L_Gp_e: 8 mm (0.32 in)		
		NPT1"	25 mm (0.98 in) L_Gp_e: 10 mm (0.39 in)		
	R	R½"	20 mm (0.79 in) L_Gp_e: 8 mm (0.32 in)	DIN EN 10226-1 JIS B 0203	
		R¾"	20 mm (0.79 in) L_Gp_e: 8 mm (0.32 in)		

1) Maximum pressure specifications only for the thread. The failure of the thread is calculated, taking the static pressure into consideration. The calculation is based on a fully tightened thread

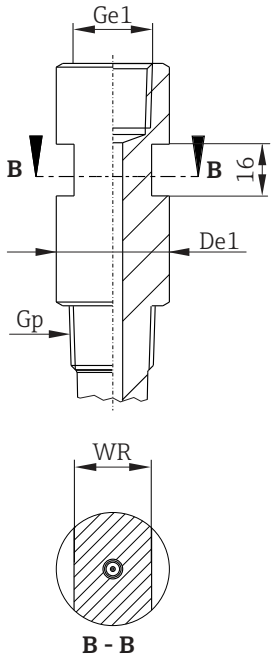
WR size matrix for threaded thermowells with hexagonal lagging



		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	WR 24				WR 27				WR 36			WR 41	
	M18x1.5													
	M20x1.5													
	NPT½"													
	G½"													
	NPSC½													

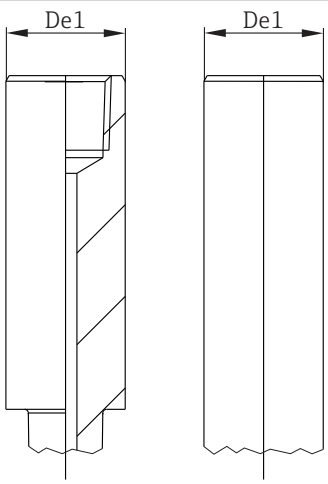
	NPSM½				
	M27x2	WR 36	WR 36		
	G¾"				

WR size matrix for threaded thermowells with spanner flats



		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	WR 22								WR 27			WR 36	
	M18x1.5													
	M20x1.5													
	NPT½"													
	G½"													
	NPSC½													
	NPSM½													
	M27x2	WR 24												
	G¾"													

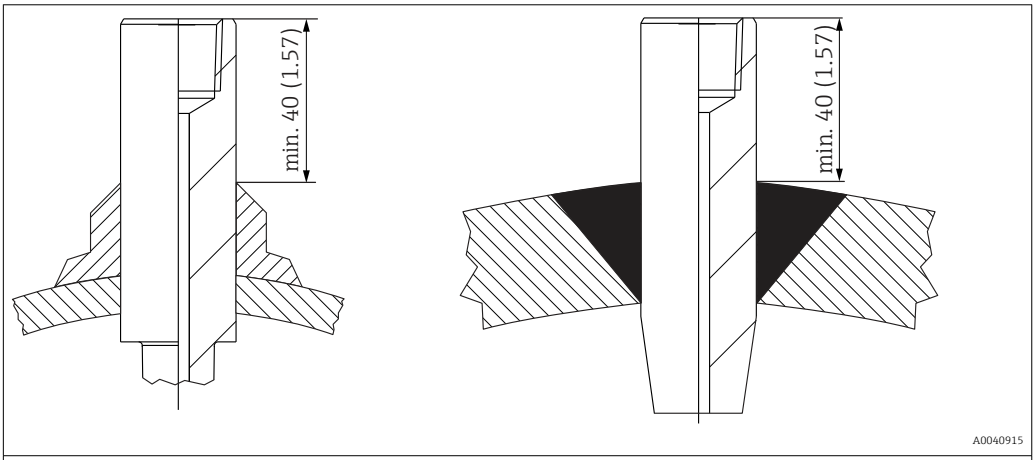
Weld-in version/socket weld



De1

- ϕ 18 mm (0.71 in)
- ϕ 24 mm (0.94 in)
- ϕ 26 mm (1.02 in)
- ϕ 27 mm (1.06 in)
- ϕ 28 mm (1.10 in)
- ϕ 30 mm (1.18 in)
- ϕ 32 mm (1.26 in)
- ϕ 35 mm (1.38 in)
- ϕ 40 mm (1.57 in)
- ϕ 45 mm (1.77 in)
- ϕ 50 mm (1.97 in)
- ϕ 26.7 mm (NPS ¾")
- ϕ 33.4 mm (NPS 1")
- ϕ 42.2 mm (NPS 1¼")
- ϕ 48.3 mm (NPS 1½")

Welding recommendation



Distance between welding seam and end of thermowell should be minimum 40 mm (1.75 in). To avoid thread deformations a dummy plug is recommended.

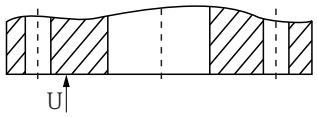
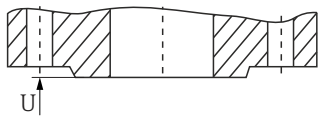
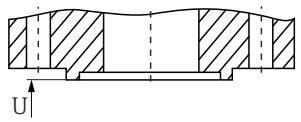
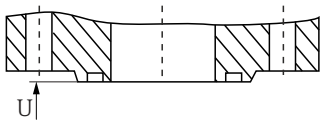
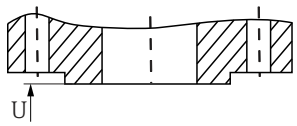
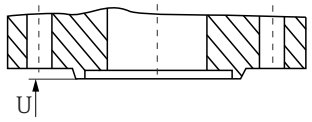
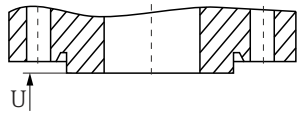
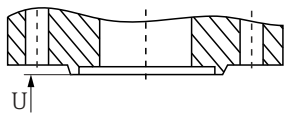
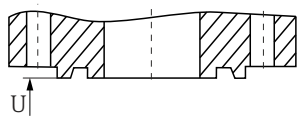
Flanges

The different materials are categorized according to their strength-temperature properties in DIN EN 1092-1 Tab.18 under 13E0 and in JIS B2220:2004 Tab. 5 under 023b. 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 25.4. 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
- HG/T flanges: Chinese Chemical Standard HG/T 20592-2009 and 20615-2009

Geometry of sealing surfaces

Flanges	Sealing surface	DIN 2526 [1]		DIN EN 1092-1			ASME B16.5	
		Form	Rz (µm)	Form	Rz (µm)	Ra (µm)	Form	Ra (µm)
without raised face	 A0043514	A B	- 40 to 160	A [2]	12.5 to 50	3.2 to 12.5	Flat face (FF)	3.2 to 6.3 (AARH 125 to 250 µin)
with raised face	 A0043516	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	Raised face (RF)	
Spring	 A0043517	F	-	C	3.2 to 12.5	0.8 to 3.2	Tongue (T)	3.2
Groove	 A0043518	N		D			Groove (G)	
Projection	 A0043519	V 13	-	E	12.5 to 50	3.2 to 12.5	Male (M)	3.2
Recess	 A0043520	R 13		F			Female (F)	
Projection	 A0043521	V 14	for O-rings	H	3.2 to 12.5	3.2 to 12.5	-	-
Recess	 A0043522	R 14		G			-	-
With ring groove	 A0052680	-	-	-	-	-	Ring-type joint (RTJ)	1.6

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

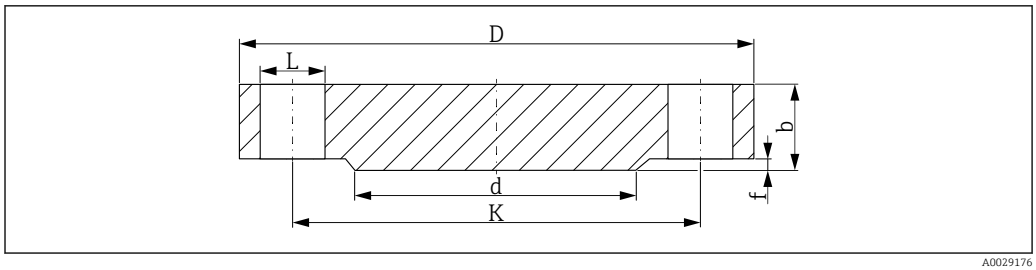
Flanges according to the old DIN standard are compatible with the new DIN EN 1092-1 standard.
Change in pressure ratings: Old DIN standards PN64 → DIN EN 1092-1 PN63.

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	-
	> 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)



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)

PN16 [1)]

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)

DN	D	b	K	d	L	approx. kg (lbs)
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)
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)
15	95 (3.74)	16 (0.55)	65 (2.56)	45 (1.77)	4xØ14 (0.55)	0.81 (1.8)
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

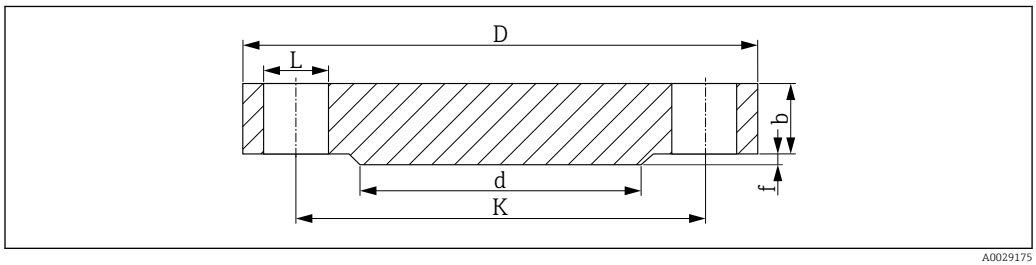
DN	D	b	K	d	L	approx. kg (lbs)
25	140 (5.51)	24 (0.94)	100 (3.94)	68 (2.68)	4xØ18 (0.71)	2.50 (5.51)
32	155 (6.10)	24 (0.94)	110 (4.33)	78 (3.07)	4xØ22 (0.87)	3.50 (7.72)
40	170 (6.69)	26 (1.02)	125 (4.92)	88 (3.46)	4xØ22 (0.87)	4.50 (9.92)
50	180 (7.09)	26 (1.02)	135 (5.31)	102 (4.02)	4xØ22 (0.87)	5.00 (11.03)
65	205 (8.07)	26 (1.02)	160 (6.30)	122 (4.80)	8xØ22 (0.87)	6.00 (13.23)

DN	D	b	K	d	L	approx. kg (lbs)
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)
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)



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 sealing surface Ra ≤ 3.2 to 6.3 µm (126 to 248 µin).

Class 150 [1)]

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)

DN	D	b	K	d	L	approx. kg (lbs)
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)

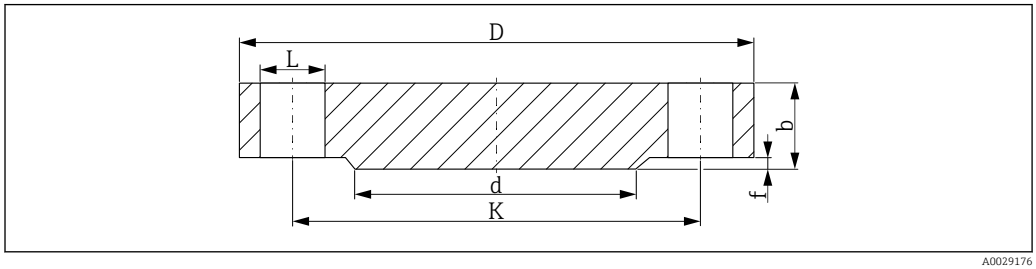
Class 900

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)

HG/T flanges (HG/T 20592-2009)



17 Raised face

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)

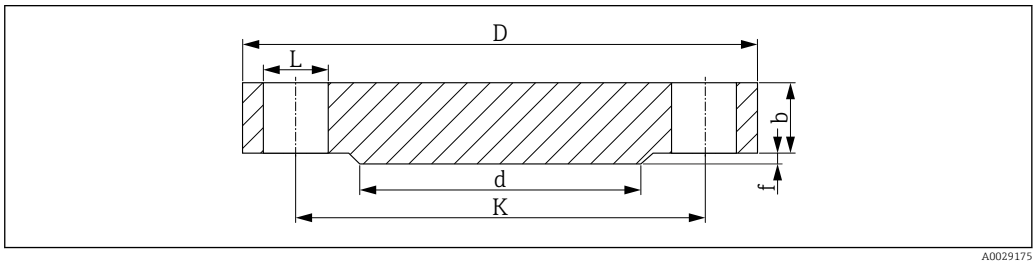
PN40

DN	D	b	K	d	L	approx. kg (lbs)
25	115 (4.53)	16 (0.63)	85 (3.35)	68 (2.68)	4xØ14 (0.55)	1.50 (3.31)
40	150 (5.91)	16 (0.63)	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)	3.00 (6.62)

PN63

DN	D	b	K	d	L	approx. kg (lbs)
50	180 (7.09)	24 (0.95)	135 (5.31)	102 (4.02)	4xØ22 (0.87)	5.00 (11.03)

HG/T flanges (HG/T 20615-2009)



18 *Raised face*

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: 2 mm (0.08 in) or from Class 600: 7 mm (0.28 in)

Surface quality of sealing surface Ra ≤ 3.2 to 6.3 µm (126 to 248 µin).

Class 150 [1)]

DN	D	b	K	d	L	approx. kg (lbs)
1"	110.0 (4.33)	12.7 (0.5)	79.4 (3.13)	50.8 (2.00)	4xØ16 (0.63)	0.86 (1.9)
1½"	125.0 (4.92)	15.9 (0.63)	98.4 (3.87)	73.0 (2.87)	4xØ16 (0.63)	1.53 (3.37)
2"	150 (5.91)	17.5 (0.69)	120.7 (4.75)	92.1 (3.63)	4xØ18 (0.71)	2.42 (5.34)

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

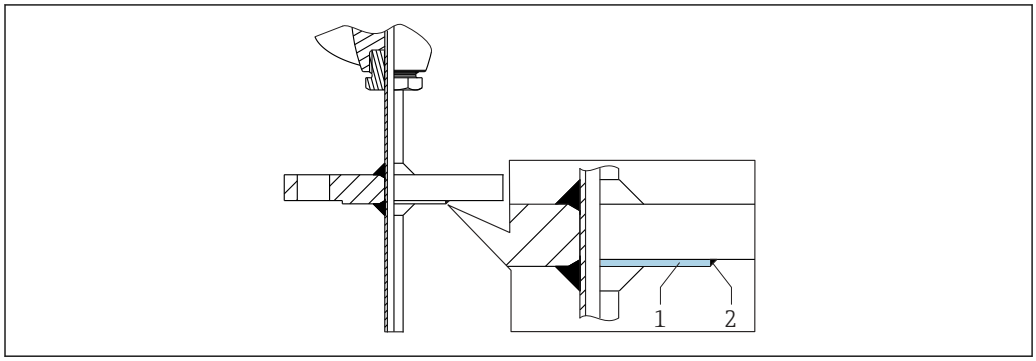
Class 300

DN	D	b	K	d	L	approx. kg (lbs)
1"	125.0 (4.92)	15.9 (0.63)	88.9 (3.50)	50.8 (2.00)	4xØ18 (0.71)	1.39 (3.06)
1½"	155 (6.10)	19.1 (0.75)	114.3 (4.50)	73 (2.87)	4xØ22 (0.87)	2.66 (5.87)
2"	165 (6.50)	20.7 (0.82)	127.0 (5.00)	92.1 (3.63)	8xØ18 (0.71)	3.18 (7.01)

Class 600

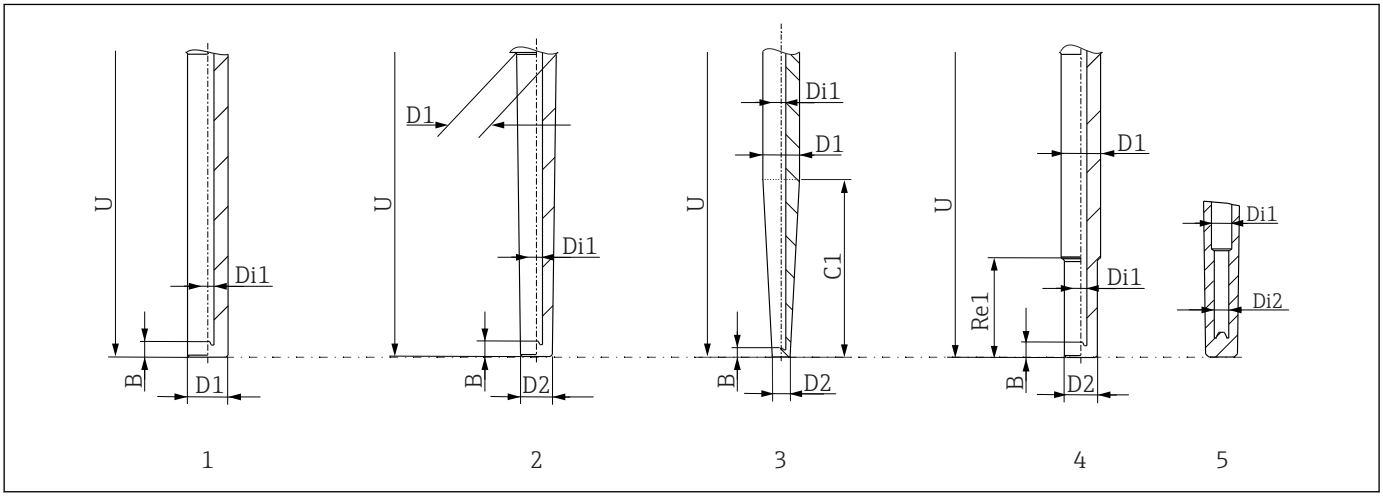
DN	D	b	K	d	L	approx. kg (lbs)
2"	165 (6.50)	25.4 (1.00)	127.0 (5.00)	92.1 (3.63)	8xØ18 (0.71)	4.15 (9.15)

Thermowell material, nickel-based, with flange
If the thermowell materials Alloy 600 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 Alloy 600 > 316L or Alloy C276 > 316L.



1 Raised face
2 Weld

Geometry of parts in contact with medium



1 Straight (complete length U)
2 Tapered (complete length U)
3 Tapered (over length C1)
4 Stepped, Re1 = 63.5 mm (2.5 in)
5 Stepped bore diameter (Di1/Di2)

Surface roughness

Specifications for surfaces in contact with medium

Standard surface	$R_a \leq 1.6$ µm (63 µin)
Finely honed surface, buffed	$R_a \leq 0.76$ µm (30 µin)

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

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

Ordering information

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

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

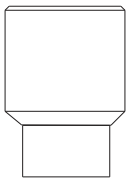
Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic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

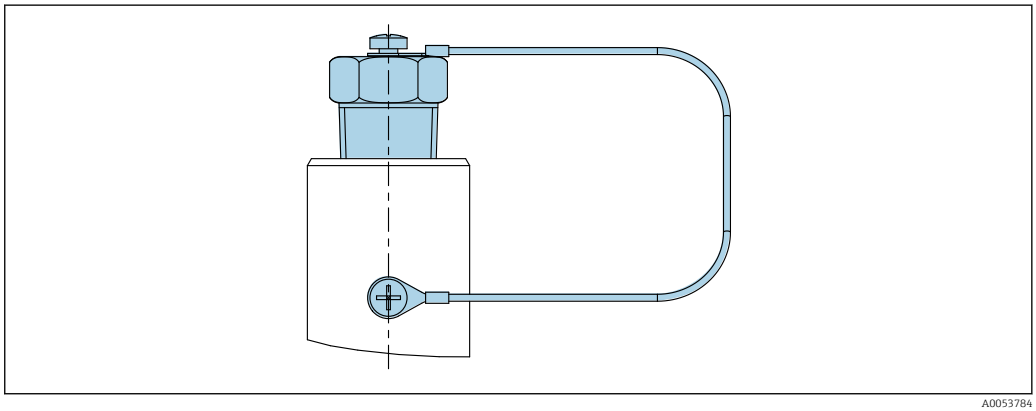
Accessories

The accessories currently available for the product can be selected at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

Device-specific accessories

Accessories	Description
 A0054624 *19 Welding nipple TA115*	Welding socket for barstock thermowell, according to DIN 43772 Form 4. Manufactured from barstock with diameter D = 50 mm, L = 50 mm. Order number: TA115-



A0053784

20 Safety plug for the thermowell + chain

Online tools

Product information about the entire life cycle of the device is available at: www.endress.com/onlinetools

Documentation

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.



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